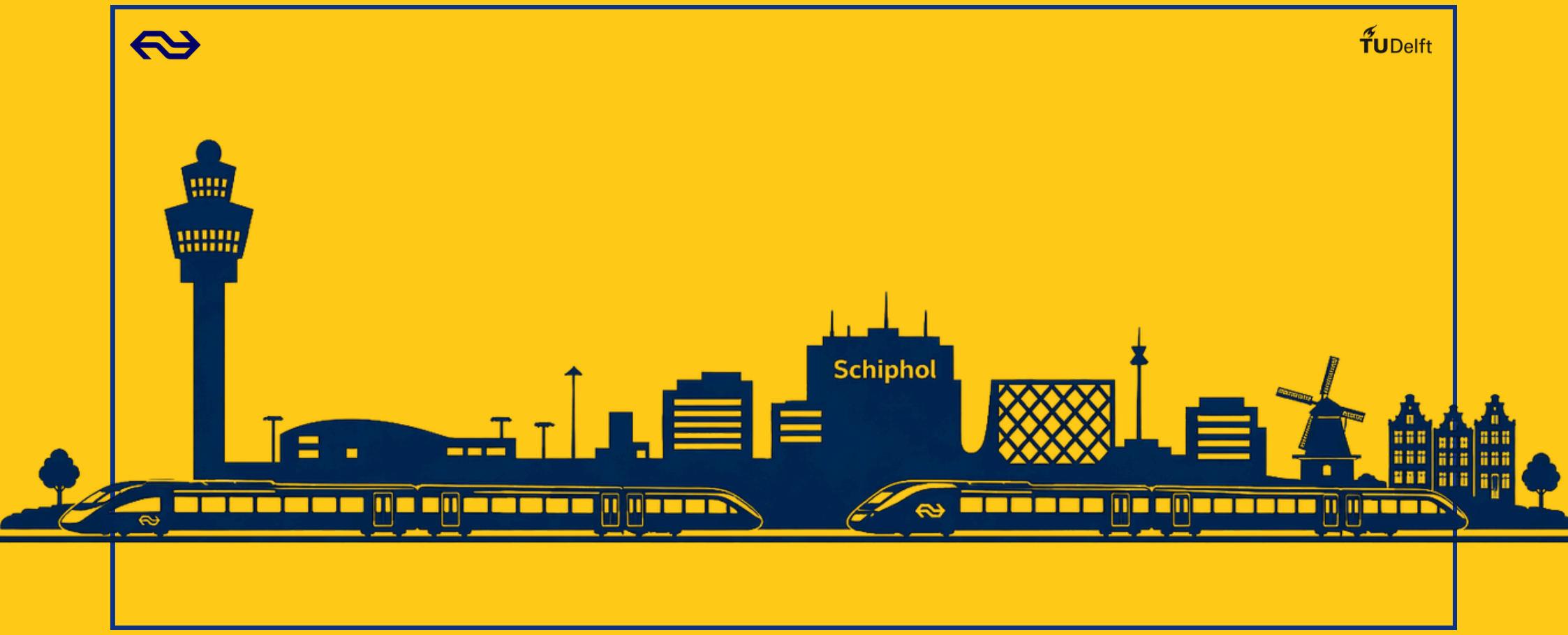
Designing Easy and Ticketed Train Travel from Schiphol Airport



Master Thesis Nynke Hilverda
Strategic Product Design
July 2026

Colophon

July 2026

Author
Nynke Hilverda

Master Thesis
Strategic Product Design
Faculty of Industrial Design Engineering
Delft University of Technology
The Netherlands

Supervisory team
Erik-Jan Hultink
Suzanne Hiemstra-van Mastrigt

In collaboration with
Nederlandse Spoorwegen
Pascal Tax (company supervisor)

Preface

This thesis is the final piece of my Master's in Strategic Product Design at TU Delft, and I am proud of where it has led. I started my studies in Delft in 2018, and even after all these years, I still learned so much during this final project. Taking on a project this big for a real company, all on my own, was both exciting and a little scary. I got to do it exactly the way I wanted, but I also missed having teammates to make big decisions together. Even so, I look back on this time happily: the days at the NS office, the many nice people I met, and the helpful feedback that made the work better along the way.

I was drawn to this subject because it sits exactly where I like to work as a Strategic Product Designer: between people and systems, between a real user standing lost on Schiphol Plaza and a landscape of organisations. I also loved how relatable it was. It is a subject everyone understands immediately, because almost everyone knows the feeling of arriving in a new place and not understanding a thing about how the public transport works. Part of what made the project so rewarding is that I ended up with a design I never would have expected at the start; the research took me somewhere I could not have predicted.

That was also the challenge. This was never a problem one party could solve alone, and much of the work was learning to navigate the different, sometimes conflicting, interests of NS, ProRail, Schiphol and Bureau Spoorbouwmeester, while never losing sight of the tired traveller at the centre of it all. Reframing the problem from teaching travellers an unfamiliar system to removing the need to understand it at all was the moment the project came together, and it taught me a lot about the value of stepping back before designing forward.

I could not have done this alone. I want to thank my supervisory team at TU Delft, Erik-Jan Hultink and Suzanne Hiemstra-van Mastrigt, for their sharp questions, their guidance, and for pushing me to think about every small decision I make. Thank you to everyone at NS, and in particular my company supervisor Pascal Tax, for opening doors, sharing information, and trusting me to run a real pilot at Schiphol. I am grateful to all the stakeholders and travellers who gave their time and honesty during interviews and the co-creation workshop; this thesis is built on their insights.

Finally, thank you to my friends, my family, and my boyfriend for their encouragement throughout this process and their enthusiasm about the topic. One of the things I enjoyed most about this project was that everyone understood it immediately. I could tell anyone what I was working on and they were instantly engaged, because everybody knows the station, or knows the feeling of arriving tired and confused at an unfamiliar train station. Many people told me they thought of me every time they checked in or out at Schiphol, and it was partly through this that I really felt everyone's support. Hearing everyone's experiences and suggestions always reminded me why this topic, and with it my thesis, matters.

This thesis is the result of many hands and many conversations, and I am proud of where it has arrived.

I hope you enjoy reading it.

Nynke Hilverda
Amsterdam, July 2026



Summary

Schiphol is the busiest gate-less station in the Netherlands and has by far the highest amount of international travellers. The problem is, a recurring share of them board the train without a valid ticket. NS asked how the journey could be redesigned so these passengers understand the Dutch check-in/check-out system without gates, while recovering lost revenue. Through desk research, stakeholder and traveller interviews, and on-site observation, this thesis reframes the problem. The cause of invalid boardings is not missing infrastructure but the absence of a clear, intuitive story that reaches tired, first-time travellers at the right moment.

Three traveller types were identified (systems misinterpreters, wayfinding-dependent, and assumption-based travellers), all unintentional fare evaders created by unfamiliarity, fragmented information and a noisy environment. Because the four key stakeholders (NS, ProRail, Schiphol, Bureau Spoorbouwmeester) hold conflicting priorities, ideas were generated in a co-creation workshop reframed through speculative design, then filtered against four constraints and scored against six stakeholder-ranked criteria using a weighted, sensitivity-tested model.

The final design is a multilingual QR-code ticket purchase at the moment travellers are already paying attention. This is at the train information screens on Plaza, where most travellers stop to find information about the time and platform of the train towards their final destination. By scanning the QR code, travellers can easily buy a fixed-price e-ticket in their own language and preferred payment method, with no need to understand the check-in/check-out system because an e-tickets does not need to be checked in. The involvement of stakeholders in the design process and the use of white label tickets from Distribusion made it possible to quickly and easily set up a pilot to test and validate the design. The pilot's success shows that a small, well-placed intervention can solve a long-standing problem. It offers NS a proven, scalable first step toward an easier journey for international travellers.

Reading guide

1

Chapter

Section

Research Question

“Quotes”

Section Conclusion

Chapter Conclusion

Glossary

TBx: Train Information screen

CICO: Check In Check Out

ComIt: Commerce & IT

NS: Nederlandse Spoorwegen (Dutch Railways)

MKS: Multimodale Knoop Schiphol

CT: Paper ticket

EMV: Europay, Mastercard, and Visa (open-loop payment)

ASD: Amsterdam Central Station

OVCP: Public Transport Card and Gates

UVB: Fine from train conductor (Uitstel Van Betaling)

KVA: Ticket Sale Machine

HKJ: How can you

RSB: Routing, Signing and Branding

KPI: Key Performance Indicator

MaaS: Mobility as a Service

Content

Preface 3
Summary 4
Reading guide 5
Glossary 6

1 Introduction 8
1.1 The goal of the Project 9
1.2 List of Stakeholders 9
1.3 Method 13
Conclusion 14

2 Discover 15
2.1 Competition 16
2.2 Learning from Abroad 17
2.3 Trends and Developments 18
2.4 Relevant Initiatives at Schiphol 21
2.5 Understanding the Challenges 23
2.6 Revenue Loss for NS 31
2.7 Stakeholder Analysis 32
2.8 Understanding International Travellers at Schiphol 33
Conclusion 38

3 Define 39
3.1 Key Take-aways for the Design Phase 40
3.2 Design Brief 41
3.3 Design Constraints 42
3.4 The Design Criteria 43
Conclusion 44

4 Develop 45
4.1 Designing the Co-creation Workshop 46
4.2 The Co-creation Workshop with Stakeholders 49
4.3 Concept Selection 52
4.4 Choosing the Final Concept 55
Conclusion 56

5 Deliver 57
5.1 The Final Design 58
5.2 Design and Pilot 62
5.3 Feasibility and Viability 65
Conclusion 68

6 Discussion 69
7 Recommendations 70
8 Limitations (+ AI Statement) 71
Concluding Statement 72

References 73
Appendix 75

1

Introduction

With the airport being more than 100 years old and the station dating from 1975, the infrastructure of Schiphol is outdated. On the other hand, passenger numbers have increased by 30% since 2022 (CBS, 2026). The station is becoming too small for the current visitors, and research shows that many travellers struggle to travel by train with a valid ticket (Knipscheer, 2024). Once they leave the plane, they encounter one of the Netherlands' most complex mobility hubs: a multimodal, commercially dense and gate-less station environment.

This problem has been known within NS for some time. Within the MKS project (Multimodale Knoop Schiphol), NS, ProRail, Schiphol and the Ministry of Infrastructure and Water Management explored a redesign of Schiphol Plaza with an OVCP(Public Transport Card and Gates)-domain. Their goal was to implement gates at Schiphol Station as well (NS, n.d.). However, these gates never came due to cost and safety concerns. As a result, many travellers still end up "trapped" behind exit gates at their final destination. Travellers have numerous explanations, like buying the wrong ticket, assuming they can buy a ticket on the train, or not knowing where to check in with their bank card. This situation is extra complicated because of the divided ownership of the station: Schiphol owns the Plaza, ProRail manages the rail infrastructure below, and NS operates ticketing and train services within these spaces. Despite the move of ticket sale machines (KVA's), the increase in tourist ticket machines and 10 train ticket sale desks, the international travellers still struggle. There are so many, that it's impossible for conductors to even write fines (UVB's) for the travellers without a ticket in one carriage.

Figure 1: Exterior Schiphol (NS Merkplaats)

1.1 The goal of the project

The goal of this project is to understand the international traveller and the underlying causes of the problem at Schiphol, so improvements can be designed that make real impact. Since there are plans to change the infrastructure of Schiphol completely by 2035, The solution should be implementable in the near future.
To do this, I hope to identify and bridge the gap between the key stakeholders and identify opportunities that are both feasible and aligned with the intuitive way of thinking of international travellers. By developing a concept for NS, the project seeks to help international travellers eliminate uncertainty in the final steps of their journey, thereby improving both NS's revenue and overall customer satisfaction.

For my thesis I am working in collaboration with the team "Development and Innovation of Service Formulas" of NS. Two of the team members are focused on Schiphol Station and have been in a long discussion with ProRail and Schiphol on what to do about the challenges on this station. To help them with this challenge, I want to answer to following question they asked me:

"How might the journey at Schiphol be (re)designed so that international passengers understand the check in/check out process without physical gates, thereby increasing revenue for NS?"

For my research I am focussing on the journey from Schiphol to ASD. However, the solution might also affect all other journeys from Schiphol.

Finally, the research will also explore the future of travelling and needs of international travellers in complex environments. This will contribute to the research on seamless air-rail travel.

1.2 List of stakeholders

What makes this project just as much interesting as challenging are the stakeholders involved at Schiphol Train Station (figure 2). It is important to understand who they are and what they do. Three layers of stakeholders can be identified; primary, secondary and tertiary stakeholders. Stakeholders can be grouped by how directly they are involved in the project: primary stakeholders are directly affected and involved in day-to-day use, secondary stakeholders influence the system but are not part of daily operations, and tertiary stakeholders shape the wider policy or institutional context (De Mascia, 2012).

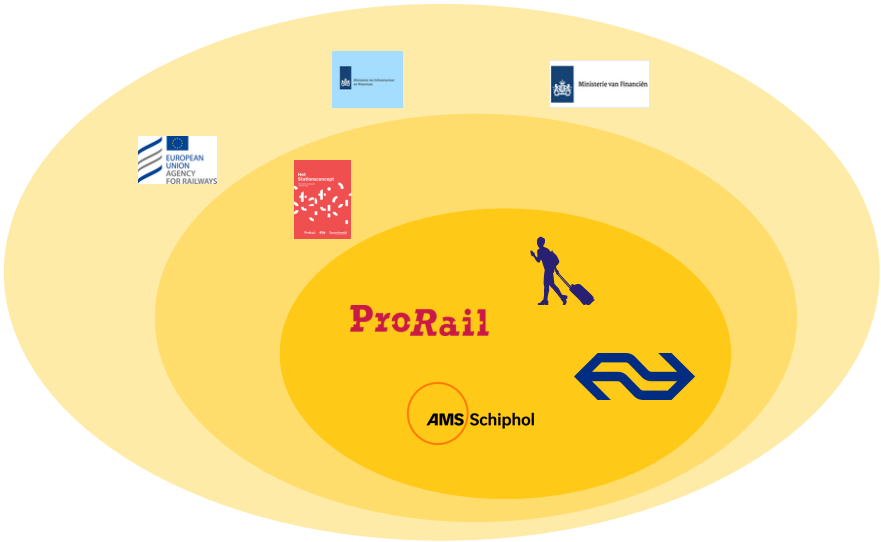


Figure 2: Stakeholder field of this thesis

The International Traveller
The first primary stakeholder that should be mentioned is the international traveller. These are travellers arriving at Schiphol from abroad who are unfamiliar with the Dutch public transport system and face difficulties with travelling to their final destination. It is their experience at Schiphol Train Station that this thesis sets out to improve, and their behaviour that determines whether any solution works. A more thorough analysis is done in chapter 2.8, where their needs and different types are described.

ProRail
ProRail is one of the primary stakeholders in this project. ProRail and NS used to be one company. In the mid90s the Dutch government wanted to make NS more independent and reduce subsidies, and an EU rule required that managing the tracks and running the trains had to be separated. So NS became responsible for the trains and stations, while ProRail became in charge of the tracks and infrastructure (NOS, 2012). ProRail gets its money from the government and from fees paid by transport operators, not from direct sales to consumers or profits from ticket sales. ProRail's main purpose is to manage and improve the Dutch railway network so trains can run safely and on time (ProRail, n.d.)

Nederlandse Spoorwegen
NS is another primary stakeholder in this project. To understand the problem at Schiphol Station, it is necessary to first understand NS as an organisation: its structure, strategic priorities, history and financial situation.

Organisational Structure and Strategy
NS is a public limited company wholly owned by the Dutch State (Government of the Netherlands, n.d.). NS itself can be divided into many subcategories (see figure 3), eventually leading to the team for which this project has been done: ‘ (development and innovation) Service Formulas’ in ‘Kern’.
The different levels in the company have different goals, with each layer becoming more specific. NS’s strategy for 2026 is to keep the Netherlands sustainably accessible for everyone, with a focus on being reliable, affordable, and engaged. This is part of NS’s broader 2025–2030 strategy. The strategy of the ComIt department at NS is to "Simplify to Accelerate". They have four main KPI’s to reach this goal (see figure 4). An important change for NS is the introduction of the OVpas, this will replace the OV chipcard that has been in use since 2007 (NU.nl, 2026). More information about OVpay can be read in section 2.3. They also want to promote different products to different types of travellers, whilst still providing a consistent digital NS experience. Besides this, there is also a digital-first focus in many teams. This means for example that they would like to decrease the number of KVA's at stations, because they aren't used that much, are very costly, and have outdated technology. With all this, they hope to reach an improved customer experience.

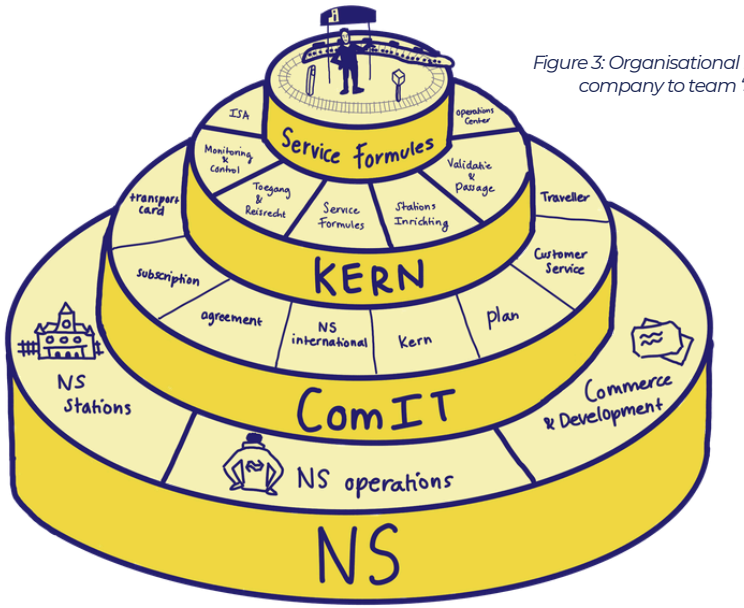


Figure 3: Organisational layers from entire company to team ‘Service Formulas’

01 **Successful OV-pas introduction**
due to migration and phasing out of the OV-chipkaart

02 **Growth in “choice-travel”**
through targeted marketing

03 **Consistent digital NS-experience**
through one digital landscape with 1 app and 1 web

04 **Improved customer experience**
through digital (self-)service and customized travel guidance

Figure 4: Four KPI's for the ComIt department

If you zoom into the ‘Kern’ team, part of ComIt, their main focus is to always provide the right resources in the (physical) customer journey (NS, n.d.). Lastly, the goal of the team ‘development and renewal service formulas’ is to support customers' door-to-door journeys by rolling out the OVCP-resources and implementing RSB principles in retail locations and on public transport customer-facing channels, while ensuring compliance with accessibility standards.

Monopoly
NS was formally created in 1938 through the merger of HIJSM and the Maatschappij tot Exploitatie van Staatsspoorwegen (SS), and has since then been the biggest railway company of the Netherlands. They have a monopoly on the main rail network (hoofdrailnet). However, The European Commission sued the Netherlands over NS's monopoly on the main rail network, claiming the 2025-2033 concession was awarded without competitive tendering, violating EU law. Companies like Arriva say it prevents market liberalization and innovation on Dutch rails (Volkskrant, 2025). Because of this push from the EU, their monopoly position will probably not last forever.

Financial situation

Because of the pandemic that struck the Netherlands in 2020, the company had to operate for several years with empty trains, while many fixed costs and long-term investments had already been made. This left NS with major financial issues, resulting in strict budgets. NS has had to be very selective in which projects it can prioritize.
In 2025, NS reported its first profit since 2019, with an underlying result of €11 million, compared with a loss of €141 million in 2024. This improvement was driven by 2.9% growth in passenger-kilometres, reaching 16.5 billion in total, a 6% increase in revenue to €3.36 billion, and €200 million in cost savings. The revenue increase was mainly the result of more passengers travelling, higher ticket revenue, and general growth in demand for rail services (NS annual report, 2026).
Although it looks like NS is moving closer to financial recovery, the company still has an enormous debt. NS reportedly owes around €1.1–1.2 billion to the Dutch government, accumulated during the COVID-19 period. This means the budget remains tight today.



Figure 5: Many people at Schiphol Plaza (Picture taken in March, 2026)

Schiphol

Another primary stakeholder is Schiphol. This section zooms in on the strategy of Schiphol and the specialities of its station; how it was designed and what makes it different than other stations.

Strategy

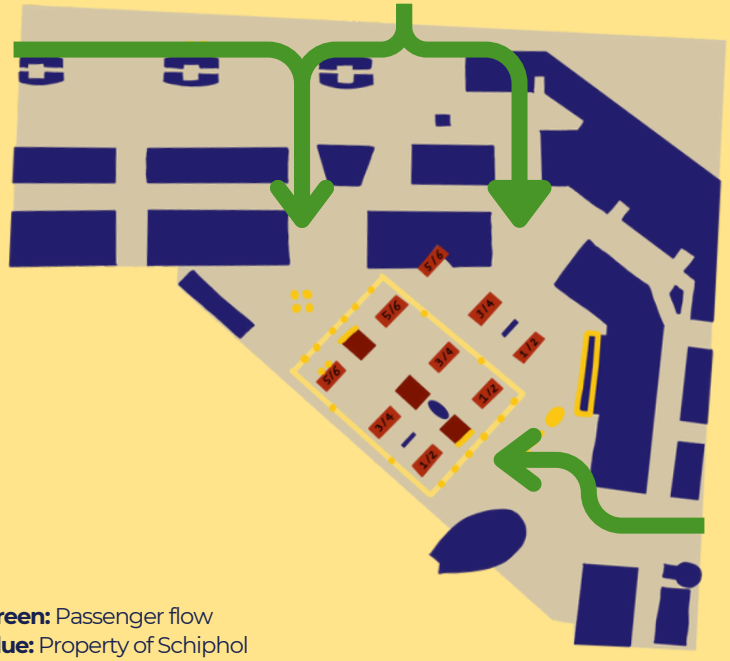
Schiphol's overall strategy is to remain a global connectivity hub while becoming the world's most sustainable and high-quality airport. In practice, that means Schiphol wants to keep the airport economically important and well connected, but reduce noise, emissions, and other negative effects on the surrounding area (Schiphol, n.d.). Especially their ambition to become more sustainable is interesting, because taking the train from the airport is definitely more sustainable than a car. Encouraging train travel to and from the airport supports that goal by shifting passengers away from higher-emission road transport.

People and function

Schiphol station is one of the biggest stations in the Netherlands, with 90.000 daily visitors (NS dashboard, 2025) and can get very crowded (figure 5). Schiphol Station is not like other stations. First of all because there are more foreign travellers than any other station. Schiphol Airport has about 64% international passengers (Schiphol, 2025). This makes it more challenging to provide an easy transfer, because international travellers are not used to the Dutch public transport system. Another big challenge is the building itself. It was build in the seventies when the number of travellers was much lower than today and it aims to be an entertainment place (Schiphol, n.d.) It combines many different functions including station, airport, shopping area, food court, transport hub. In the last decades it has had many add-ons, but there is no logical sense. Whilst many desire a completely new layout for the station, its limited surrounding area, the number of daily visitors, and its enormous costs prevent this from happening anytime soon.

Open payment border

Schiphol Station is the only big station (>70.000 daily visitors) in the Netherlands that does not have closed borders. With an open payment border, passengers check in and out using CICO poles instead of passing through physical access gates. While this gateless setup at Schiphol reduces queues, handles peak loads more effectively and safer, and allows for direct walking routes, it places a cognitive burden on passengers. Without these gates, they have to remember to check in and/or out, which is easy to forget.



Green: Passenger flow
Blue: Property of Schiphol
Red: Escalators/elevators/stairs owned by ProRail
Yellow: Resources from NS

Figure 6: Station lay-out at Schiphol

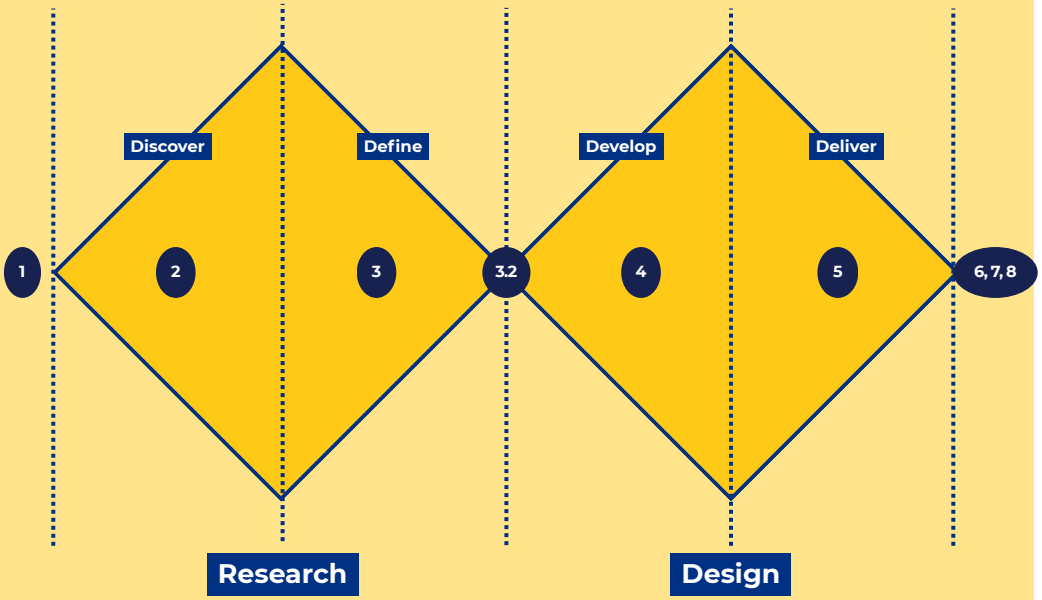
Station layout
The station layout reinforces this problem (see figure 6 above). Unlike a conventional Dutch station, Schiphol has no distinct station hall. The station hall is a space where, according to Bureau Spoorbouwmeester's design guidelines, a traveller would normally slow down, orient, and prepare for the journey. This makes it hard for the travellers at Plaza to go through the phases that are ordinarily designed at stations where missed check-in's and check-out's are less common.
It is important to realise that a major renovation of Schiphol Plaza is planned for 2035. The plans are nowhere near finished, but it will definitely include a more logical station design as described in the guidelines of Bureau Spoorbouwmeester, and maybe even include ticket gates. This is important because it means that within the scope of this research, there will be no enormous renovations in the station itself.

Bureau Spoorbouwmeester
Bureau Spoorbouwmeester is a secondary stakeholder. They are involved in projects carried out by NS and ProRail and can influence decision-making, but they do not have final authority and are not involved in day-to-day operations. Spoorbeeld is the document that has all the design guidelines, and it is very extensive. It exists to create a clear, recognizable, and user-friendly railway environment that improves the passenger experience and strengthens trust and safety. Important for my research is that they also think it's important that the use of facilities and services is straightforward, which is listed in Spoorbeeld as one of their priorities (Bureau Spoorbouwmeester, n.d.).

Public Authorities
The Ministry of Infrastructure and Water Management sets the main framework for Dutch Rail policy, public transport, and the concessions under which NS operates. The Ministry of Finance "owns" the NS and their financial decisions can affect NS's funding and long-term position. The European Union / European Railway Agency set broader rules for rail competition, interoperability, and regulation across Europe.
The Ministry of Infrastructure and Water Management, Ministry of Finance, and the European Union/European Railway Agency are tertiary stakeholders because they influence NS through policy, ownership, and regulation rather than through direct operational involvement.

1.3 Method

In order to answer the research question, the double diamond method is applied. The project is divided into 4 phases, all taking approximately the same amount of time, adding up to 20 weeks in total. The first diamond consists mostly of research and defining the problem. This includes the discover and the define phase. The second diamond consist mostly of designing and iterating concepts. This includes the develop and the deliver phase. A simplified version of this process with the included chapters is shown in figure 7.



1. **Introduction**
2. **Context Analyses & Qualitative Research**
3. **Problem definition**
   - **3.2 Design brief**
4. **Co-creation workshops & Idea selection**
5. **Final design & Pilot**
6. **Discussion**
7. **Recommendations**
8. **Limitations**

Figure 7: The double diamond method and its corresponding chapters

The methods I have used in the four phases of the double diamond are shown below.

Discover

Desk Research

Collecting and analysing existing knowledge, including a competitor analysis, benchmarking solutions abroad, and an analysis of relevant trends.

Qualitative fieldwork

Semi-structured interviews with stakeholders, international travellers and service employees combined with ethnographic observation of travellers.

Qualitative Data Analysis

Coding the data with a predefined, iteratively refined codebook and directed content analysis with binary frequency counts.

Synthesis and Mapping

Translating the findings into a stakeholder map with tensions, three first-time-traveller personas, and a customer journey map.

Define

Demands and wishes

Translating the research into non-negotiable design constraints (demands) and differentiating design criteria (wishes).

Develop

Co-creation and ideation

Generating ideas together with stakeholders through a facilitated workshop using "how can you?" questions, a pilot workshop and speculative design. Input from visual-thinking consultancy Flatland grounded in dual coding theory, and dot voting to discuss the most promising ideas.

Structured Concept Evaluation

Assessing the concepts in a weighted, multi-criteria decision model with the use of a constraint filter, criteria weights aggregated through a Borda count, an assumption log, a sensitivity analysis, and an inter-rater reliability check.

Deliver

Feasibility, Viability and Desirability Assessment

Evaluating the final design against these three lenses

Pilot

A test of the final design at the TBx screens on Plaza, measuring whether and how travellers use the QR touchpoint to buy a valid ticket.

Conclusion

This chapter set out the problem this thesis addresses. Schiphol is the busiest gate-less station in the Netherlands, built on ageing infrastructure that was never designed for today's passenger numbers, and the planned gates of the Multimodale Knoop Schiphol project will not be installed. In this gate-less setting, international travellers keep boarding the train without a valid ticket. This problem costs NS revenue and creates frustrations when the travellers end up at ASD with closed gates. The goal of the project is therefore to help these travellers board with a valid ticket.

The stakeholder involved in the decision making at Schiphol Station are NS, ProRail, Schiphol, Bureau Spoorbouwmeester and the public authorities. They each hold different, sometimes conflicting interests, which is part of why the problem has not be resolved yet. To navigate this complexity, the project uses the double diamond method, consisting of a discover, define, develop and deliver phase. The next chapter begins the discover phase by investigating the situation at Schiphol Station.

2

Discover

In this chapter the project research question is explored. This chapter explains the context of the problem and it covers a competitor analysis, an analysis of initiaves abroad, important trends and developments, and projects that have been done at Schiphol Train Station in recent years.

It also includes qualitative research to better understand the behaviour of international tourists and the needs of different stakeholders. Rather than continuing the years-long stakeholder debate about what could be changed, this chapter refocuses on what the traveller at Schiphol actually needs, but always within the real constraints of the station.

By combining the desk research and the qualitative research, an international traveller analysis, customer journey and stakeholder analysis were made.



Figure 8: Schiphol Plaza (NS Merkplaats)

2.1 Competition

To understand the needs of the international traveller it is important to know why they choose the train, and what NS its value is at Schiphol Plaza. After spending some time at Schiphol, I have signalled 6 main competing travel options (Figure 9). I have visualized the competing travel options on two axes in figure 11; rental cars, hotel shuttles, taxi's, ride hailing apps, touring coaches, busses and trains. At major hubs like Schiphol, the train station is located directly beneath the central hall, acting as a "natural gateway" for air travel. This exceptional proximity is a major reason why nearly 50% of all origin and destination passengers at Schiphol already utilize the train as their main mode of transport to and from the airport (Toet, 2025).



Figure 9: Travel options to and from Schiphol (Picture made in March, 2026)



Figure 11: Commercial for Uber (source: NS Colleague 27-04-2024)

When deciding their mode of transportation, international travellers at Schiphol Airport look at total travel time (driving plus waiting), costs (like tickets, parking, or fuel), and trip purpose (van Nijen, 2024). That's why I chose to compare travel options based on the time that it takes until you reach your final destination and the price of the entire travel.

As shown in figure 10, NS is the fastest and most affordable option, which makes it very attractive, especially if you're on a budget. However, price and speed are not the only reasons why people choose a certain mode of transport. At Schiphol, competitors actively try to convince travellers to choose them. Ride-hailing services like Uber (figure 11) and Bolt in particular have large advertisements in the baggage reclaim halls, which can push people towards choosing that option instead. Also, giving people the option to scan and use their service immediately can sound very appealing if other options seem overly complicated.

Sustainability is another factor that influence people's choice. Taking public transport is the most eco-friendly option, which matters to some travellers (Toet, 2025). People with higher incomes on the other hand, may prefer a taxi or rental car for the extra privacy and comfort. Practical factors like a lot of luggage or travelling in a large group can also make public transport a less appealing choice.

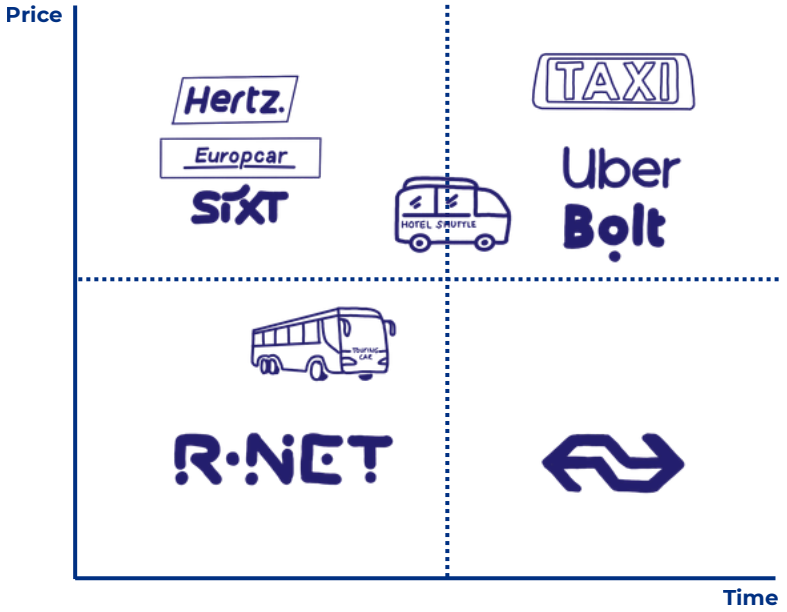


Figure 10: Travel options at Schiphol, compared using price and time

2.2 Learning from abroad

Every country you go, the public transport system is different. This causes difficulties because at every airport station there is a new system to learn. However, it's also a great way to get inspiration to do things differently. Three examples from abroad are highlighted in this section.

Arlanda Express

The first airport that sets a great example, is the Arlanda Airport with the Arlanda Express in Stockholm. The first thing I noticed when I was at this airport was the clear and recognizable communication of this train (Figure 12). A case study showed that Arlanda Express is easy to use because the service unifies its previously fragmented ticketing and customer channels into one omnichannel system, making pricing and access consistent across app, website, and kiosk (Valtech, 2024). The station is just underneath the airport and with simple wayfinding, and system explanation, a low-friction journey is created that works very well for international travellers who are unfamiliar with the airport environment.

Lufthansa

Lufthansa's Express Rail model shows how intramodality can simplify travel by combining train and flight in one booking. They provide one ticket, transfer guarantees, and local public transport included in the rail leg (figure 13). This way, international travellers don't have to understand yet another system after a long journey. Already having secured your ticket, your only worry is to find the right platform. This model is a relevant benchmark for how airport access could be designed more seamlessly for international travellers (Hill & Mullen, 2024).

Narita Airport

Nikken Sekkei's design for Narita Terminal 3 is a strong example of simple wayfinding: instead of expensive moving walkways or illuminated signs, the designers used a running-track-inspired floor graphic system, strong colour coding, and a stripped-back interior to guide passengers intuitively (figure 14). The result is wayfinding that feels playful but is very easy to understand, because travellers can follow the route almost instinctively rather than stopping to decode information boards. It shows that international travellers can be supported through simple visual cues, reduced complexity, and one dominant guiding logic (Inspiration Grid, 2015).



Figure 12: Arlanda Express touchpoints

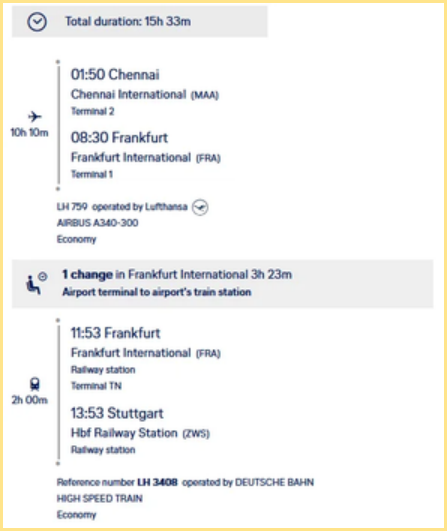


Figure 13: Combination ticket from Lufthansa



Figure 14: The floor at Narita Airport

2.3 Trends and developments

In this section I will explain relevant trends and developments. They are relevant because they have a connection to how we plan our travel, how we pay for it and what our expectations are. They also show a gap between what is currently possible and what is done at Schiphol Station at this moment.

Barrier-free travel

The future of the open payment border at Schiphol is moving towards a concept called "barrier-free travel", aimed at reducing the cognitive burden on international travelers who often struggle with CICO poles.
To fix this, the Visiedocument Mobiliteit Schiphol (Hiemstra-van Mastrigt, 2018) describes a shift where the plane ticket also works as a public transport ticket. Instead of having to find physical card readers, travelers will use their smartphones for automatic payment through apps they already use, like WeChat or Messenger. The system will also send helpful alerts to their phones, telling them exactly which train to take or if there are delays. The ultimate goal is to make the "payment border" invisible, so travelers can move smoothly from the plane to the train without any stress.
The paper also describes a pilot, to test this new system, but unfortunately due to the pandemic the pilot did not happen. Still, the underlying need it tried to solve (invisible payment borders for international travellers) is relevant, and the conditions to solve it like the OVpay infrastructure, mobile wallets and QR adoption have actually improved.

Mobility as a Service (MaaS) in the Netherlands

In the Dutch context, MaaS is defined as a digital platform that allows travelers to plan, book, and pay for their entire multimodal journey in a single environment (figure 15). MaaS has evolved in the Netherlands from a technology-driven "MaaS 1.0" into a more holistic "Public Mobility" (MaaS 2.0) framework, which focuses on building a healthy ecosystem to achieve societal goals like reduced car ownership and improved sustainability (Larco et al., 2024).
While applications like 9292 and the NS app are well-known, the Dutch "Programma MaaS" (2017–2022) enabled a wider landscape of regional apps, including Gaiyo, Glimble, and Amaze, to test various integrated travel solutions (Beneder et al., 2022). However, because the Dutch public transport system is built around the OV-chipkaart, many MaaS providers struggle to offer competitive prices. Current regulations often prevent MaaS apps from reselling specific discount products or subscriptions, meaning their tickets would be much more expensive than regular fares, not really suitable for a healthy business model.

Furthermore, while international travelers often rely on global apps like Citymapper, the Dutch strategy aims to integrate these users into a localized yet interoperable ecosystem.
NS is a central figure in this transition, because it has adopted a strategy to function as both a transport operator and a MaaS provider. By integrating shared mobility such as OV-fiets, shared scooters, and cars directly into its digital platform, NS seeks to own the "first and last mile" of the journey and reduce fragmentation.
However, there is still a mismatch between user expectations and current functions, specifically regarding the geographical limitations of ticketing and insufficient integration with broader MaaS initiatives. To reach its full potential, MaaS apps have to go beyond standalone products and function as bridges within a complex transport ecosystem (Zitrický et al., 2025). This requires active government steering to remove legal barriers in the Wet Personenvervoer 2000, standardize data exchange via the TOMP-API, and ensure a level playing field where all mobility providers can compete fairly (Beneder et al., 2022).

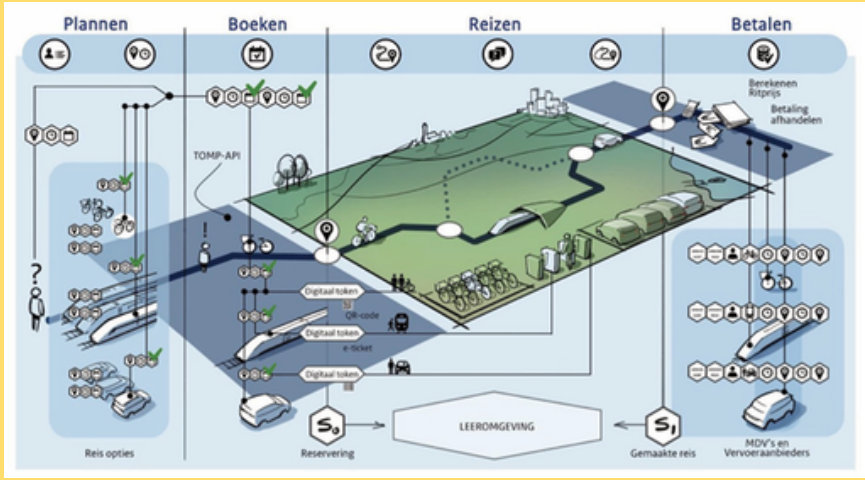


Figure 15: Mobility as a Service (Beneder et al., 2022)

OVpay
In the Netherlands, only about one in five payments is made with cash, compared to more than half (52%) of all payments across the eurozone, making the Netherlands the most card and digital payment-oriented country in the euro area (De Nederlandsche Bank, 2025). One of the biggest changes is that the smartphone has become a powerful financial tool. Instead of carrying a physical wallet, many people now use mobile wallets like Apple Pay or Google Pay to pay for items by simply tapping their phone or scanning a QR code. This "silent revolution" is driven by new technology and the fact that people find digital payments much more convenient and efficient (Dauletova et al, 2025).

OVpay allows public transport passengers in the Netherlands to check in and out using their debit card, credit card, or mobile phone, removing the need for a separate OV-chip card. The system was developed by Translink and public transport companies, together with banks and the Dutch Payments Association. Since June 2023, OVpay has been available across all public transport operators in the Netherlands, making it the first country in the world with a nationwide solution like this. The familiar OV-chipkaart is disappearing and being replaced by the OV-pas (figure 16) at the end of 2027 (Van den Broek, 2026). This is integrated in the OV-pay system and will also be able to be used from your e-wallet. When travellers use OV-pay by checking in with a creditcard, it is easy because they do not need to register or top up a balance. By December 2024, 41% of all contactless check-ins in public transport were made with a debit or credit card, up from 33% a year earlier (Dutch Payments Association, 2026). In the case of international tourists it is less easy because they still face the problem of figuring out what to do and where to go. There is potential here, but because they don't know the system the experience for first-time international travellers is not great. Another downsides of using your bankcard to check in is that there is less price transparency, since charges appear later on a bank statement, and it has no compatibility with subscriptions and discount plans, which still require an OV-chipkaart or OV-pas.

Intolerance for complexity
The confusion around OVpay is not accidental, it is part of bigger design problem. The infrastructure has improved, but the experience has not kept up. Understanding why requires looking at how people make decisions under pressure.
Digital interfaces increasingly shape user expectations by making interactions feel immediate, intuitive, and low-effort. Human reasoning operates through two different cognitive systems: a fast, automatic system driven by pattern recognition, and a slower, deliberate system that requires conscious effort (Kahneman, 2011). In this digital age, people have become accustomed to the fast and automatic system that support quick action with minimal cognitive load (Patterson, 2017). The Calm Technology movement, formalised by Case (2024), captures this shift: the future of interface design lies not in adding features but in reducing the cognitive load for users at every interaction point.



Figure 16: The new OV-pas that will replace the OV-chipkaart (Van den Broek, 2026)

This intolerance for complexity becomes especially critical in high-stakes, time-pressured moments. Research by Plonski et al. (2025) shows that time pressure during navigation in unfamiliar environments significantly increases subjective stress and degrades performance. Arriving at Schiphol Station has all of these stressors at the same time: an international passenger who has just completed a long flight arrives in an unfamiliar environment, under time pressure, managing luggage, jet lag and sometimes children. Their cognitive capacity is already depleted before they encounter the ticketing system.

The phygital continuum
This need for simplicity is related to the need of the modern travellers using digital technology throughout their entire journey. Physical and digital experiences are seamlessly blended through smartphone mediation, we call this the phygital continuum (Abd El-Hakim, 2025). This is an iterative and non-linear process where travellers engage in a cyclical circle of searching, encountering, and re-evaluating their plans in real-time. These loops allow for planned serendipity, a strategy where travellers use structured digital frameworks to facilitate spontaneous, opportunistic discoveries within managed parameters like time and budget (Abd El-Hakim, 2025).
As a result, the modern traveller is no longer a passive consumer but an active optimizer who co-creates their journey through constant digital feedback. However, this digital integration creates a paradox of digital dependency: while smartphones empower travellers with a sense of control and empowerment, they also act as a stressor, triggering anxiety and a "fear of missing out" when they lose connection or information becomes overwhelming (Abd El-Hakim, 2025). Schiphol is exactly the type of environment where cognitive overload peaks.

Smart ticketing
The way train tickets are bought, stored, and validated is changing rapidly towards a smart system. For this trend we can take a look at ticketing in the UK. National Rail distinguishes three main types of smart ticketing in the UK: smartcards, which store tickets on a reusable card tapped at a reader; eTickets, which are sent as a PDF by email and displayed as a barcode on a phone or printed at home; and mTickets, which are stored directly in a mobile app or digital wallet and must be activated before travel (National Rail, n.d.).
Each of these represents a step forward from physical tickets, but all three still require something from the user before they arrive at the station (an account, an app, an advance booking, or a printer). For an international tourist arriving at an unfamiliar station it is still not ideal. Ferreira, Ferreira, and Dias (2021) identify this as a key reason mobile ticketing is still a struggle from many people.

Beyond local systems
Alongside smart ticketing, tourism-facing digital services are increasingly expected to meet international visitors in their own context. They provide information in their language, they can pay with their usual payment method, on their own device, instead of having to learn a local system. The platform adapts to the user, not the other way around (Gutierriz, Ferreira, and Fernandes, 2025).

A white label solution is a product or service built by one provider but delivered without that provider's branding, so that it can be adapted in language, appearance, and payment options to suit any user. In the context of ticketing, this means a traveller can complete a purchase through a familiar, multilingual interface without ever needing to engage with the underlying Dutch transport infrastructure. One existing provider of exactly this kind of white-label rail ticketing is Distribusion, a B2B ticketing platform that already has a distribution relationship with NS. Distribusion can issue a valid train ticket through a multilingual, multi-payment purchase page that has the appearance of NS. For example, if you buy an e-ticket for an NS-train through Booking.com or Google Maps, this is done through Distribusion.

Conclusion
The trends described in this chapter converge on the same underlying problem. Travel behaviour and planning are becoming more digital and more mobile and the Netherlands has invested heavily in the infrastructure to support this, from MaaS platforms to a nationwide OVpay system. At the same time users have less and less tolerance for complexity and expectations are high. The tools to solve this are available: QR codes as frictionless entry points, white label interfaces that adapt to any language and payment method, and smart ticketing systems that no longer require advance registration. Phones are becoming smarter and smarter, and are actually great tools that can contain many solutions all at once (figure 17).

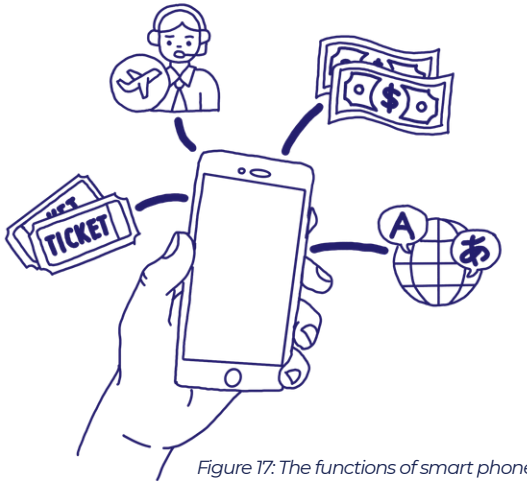


Figure 17: The functions of smart phones

2.4 Relevant Initiatives at Schiphol

As mentioned in the introduction, this problem at Schiphol Station is not new to the NS. Multiple initiatives have been tested and implemented at Schiphol and ASD. These initiatives have not solved the problem yet, and that's what makes them interesting. What are these initiatives, and why have they not succeeded in solving the problem? This is highly relevant information for the design phase.

Floor sticker

As mentioned in the introduction, the placement of gates is not an option. Still, you want to give the traveller a sense of where they enter the "stations domain". Instead of the gates, where travellers would normally feel the moment of stepping into the station, NS has placed a blue floor sticker to show where the gates would have been (figure 18). This is where you should check-in for your journey. Its placed alongside the CICO-poles that are placed on the Plaza.
In reality, it does not bring the clarity that it should because the decrease in lost check-ins and -outs since the placement of the floor sticker is quite small (and it is hard to measure what part of this is due to the floor sticker). The limited effect is probably explained by a combination of factors: poor visibility from certain angles due to the lighting, the many surrounding distractions (people, signage), and the counterintuitive placement on the floor while all other information is much higher up (see figure 19).

Figure 18: The floor sticker at Schiphol plaza





Figure 19: The floor sticker at Plaza is difficult to notice (picture taken March, 2026)

Mastercard campaign

With the rise of check-ins in public transport with credit cards, Mastercard has seen a potential in promoting the use of their product They created a campaign that promotes checking in for public transport with your mastercard. When you arrive at baggage claim, you see the campaign at several screens. They have also added it to the fences in the arrival hall, so it's one of the first things you see (figure 20).
After the campaign has been going on for approximately 6 months, it still has not shown a significant increase in travel with valid tickets. I believe the biggest issue with this campaign that it is not clear who you are targeting. There is no recognition for people who want to travel by train, that this advertisement is important for them. It is also unclear where to check in. The dark colours, subway-style lines, and simplified outline of a CICO pole have no recognisable link to NS's visual identity, so travellers do not realise that these refer to the yellow CICO poles at Schiphol Plaza (or other NS touchpoints) they are meant to interact with.

Figure 20: The Mastercard campaign on fences at arrivals (left) and screens in baggage hall (right) (picture taken April, 2026)





Pop-up counter at ASD
During a trial at Amsterdam Central, a pop-up counter was placed next to the information desk to help tourists buy a tourist ticket for Amsterdam (figure 21). Relatively few tourist tickets were sold at the pop-up desk, so the numbers do not justify a tourist ticket machine at that location. The desk did help inform travellers and ease pressure on the main information desk.
When I discussed the pop-up desk with an NS colleague, it was mentioned that it probably did not work because of the location, although it was the only location they got permission for. The pop-up was too far from the exit gates, so people did not know how to get there. An information can only help a number of people, not nearly the number of people that have this problem at ASD. Another reason it was not that successful can be that people are so close to leaving the station, that it feels like too much hassle to make an effort to buy a ticket there. Last but not least, it does not appeal to international travellers with this problem, as it only shows 'OV-informatie'.

Travel information in baggage hall
With the intent of giving more information on travel options and how to access this, information boards (figure 22) are shown in the baggage halls of Schiphol. It also contains a QR code, that will explain how contactless payments work in public transport.
Unfortunately, research done by Schiphol showed that these QR codes were rarely scanned. One reason is that a lot of international travellers don't have cabin luggage with them, which means they quickly pass through this hall. People who do have luggage, are possibly more focussed on the arrival of their luggage than the next step in their journey. Secondly, the screens contain a lot of text and are hard to read, still not explaining clearly the process of gaining a train ticket. Lastly, the QR code is really small.

Figure 22: Explainers in baggage claim at Schiphol (Picture taken by NS colleague, 2024)

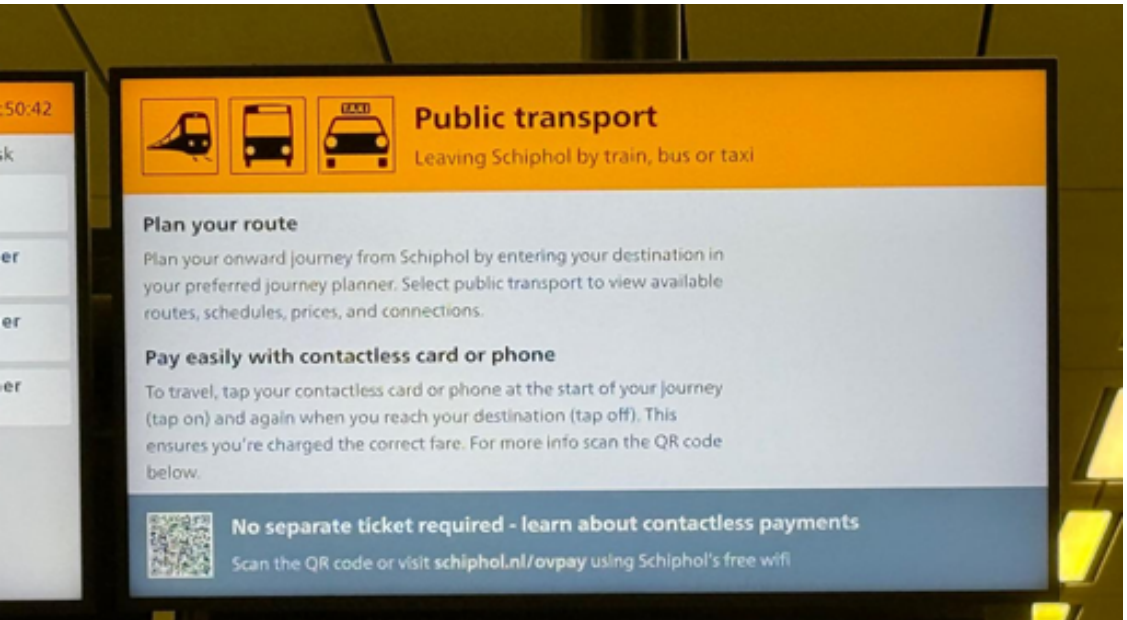




Figure 21: The pop-up counter at ASD (NS, 2019)

Section conclusion
The floor sticker, the Mastercard campaign, the pop-up counter at ASD and the information boards in the baggage hall each tried to help the international traveller, but unfortunately were not successful. First, they reached the traveller at the wrong moment or place in the journey. Second, they were not recognisable as part of the train journey. Third, they assumed prior knowledge and effort. In short, these initiatives were waiting to be found and decoded rather than meeting the traveller actively, at the right moment, in a recognisable and self-explanatory way.

2.5 Understanding The Challenges

In this chapter I will dive deeper into the problem by gaining multiple perspectives on the issue at Schiphol Train Station through semi-structured qualitative interviews and observations. I will explain what interviews I did and why, how I have analysed the data from these interviews, and what conclusions I can derive from the interviews and my observations.
In order to learn about the perspectives from different stakeholders and to understand the challenges for international travellers I have conducted several semi-structured interviews. To learn more about the intuition of the travellers and to gain insight into the number of international travellers with this issue, I have also done observations.

In total I conducted:
2 interviews with NS employees, 1 with a Schiphol employee, 1 with a ProRail employee and 1 with an employee from Bureau Spoorbouwmeester. These interviews were held to understand the frustrations and desires around this topic from different stakeholder perspectives.
I have also spoken to 11 travellers at Schiphol Station, 9 at ASD, and I have spoken with 6 service employees at ASD. These interviews were conducted to hear about the most common mistakes and misconceptions from international travellers who travel from Schiphol Train Station. An overview of the interviews can be found in table 1.

This study was conducted as a qualitative study because the goal was to understand experiences, meanings, and contextual factors in depth rather than to measure them numerically. Qualitative research is well suited to exploring the "why" and "how" behind a phenomenon and to capturing participant perspectives in real-world settings (Maxwell, 2013). Because this project focused on stakeholder interests and the passenger experience at Schiphol Station, a qualitative approach is the best way to generate rich and context-sensitive insights (Maxwell, 2013).

Table 1: Overview of the interviews

	International travellers	**Stakeholders**	**Service employees**
What	Semi-structured qualitative interview	Semi-structured qualitative interview	Semi-structured qualitative interview
Time	+- 5 minutes	30-60 minutes	+- 10 minutes
Respondents	20	5	6
Where	Schiphol & Amsterdam Central Station	NS office, ProRail Office, Schiphol Office, Online	Amsterdam Central Station
Goal	Consumer insights	Stakeholder alignment and design opportunities and limitations	Consumer insights

Data collection and analysis
The interviews with stakeholder employees were all recorded with permission and later transcribed. The interviews at Schiphol and ASD were noted down with pen and paper and later transcribed manually. The interview data were analysed using a deductive codebook-based approach. Following the logic described by DeCuir-Gunby et al. (2011), the analysis started with a set of predefined codes that were derived from initial research, the research questions, and the specific context of the project. These initial codes were used to organize the data in a structured way and to guide the first round of interpretation. During the coding process, several additional data-driven codes emerged from the interviews, and previous codes were rephrased.

Research Results
The gathered insights identify the main challenges that cause the situation at Schiphol. In addition, it provides a guideline for potential solution areas and the ambition & goals for the new journey.

Getting stakeholder insight

In this section I will elaborate on the interviews that I have held with executive employees from NS, Schiphol, Bureau Spoorbouwmeester and Prorail. I will explain my approach, the data analysis and my conclusions.

Research objective
The goal is to understand the problem the international travellers face in more detail, and additionally; what is important for the stakeholders to have a successful solution. This has led me to the following research questions:

Q1: What is making it difficult for international travellers at Schiphol to travel with a valid ticket for the train?

Q2: What is necessary for a solution to be viable and successful?

In order to answer these questions I have asked them about their responsibilities, how they would describe the problem, the journey at Schiphol, a reflection on recent project or solutions, how they have experienced working together, and what they think is necessary for change. The interview guides can be found in Appendix A.

Data collection
All the interviews were recorded, with permission, and later transcribed using MacWhisperer. To correct the transcription from small mistakes I have asked chatNS (NS AI software):

"Can you convert the uploaded transcript into a cleaned-up version without changing its content? Please do the following: Correct unfinished and awkward sentences . Fix obvious typing and transcription errors. Do not add your own interpretations. Do not omit any content and do not summarize. Do not change the message or meaning; only the phrasing, spelling, and consistency of terms."

The final transcripts were read several times to become familiar with the content. Next, the transcripts were coded systematically using the codebook. Relevant fragments were assigned to the predefined codes when they matched the initial codes. In cases where the data provided additional nuance or relevant insights, the coding scheme was refined to better reflect the interview material.
After coding, the coded fragments were grouped per theme and compared across interviews to identify patterns, similarities, and differences. This approach works well because the analysis was guided by existing concepts rather than by fully open coding. In other words, the analysis started from a structured framework, which allowed the interview data to be examined in a focused and transparent way. The codebook can be found in table 2.

Results
The first set of codes captured the main concepts that were already expected to be relevant in the study, including resource accessibility, stakeholder management, ticketing, the unique context of Schiphol Station, the interests of ProRail, the interests of Schiphol, railway design guidelines, the passenger perspective, and information provision. In line with the iterative nature of codebook development, the transcripts were then read and coded in relation to these predefined categories, while the codebook was refined whenever the data showed recurring meanings that were not yet fully captured.

During the coding process, additional data-driven codes emerged from the interviews. These included safety assurance, perceived chaos, unfamiliarity, the CICO process, and desirable solutions. In some cases, existing code labels were renamed to fit with the content of the data and to make the codes more precise and consistent. This refinement process is in line with qualitative coding practice, in which codes are not treated as fixed labels but as analytical tools that may be adjusted as understanding of the data develops (DeCuir-Gunby et al., 2011).
Finally, the codes reflected four analytical dimensions: Dutch travel system unfamiliarity, Information uncertainty, stakeholder and organizational interests, and the specific spatial and institutional context of Schiphol Station. The colours in the codebook link each code to the dimension it belongs to.

Table 2: Codebook stakeholder interviews

Initial Code	Final Code	Times mentioned
Finding the resources	Resource accessibility	28
Stakeholders	Stakeholder alignment	26
Ticket sale	Ticketing process	21
NS interests	NS interests	15
ProRail interests	ProRail interests	16
Schiphol interests	Schiphol interests	17
Spoorbouwmeester interests	Spoorbouwmeester guidelines	11
Schiphol Station	Schiphol Station context	28
Traveller	Traveller needs	18
Wayfinding	Information provision	41
Chaos	Perceived Chaos	10
-	Safety assurance	8
-	CICO process	7
-	Unfamiliarity	16
-	Desirable solutions	10

Answering the Research Questions
With the results we can now answer the following research questions. Quotes from the interviews are provided to substantiate the answers. The original Dutch quotes can be found in appendix B.

Q1: What is making it difficult for international travellers at Schiphol to travel with a valid ticket for the train?

Dutch travel system unfamiliarity
One reason for explaining why it is so difficult for international travellers at Schiphol to travel with a valid ticket, is that they are unfamiliar with the travel system we have in the Netherlands:

"People are not familiar with the public transport system in the Netherlands, and therefore also not with checking in and out." (interviewee 1 (NS))

This makes it difficult for them to follow the right procedure. They don't recognise the CICO poles and ticket machines as something to interact with.

"We don't have gates; they are poles. These are poorly recognized by the international traveler. We now have those stickers, but recognizability is, I think, the most important point: the recognizability of the station is insufficient." (interviewee 5 (ProRail))

People often compare it to systems they have at home or they know from other destinations abroad, so they are not surprised when they don't have a ticket yet when they enter the train.

"It is more about: how does it work in the traveler's country of origin? In some countries you validate your ticket only inside the vehicle itself, especially with urban and regional transport. Then you expect validation machines in the vehicle, or on the platform." (interviewee 2 (Schiphol))

Information uncertainty

Another issue is that keeps popping up is that there is no explanation of the system:

"So: how do I get the information so that I immediately know how the journey works? Where do I need to get off or transfer? How does it work? The findability and the non-findability of the train and of the information are an issue." (interviewee 2 (Schiphol))

"Yes, and especially if you travel alone, no children, then a debit card is super convenient. You just need to know in advance what you have to do." (interviewee 3 (Bureau Spoorbouwmeester))

"And I have the idea that there is a group that does know how to do it but does not want to use it because they also want to know what it costs." (interviewee 4 (NS Stations))

There is no clear information of how the system works that the international traveller is able to find, for instance about how to get a ticket, what resources at Plaza you should use, and also in case of using a credit card, what it costs. Additionally, even if the system information would be there, it would still be a challenge to find this information. There is a lot of other information at Plaza which makes it difficult to stand out.

"but Plaza is a cacophony of information." (interviewee 4 (NS Stations))

Right now, the traveller has to intentionally look for this information online, so a system in which the information comes to you naturally and is explained clearly is preferred.

Q2: What is necessary for a solution to be viable and successful?

Stakeholder and organizational interests

The three most important stakeholders at Schiphol Train Station are ProRail, NS and Schiphol. Ultimately ProRail and Schiphol make the decisions when there are changes. So, being aligned is very important.

"You see that due to those various interests it is sometimes difficult to put the overarching interest – the traveler's interest – first, because there are so many other interests at play." (interviewee 5 (ProRail))

This shows that there is common ground, but there are also undeniable differences. For NS, the ticket sale is an important issue. They lose money over this, but they also damage their brand-image when people have a frustrating experience.

"You have to do something about it, otherwise the problem grows larger: more people without a valid ticket on the train, more dissatisfied customers." (interviewee 1 (NS))

ProRail is a company operating more on the background, at least for the travellers. They have responsibility for everything as soon as you take the stairs or elevator down. Their most important goal is safety.

"Our primary goal is to ensure a safe transfer." (interviewee 5 (ProRail))

Schiphol is the owner of the Plaza, and this means that they also have commercial interests. They also want an easy travel experience for their passengers, but for them it's usually a trade-off between that and their revenue.

"Those large advertising displays hanging above Plaza are extremely distracting. We would preferably have those removed as well. But of course, Schiphol generates revenue from them." (interviewee 5 (ProRail))

In order for a solution to be realizable and successful, these interests should all be taking into consideration. Without this, either one of the involved parties will not be eager to support the plans.

Specific spatial and institutional context of Schiphol Station

To be able to design something for Schiphol Train Station, you have to understand the limitations of the area. Many interviewees mentioned that gates would be the best solution. However, due to safety concerns this is not an option.

"That is definitely not going to happen. I will also tell you why: very practically. Gates are places where people could potentially hide behind. They simply want an unobstructed view, yes... they want a clear line of sight." (interviewee 4 (NS Stations))

It would also be the most expensive option, since gates are very costly. But other big implementations at Plaza will quickly become too expensive. The number of people there makes it a very expensive space.

"that Plaza, which is a sort of commercial space with all kinds of crossing flows of people from the parking garage, airplanes, you name it... If something changes there, it is usually also very expensive. It is very busy. So everything you do there comes at a cost." (interviewee 3 (Bureau Spoorbouwmeester))

The last important thing to keep into consideration is that it is not an ordinary station. Because most people are not like ordinary travellers. And this forms one of the foundations of this research, because Schiphol has a huge amount of international travellers, who think differently and know less than Dutch travellers. In addition, they also speak different languages and use different methods of paying.

"What is unique is that 80% of the audience is different. Because that is where it all comes back to: and that is the tourist." (interviewee 4 (NS Stations))

Getting consumer insight

In this section I will elaborate on the interviews that I have had with 11 international travellers at Schiphol Train Station, 9 international travellers at ASD, and 6 service employees at ASD. I will also explain why I did observation and what I have observed. I will explain my approach, the data analysis and my conclusions.

Research objective

The goal is to understand the group of people who make the mistake of travelling without a valid ticket. I want to know their way of thinking and where there are opportunities for improvement. These interviews were prepared after having already done a few other interviews, which had helped me with the preparation of the main research questions for this chapter:

Q1: What do international travellers find the most difficult when trying to travel by train with a valid ticket?

Q2: What would be the most intuitive way for people to find travel information?

In order to answer these questions I have asked travellers how they prepared for their journey, what they struggled with, and what would have helped them. I have asked service employees what they are asked the most and what they believe causes this and can help this problem. The interview guides can be found in Appendix C.

Data collection travellers

9 interviews with international travellers were held at ASD and 11 interviews with international travellers were held at Schiphol. The interviews were held at the stations using printed out questions sheets. I wrote all the answers down on the paper and later transcribed these to an Excel file. The results from the interviews are somewhere between qualitative and quantitative data. That's why these short field interviews (n=20) conducted at Schiphol and ASD were analysed using directed content analysis, a flexible quantitative-qualitative method ideal for brief textual responses.

Following Gheyle & Jacobs (2017), the short handwritten answers were treated as structured textual data where predefined categories were systematically applied to generate replicable frequency counts while remaining sensitive to contextual meaning.
A deductive coding scheme was developed with 8 categories, operationalized as binary presence markers for each respondent's response, visible in table 3.

Table 3: Codebook traveller interviews

Code	Definition	Count (max 20)
Prepared	Respondent arrived ready for process	12
Confused	Expressed uncertainty	18
Overconfident	Assumes familiarity without verification	6
Unfamiliar	Does not recognise NS touchpoints	14
Digital solution	Uses digital navigation	13
Human assistance	Uses help desk/staff	7
Getting ticket problem	Explicit ticket purchasing problem	7
CICO problem	Explicit check-in problem	12
Finding the platform	Difficulty finding the right train or platform	7



Figure 23: Intervieweing service employees at ASD (picture taken April, 2026)

Data collection service employees

6 interviews with service employees were held at ASD (figure 23). Similarly, the data from these interviews were treated as structured textual data where predefined categories were systematically applied to generate replicable frequency counts while remaining sensitive to contextual meaning.
A deductive coding scheme was developed with 7 categories, operationalized as binary presence markers for each respondent's response, visible in table 4.

Table 4: Codebook service employees interviews

Code	Definition	Count (max 6)
Wrong ticket	Buying an incorrect ticket such as the one from GVB	4
Tired/stressed	Feeling tired or stressed after a long journey	1
Brits	People from the UK as the most common group	4
Exploiting	People who know you have to buy a ticket but don't because you won't be checked	2
Ticket on the train	People who think you can buy the ticket on the train	3
Wrong CICO pole	Confusion from the red supplement pole at the platform	2
Ambiguity	Having too much and confusing information at the station as well as online	4

Results

Traveller interviews (n=20) revealed high levels of confusion (18/20) and unfamiliarity (14/20), confirming that travellers frequently experience communication ambiguity at both Schiphol and ASD. While most travellers arrived prepared (12/20), CICO problems (12/20) and preference for digital solutions (13/20) suggest process familiarity gaps still exist despite prior planning. Notably, only 7/20 reported ticket purchasing problems. A reason could be that people are planning on using their credit card more often, or feel like they are more knowledgeable than they actually are.. Although 4/6 service employees mentioned the GVB tickets to be problematic, only 2/20 travellers actually bought one. Almost every traveller I spoke with arranged their transport after they landed at Schiphol, even if they had read something about it before.
Service employee interviews (n=6) identified wrong tickets (4/6) and British tourists (4/6) as primary issues, alongside ambiguity from excessive station information (4/6). Exploiting behaviours (2/6) and wrong CICO poles (2/6) highlight deliberate system gaming and physical signage conflicts

Observations

Observing passengers at Schiphol and ASD provided extra contextual insights and revealed actual behaviours that self-reported interviews might miss, giving a more authentic understanding of navigation challenges and system interactions (Patton, 2015). I was also planning to use my observations to get a grasp on the size of this issue, and what it actually means for NS if they leave this problem as is.

Observing the traveller at Schiphol Train Station

The first thing I noticed, which is in line with the interviews I have held, a lot of people blindly walk past the ticket machine and CICO-poles. They have just left the plane, in some cases got their luggage, and walk towards the TBX-screens to see what train they should take and where it's leaving from. A lot of people stand still there for a long time, so it gets quite crowded (figure 24). From these screens they walk right to the platform, hoping to catch their train. They are unfamiliar with the CICO poles and don't interact with it.

Figure 24: Crowd looking at the TBx screens at Schiphol plaza (picture taken April, 2026)





The next place I observed the international travellers was at the at the platform of the Airport Express Train to ASD (platform 3). On this platform there is a red supplement pole (figure 25) which is usually mistaken as a CICO-pole. Some people walk upstairs when the check-in/validation fails. However, a lot of people assume it's broken and hop on the train, that arrives there approximately every 7 minutes. It's at this point that people think about check-in, but are still uncertain of how the system work and are not aware that they have done something wrong or what they should do instead. Since this has also come up in many of the interviews at both stations, I would say this supplement pole is quite confusing.

Figure 25: Confusing supplement pole at the platform (picture taken April, 2026)

To conclude, I have to mention that most international travellers look quite stressed and uncertain. Looking at the TBX screens, the screens on the platforms and at their phones with a lot of uncertainty and raised eyebrows. In addition, some people have had long journeys, have luggage and probably want to reach their hotel as soon as possible. There is a lot of potential here to create a better end of their journey to Amsterdam and begin of their trip.

Answering the research questions

With these results we can now answer the research questions.

Q1: What do international travellers find the most difficult when trying to travel by train with a valid ticket?

<u>Plenty of resources but without system clarity</u>

These results tell us that even though people come prepared and there are many ticket machines, international travellers are still not able to find the right information at the right time.

"People immediately walk downstairs when they are at Schiphol (which is strange, there are 56 check-in poles that they miss), they often indicate that they 'have not seen anything' " (Service Employee at ASD)

"There are many ticket machines, many check-in poles, that is not the issue. But people do not ask when they cannot find something. Sometimes they buy the wrong tickets." (Service Employee at ASD)

With all these CICO poles and ticket machines at the station but many people not recognising them as touchpoints for the train, we can conclude that system clarity is the real issue here. When I asked what was the most difficult part of the journey, a traveller at ASD said:

"...now that you mention it, I saw the poles but I did not know those were meant for checking in for the train." (International Traveller at ASD)

Blind assurance in system unfamiliarity
Another thing I noticed, in the interviews as well as in my observation, is that some people are not aware of their own ignorance. People may assume they already understand how the system works, so they do not question it or seek clarification. This fits the Dunning-Kruger effect, where people with limited knowledge can overestimate their own understanding because their lack of skill also reduces their ability to recognize that gap in the first place (Kruger & Dunning, 1999).

During my interviews at Schiphol Train Station I had several conversations with people who told me they knew how to check-in and they were just looking for the train. However, after I showed them where the CICO pole was located, they were completely surprised.

Q2: What would be the most intuitive way for people to find travel information?

Almost everyone I spoke with had difficulty finding something at the station. Whether that's the right platform, how to buy a ticket, or how to check in. The right information exists, but international travellers do not actively search for it before they need it. A key insight from my research is that the solution has to reach them at the moment they need it, through channels they are already using. There are two moments when to approach them.

When they plan their journey
More than half of the interviewees mention the use of Google Maps, and everyone I spoke to had access to internet. Some people even made use of the NS app. Useful online platforms are also travel agencies, who they definitely interact with when they are booking their flights. It was also mentioned multiple times during my interview with executive employees, that there is potential in reaching them before their flight, on booking platforms.

When they realise they need a ticket
For travellers who arrive without a ticket, there are a few moments where they realise something is wrong. The first is at the platform, where after still not succeeding to check-in, they get suspisious, but they still board the train. The second moment is on the train itself, for example when a conductor checks tickets or they expected it here but there is no option. The third moment is at the gates at Amsterdam Centraal, where travellers without a valid ticket cannot get through. Knowing where these moments occur is valuable because it shows where a ticketing solution could be provided at a time where travellers are already thinking about it.

Conclusion
Across stakeholder interviews, field interviews and observations, the core finding is clear: there is plenty of infrastructure and information, but no intuitive, coherent story that guides international travellers to travel with a valid, correctly validated train ticket from Schiphol. I believe that working together with stakeholders instead of against each other, is the key to creating a journey that is actually viable and will therefor help the international traveller. The four main themes, and how they are connected with eachother, are visualised in figure 26.

International traveller
Travellers arrive tired, stressed and cognitively overloaded. Many are unfamiliar with NS resources and compare Schiphol to systems at home, sometimes being overconfident. As a result, they miss key touchpoints (ticket machines, CICO-poles) and only start thinking about tickets or validation when it is too late.

Information Uncertainty
System information is fragmented over many digital and physical channels and is hard to find at Plaza. There is no simple explanation of how the Dutch CICO system works at intuitive places. The issue is therefore not a lack of resources, but a lack of information about the system.

Stakeholder Interests
NS, ProRail, Schiphol and Bureau Spoorbouwmeester all see the issue, but work under different priorities: revenue and image (NS), safety (ProRail), commercial interest (Schiphol), and design quality/recognisability (Spoorbouwmeester). Structural solutions require alignment and understanding.

Spatial Context Schiphol
Schiphol is a gate-less, extremely busy, commercially valuable station with small platforms and strict safety requirements. Many "obvious" fixes, such as installing gates, are not feasible or would be prohibitively expensive. The ownership split between Schiphol (Plaza) and ProRail (station) further complicates interventions.

Together, these themes explain why international travellers so often board without a valid ticket: in a complex spatial and organisational setting, overloaded and overconfident travellers are not given a clear story of what they need to do, where, and when. Any effective solution will therefore need to (1) start from the international traveller's behaviour and state, (2) create a clear story, (3) be co-designed and supported by all key stakeholders, and (4) fit the spatial and safety constraints of Schiphol Station. How all the themes are resulting in the four main themes, and how they are connected, can be seen in figure 26.

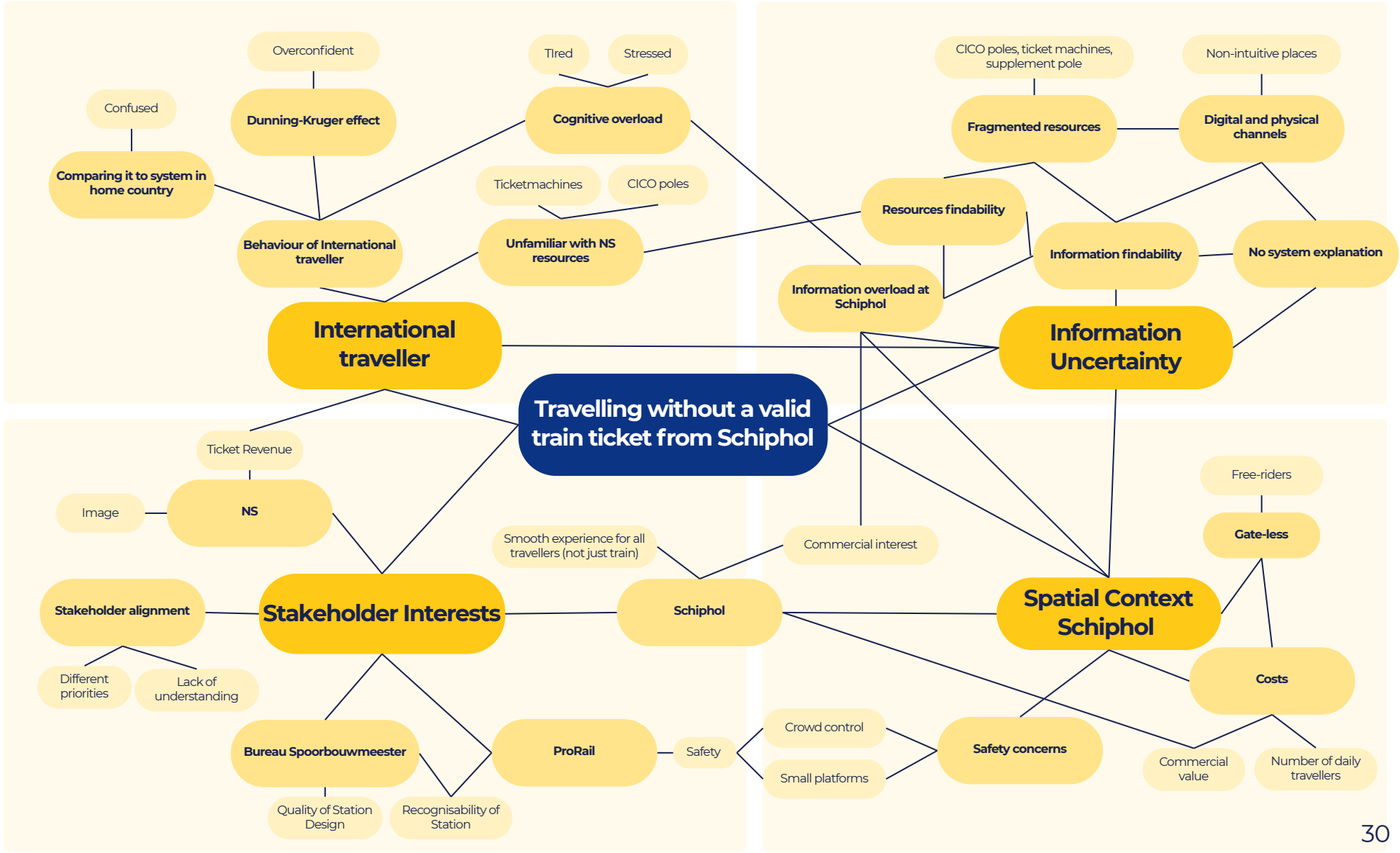


Figure 26: Connected themes from the qualitative research

2.6 Revenue Loss for NS

One of the questions from NS was to get insight in the revenue loss NS has caused by this problem. This is also important to know, so it can validate expenses that have to be made for a potential solution.

Data from ASD

Although service employees mentioned that they speak to about 50 international travellers stuck at ASD per hour, everyday, this number seems a bit unlikely. This would mean that there are about 10.000 travellers stuck every week, which doesn't makes sense compared to 30.000 travellers in total that go from Schiphol to ASD every week (NS Data). A more trustworthy source is the amount of times a service employee has used their card to open the gates. This happens approximately 2000 times a week in total (NS data).
Of course, there are sometimes other cases that they need to open the CICO gates, but on the other hand does this data not include tourists who tailgate and leave the station without the help of a service employee. This means that 2000 ticketless trainrides is a logic estimate.

2000 people on average a week that use the sprinter from Schiphol to ASD without paying (this tickets costs €5.50). This is roughly 104,000 travellers per year and this represents a revenue loss of almost €600,000 per year (and this is only the shortest and cheapest route).

Nationwide Revenue Loss

NS data also showed that 40% of the e-tickets and paper tickets sold are for the route from Schiphol to Amsterdam Centraal. Only e-ticket and paper-ticket data was considered here, as this gives a clearer picture of international travel behaviour than that of Dutch travellers, who typically travel with an OV-chipkaart or OVpay. The remaining 60% travel to other, more distant stations where fares, and therefore the revenue lost per traveller, are higher.
Based on the roughly 104,000 no-ticket travellers to Amsterdam Centraal, it can be assumed there are 260,000 no-ticket travellers per year across all destinations. Taking the conservative assumption that fares to these further stations are on average around twice the Amsterdam Centraal fare, the total annual revenue loss is estimated at approximately €2 million. It is important to be cautious because it is largely based on assumptions, but even then the figure comfortably exceeds €1.5 million, which makes clear that the problem represents a structural loss of revenue for NS rather than a marginal one.

€600.000

Estimated yearly revenue loss (Schiphol - ASD)

€1.500.000

Estimated yearly revenue loss (All routes)

The costs of service employees

Another expense that should be taken into consideration are the costs of the service employees that are hired to help travellers at ASD. To get insight into the costs of this I consulted the Station Manager of ASD. However, he mentioned that these service employees are hired for numerous types of activities, and helping international tourists leave the station without a ticket is just one of them. If the problem at Schiphol would be solved, they would have more time to help travellers with other issues and have a less stressful and demanding shift, but there would not be less people scheduled to work. He also mentioned that many service employees find this part of their work frustrating, as it can feel like they are resolving a repetitive and never-ending problem that originates elsewhere in the organisation rather than with the travellers. In other words, solving the problem would not directly reduce staffing costs. Its value here is not financial but qualitative: a more relaxed working day for the service employees, and the chance to spend their time on more meaningful tasks.

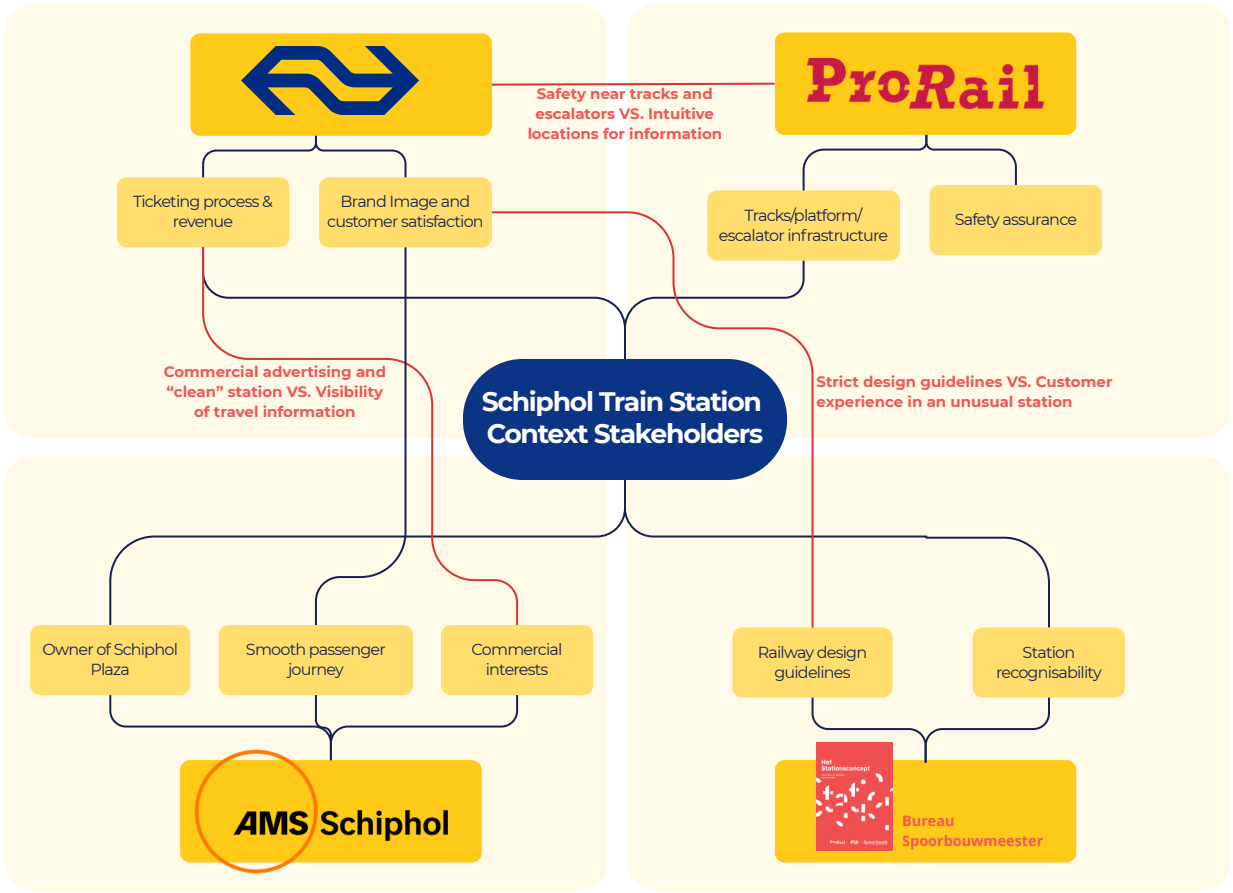


Figure 27: Stakeholder analysis

2.7 Stakeholder Analysis

If there is one thing that I've learned from the interviews it's that stakeholder involvement is very important. Not only because they all have different interests, but because it is vital for the implementation of changes and additions to Schiphol Plaza. The stakeholder map in figure 27 shows the different responsibilities of NS, Schiphol, ProRail and Bureau Spoorbouwmeester, and where their interest are tense.

Tensions

With Schiphol there is a shared ambition for an easy, fluent travel experience, but this is undermined by commercial priorities in Plaza that compete with clear wayfinding and system information. Spoorbouwmeester and NS agree on the goal of a pleasant journey for international travellers, but potential solutions are often constrained by the strict station design framework. ProRail is an important stakeholder with a dominant safety perspective, which can limit infrastructural interventions NS would prefer at places where crowds are bigger.

The way forward

Integrating air and rail travel into a single, seamless experience is a systemic challenge that requires designing journeys as cohesive units rather than isolated segments (Toet et al., 2025). This integration depends on effective orchestration to ensure decisions prioritize the passenger's end-to-end experience over individual organizational interests. Furthermore, operators must exchange real-time data to reduce friction when crossing system boundaries, providing the proactive assistance that gives travelers a sense of control (Toet et al., 2025). To achieve this vision, co-creation sessions are essential for stakeholders to move past siloed thinking (Delft Design Guide, 2013). When all stakeholders experience the passenger journey through collaborative sessions, they can find common ground and develop the passenger-centric mindset that is necessary for successful integration (Tassoul, 2004).

2.8 Understanding international travellers at Schiphol

The qualitative research showed that the state and characteristics of international travellers is a very important part of the problem. The scope of this research is to help international travellers at Schiphol Station with an easy and ticketed travel to Amsterdam Central. However, targeting just the “international traveller” is not nearly specific enough. First of all, not all international travellers are unaware of our public transport system, so we need to zoom in on first-time users. This section will look into the state and the specific challenges of these first-time travellers. It is also important to understand the behaviour of different types of international first-time travellers. Only when it is known who the design is for, can the design phase begin.

Challenges for first-time international travellers

Cognitive load

First-time travellers are travellers who, in this case, come to Amsterdam through Schiphol Airport for the first time. Research done by Lehr (2016) shows that first-time travellers don't have a routine. Because of this, they have to actively look for all information and for confirmation, resulting in a high cognitive load and stress (Liu, 2019). In line with the qualitative research, Lehr (2016) also mentions the information overload that most first-time travellers experience. This, in combination with unsuccessful check-ins or ticket purchase, can leave first-time users with a negative experience. Schiphol has many travelling options but not a distinctive appearance for train touchpoints to make this journey easy (see figure 28). Another thing that causes confusion for the first-time international traveller is that they often base their expectations on the dominant mode of the journey, typically the flight (the baseline modality). This means they expect the same level of service from the rail segment as they do from the flight, even though this is completely different at Schiphol (Toet, 2025).

Figure 28: Wayfinding at Schiphol (MSI Sign Group, n.d.)



Figure 28: Stakeholder analysis

In the article Wayfinding Signage Considerations in International Airports, Paul Symonds (2017) explains that guiding people through airports is extremely difficult because these spaces are like complex mini-cities. Travelers are often in a relaxed or emotional state where they become "unthinking individuals". The author mentions that when people are on vacation, they can become as "mindless and docile as sheep" meaning they stop focusing on details and simply follow the crowd. This behavior makes it hard for standard signs to work because travelers might be in a passive mood and ignore the information around them. The author argues that because international travelers have so many different languages and cultural backgrounds, designers must stop treating wayfinding as just a mental task and instead understand it as a social and emotional experience.

Linguistic and transactional barriers

In line with the realisation that it is a social and emotional experience, coming from a different country, where they use different apps, speak a different language and have different systems for ticketing and paying, is another challenge.
While basic tasks can often be completed in English, travelers struggle when situations become detailed or complicated (Liu, 2019) . Much information is provided only in Dutch (and sometimes English) leading to failure in understanding critical instructions (Lehr, 2016).
Because international travellers also use different payments systems, the payment options that can be used in the NS app, on the NS website, or at the ticket machines from NS, can be very limited (figure 29 shows only two payment options on the website of NS). The research by Lehr (2016) also mentioned that a major pain point for international tourists is the rejection of international bank cards or the need to enter a pin code when using a credit card.

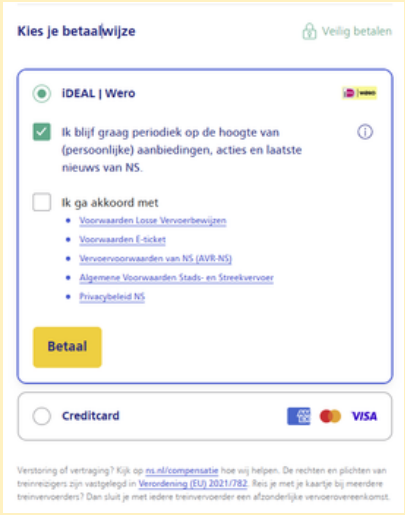


Figure 29: Buying train tickets online can only be paid for with iDEAL or certain types of credit card (screenshot, May 2026)

Deliberate VS automatic decision making

The behaviour described becomes clearer when you look at how people make decisions. Kahneman (2011) distinguishes 'fast, automatic and driven by pattern recognition decisions making' from 'slow and deliberate decision making'. As I explained in the Trends and Developments chapter, travellers have grown used to interactions that ask almost nothing of slow and deliberate decision making, and they have a low tolerance for complexity.

At Schiphol this is amplified: the international traveller arrives jet-lagged, under time pressure and managing luggage, with their cognitive capacity already depleted (Plonski et al., 2025). In this state they rely almost entirely on automatic decision making, they don't stop to study an unfamiliar environment or decode the Dutch system, but act on quick pattern recognition, look for what resembles home, and head straight for the train. This explains why they walk past ticket machines and CICO poles, because recognising them would require deliberate decision making which they are not able to do most of the time.

Identifying three types of first-time international travellers

Figure 30 shows how the first-time international travellers can be divided into three groups. First, a distinction is made between travellers who do and do not have a valid ticket. The group without a valid ticket is the focus of this research. During observations at Schiphol Station and Amsterdam Centraal, many different reasons emerged for why travellers ended up without one. Reasons were:

- They bought a ticket for an another public transport provider
- They couldn't find the CICO pole
- They thought the supplement pole was the CICO pole
- They didn't know where to buy a ticket
- They thought they could buy a ticket on the train

These reasons reflect different levels of preparation and different types of misunderstanding. By mapping travellers along two axes (prepared versus unprepared, and valid ticket versus no valid ticket) three main groups emerge who consistently end up travelling without a valid or correctly validated ticket.

Intentional fare-dodgers are excluded from this research, as they deliberately choose not to pay. According to NS colleagues, this group likely represents around 1% of travellers, similar to the rate of "zwartrijders" in the Netherlands. They also mentioned that fare-dodgers will most likely always find a way to avoid paying.

It is good to know that although there are three groups, not all three groups are the same size. Although it's hard to say which group is the biggest, my guess would be that wayfinding dependent travellers is the biggest group. Most of the problems mentioned occur within this group. 14/20 travellers mentioned they didn't recognise NS touchpoints, and 12/20 had CICO problems, meaning they knew they had to check in, but were able to find the right touchpoints. 6/20 were overconfident, showing that they travelled with wrong assumptions (smaller group), but only 2/20 bought GVB tickets so misinterpreted the system (smallest group).

systems misinterpreters

Travellers who try to perepare themselves for their journey, but misunderstand how the (NS) system works, for example by buying a ticket for the GVB.

wayfinding dependent travellers

Travellers who mainly rely on guidance along the way (signage, announcements, staff) instead of prior knowledge. They would miss the check-in poles because they dont recognise it.

assumption based travellers

Travellers who act on their own assumptions instead of verifying information. For example thinking you can buy a ticket on the train because they do that at home as well.

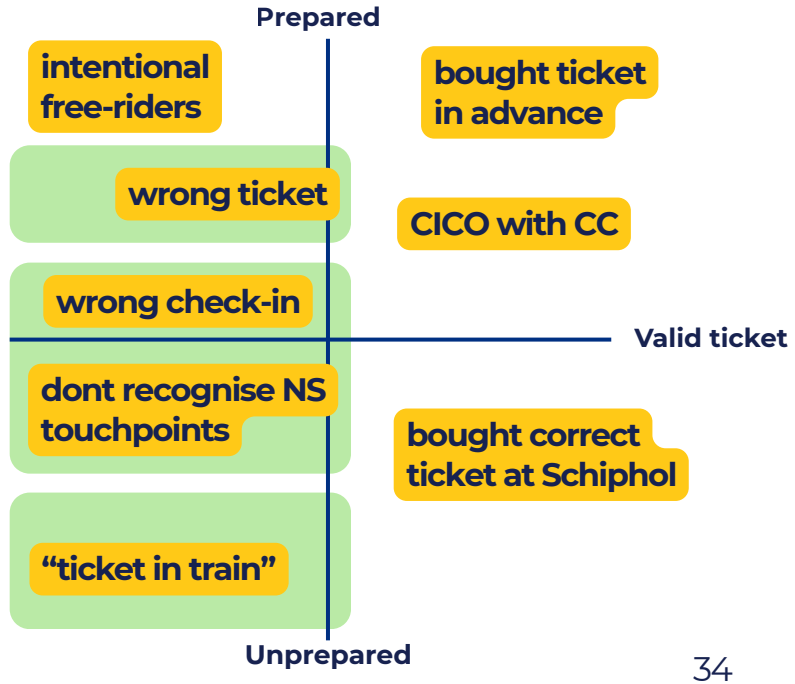


Figure 30: Identifying three types of international travellers

Customer Journey
Now that we know who these first-time international travellers are, it is time to look at how they experience their journey from booking flights at home to arriving at their hotel. A tourist does not experience Schiphol, NS, wayfinding and ticketing as separate systems, they experience one connected journey. After observing travellers at Schiphol Station and studying the broader travel context, the full customer journey of an international first-time traveller can be mapped.
The train journey itself, although only a small part of the overall trip, carries disproportionate weight (Kahneman, 2011). The recency effect shows that the final stage of a journey strongly shapes the overall memory of the experience, because recent events are weighted more heavily than earlier ones (Abenoza et al., 2018). Failing to check in and therefore boarding without a valid ticket, or struggling to exit at Amsterdam Centraal can therefore overshadow an otherwise smooth trip. This makes it all the more important to get this part of the journey right, for NS, the airline, ánd for Schiphol.

Figure 31 on the next page shows the customer journey, experienced by the three different types of first-time international travellers. Their different levels of preparation influence how they experience the journey, and when they experience pain points. The figure shows again that the wayfinding dependent travellers is the biggest group, this is where most of the pain points occur.

The steps below describe the customer journey for each type of traveller if everything would go without troubles. The customer journey on the next page show the same steps, but this time with their specific pain points and how the journey is experiences over time by travellers that unintentionally do not get a ticket.

Step 1 - Home
At home you plan your trip. This includes booking the flight, booking an accomodation, maybe some activities and in some cases also the transport from airport your accomodation.

Step 2 - Flight
You take the plane to Schiphol Airport

Step 3 - Schiphol Airport
You arrive at Schiphol Airport and enter the airport through the gate

Step 4 - Baggage Reclaim
In some cases, you have checked in your luggage. In this case you have to wait at the baggage reclaim for your luggage. In other cases you can just walk through the baggage reclaim to leave the airport.

Step 5 - Arrival Hall
You leave the baggage reclaim and enter the arrival hall, where someone could be waiting for you. Most of the time, you now have to find your own transport to your final destination.

Step 6 - Schiphol Plaza/Schiphol Train Station
By following the signs to "train' you enter Schiphol Train Station, also known as Plaza.

Step 7 - TBx screens (Train Information)
To get the correct information you walk towards the information screens at the Station. This contains the information on where your train will leave and at what time.

Step 8 - Ticket Purchase or Check-in
To board the train correctly, you buy a ticket if you don't have one yet, or you check in at the CICO pole with OVpay.

Step 9 - Platform (Beneath Plaza)
At the platform you wait for the train. The information screen shows at what time the train will arrive.

Step 10 - Sprinter (Train)
You board the train to Amsterdam Central Station, the train journey takes about 17 minutes.

Step 11 - Amsterdam Central Station (ASD)
At ASD you leave the station by checking out with OVpay or the ticket that you bought.

Step 12 - Hotel
You can take the tram, metro or bus to your final destination. You can also walk or take the bike if you feel like it.

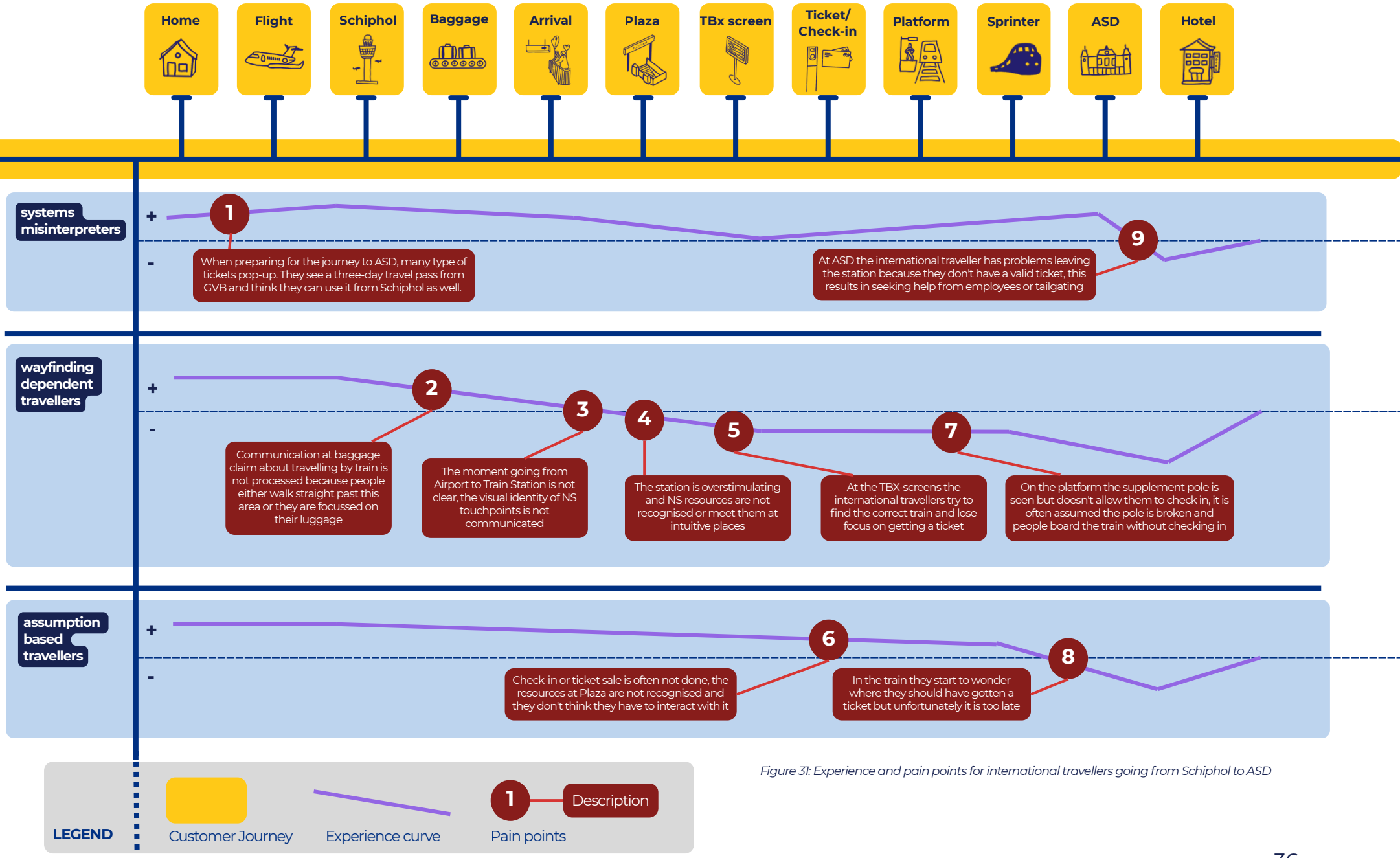


Figure 31: Experience and pain points for international travellers going from Schiphol to ASD

Discussion: Implications for the design phase
All three traveller types share the same journey, the same environment, they have some different and some overlapping pain points, yet they fail at different moments and for different reasons. As mentioned before, the biggest group is probably the wayfinding dependent travellers. Many reasons for travelling without a ticket occur within this group, so it is definitaly the most interesting group to look at.

However, designing exclusively for the largest group would mean leaving significant opportunities on the table. According to research by Toet et al. (2025), effective solutions must address multiple moments across the journey, And they should only be evaluated on how they serve the biggest group but also how they might help others. A solution that helps a wayfinding-dependent traveller recognise a CICO pole may at the same time help a systems misinterpreter understand that they might have the wrong ticket. On the other hand, an intervention aimed at assumption-based travellers, for example, explicitly communicating that tickets cannot be bought on the train, may have little effect on someone who is simply lost in the environment. It is therefore important, after the ideation phase, to reflect on which ideas serve the largest group, which ideas risk creating confusion for another group, and which work across all three. Ideally, a solution functions for all three traveller types at once; at minimum, it should not create new pain points (for any group).

One additional distinction cuts across all three groups and adds another layer of complexity: the difference between digitally oriented travellers and those who prefer physical signage or staff. This dimension is not captured in the traveller matrix, but is important to keep in mind in the design phase.

The insights from this last section form a clear foundation for the design phase. They show who to design for and where the journey currently breaks down. The challenge ahead is to translate this to ideas, for which the design brief in the next chapter will help.

Conclusion
Scoping the international traveller down to first-time travellers shows three types of travellers without a valid ticket: systems misinterpreters (buy the wrong ticket), wayfinding-dependent travellers (walk past unrecognised CICO poles and KVA's), and assumption-based travellers (expect to buy on board). Arriving tired, overstimulated and unfamiliar with the system, they are already under a high cognitive burden, so they tend to switch off, rely on habits from home, and follow the crowd rather than actively search for information. The customer journey shows they experience Schiphol, NS, wayfinding and ticketing as one connected journey, and the short train leg is important for how they experience the whole journey. All three share the same route but fail at different moments. Not all groups are the same size, but a good solution preferably works for all of them, or at least not against any.

Conclusion

The discover phase tries to answer the question: why do international travellers so often board the train at Schiphol without a valid ticket and what is necessary for a solution to be successful? A competitor analysis, international benchmarking, a trends and developments analysis, a review of past initiatives, qualitative fieldwork, a loss of revenue estimate, a stakeholder analysis, and an in-depth study of the travellers themselves all try to help answer this question.

The competitor analysis showed that the train is fast and cheap and still loses travellers, meaning there are other things like comfort and ease of use that make other travel providers more appealing. Looking abroad confirmed that the difference is made by experience design. Each of these successful experiences point toward solutions that are easy and intuitive.
The trends analysis placed this in a wider context: travel is moving toward barrier-free, cashless and contactless journeys, travellers increasingly expect simplicity and react badly to complexity, and the line between physical and digital is blurring. The conclusion was that a design that brings different features together for the specific situation of the international traveller arriving at Schiphol, is missing. The review of past initiatives made the same point from the opposite direction, they reached travellers at the wrong moment, were not recognisable as part of the train journey, assumed prior knowledge, and waited passively to be found.

The qualitative research grounded these observations in real behaviour. Interviews with stakeholders, twenty international travellers and six service employees, supported by observation, showed that Schiphol does not lack ticket machines or check-in poles; what it lacks is simple information at the right timing. Travellers don't ask for help a lot of the time and often only realise they need a ticket once they are on the train or at the gates at ASD. The revenue analysis showed that the consequence is a revenue loss of roughly €1.5 million euros every year.

After analysing my research, the stakeholder analysis explained why the problem has been a process for years. NS, ProRail, Schiphol and Bureau Spoorbouwmeester each have different interests and priorities (revenue and image, safety near the tracks, a clean and commercially valuable station, and strict design standards). The barrier is therefore as much organisational as it is spatial.

Finally, the analysis of international travellers narrowed the focus to first-time international travellers and showed that they arrive overstimulated, lean on wayfinding rather than active searching, and face both a language and a payment barrier. They were captured in three personas: systems misinterpreters, wayfinding-dependent travellers and assumption-based travellers .They share the same journey and environment but fail at different moments and for different reasons. Because the short train leg disproportionately shapes the overall memory of the journey (the peak-end rule), getting it right matters more than its length suggests.

Taken together, the discover phase leads to the conclusion that there is not a lack of infrastructure, but the journey misses intuitive and coherent touchpoints that reach the right traveller at the right moment. This is in a situation where stakeholders with competing interests should find common ground in order to make decisions. A workable solution must therefore be findable without prior knowledge, recognisable as part of the train journey, placed where the traveller is already paying attention, and acceptable to all four stakeholders. These requirements are carried into the define phase, where they become a design brief, constraints and criteria.

3

Define

The discover phase produced a rich but broad picture of the problem. The goal of this chapter is to converge my findings into a focused direction for the ideation phase. It is important that it is clear what a solution must achieve and within which boundaries it has to work. This is the second half of the first diamond, where research is turned into a concrete brief.

The chapter does this in four steps. It begins with the key take-aways for the design phase, discussing the most important insights from the research into the points that should guide every design decision. Then the findings are framed in a design brief, which sets out the design challenge and the revised research question. The design constraints define the hard boundaries that any solution must respect, and the design criteria describe the qualities that separate a good solution from a merely acceptable one. Together, these form the foundation for the ideation that follows in the develop phase.



Figure 32: Schiphol Plaza (NS Merkplaats, n.d.)

3.1 Key take-aways for the design phase

The importance of the stakeholders in design

One of the most important findings of my research is how important it is that the biggest stakeholders ProRail, Schiphol, Bureau Spoorbouwmeester and NS and cooperating. The interviews revealed that they have different interests and together have a hard time agreeing on interventions at Plaza. A good way for interventions to really have impact is for them to be co-created with key stakeholders, which will be explained in section 4.1. It should also fit within the spatial, safety, systematical and financial limits, which will be explained further in section 3.3 about design constraints.

Designing for the international traveller

The thesis focuses on three main types of first-time international travellers at Schiphol who try to follow the rules but still often end up on the train without a valid or correctly validated NS ticket. All three groups are unintentional fare evaders created by unfamiliarity, fragmented information and the complex, noisy environment at Schiphol Station.

The research shows that the main problem is not a lack of machines or check-in poles, but that the train system at Schiphol is unclear and confusing for international first-time travellers. They arrive tired and stressed and walk straight past ticket machines and CICO poles. Information about tickets and check-in is spread over many places and channels, but there is not one clear explanation. Even if there would be, would it be too much for these international travellers to understand and remember? Usually explanations are not in their native language and some people travel with assumptions about public transport systems in their home country.

Keeping a user centric perspective in the design phase

While the complexity of stakeholder interests and spatial constraints at Schiphol Station shapes the boundaries of any solution, it is essential that the design process is still focussed on the experience of the international traveller. The discover phase has made clear that the core problem is not technical or infrastructural, it is experiential. To prevent the solution from being driven by organisational convenience rather than traveller needs, a user-centric perspective must be actively maintained throughout the design process. This means continuously returning to the question: does this work for a tired, first-time international traveller who has just stepped off a plane and has no prior knowledge of the Dutch public transport system? This question is what lead me to the design criteria in section 3.4, which formulate how I will grade all ideas coming from the develop phase.

This perspective will also be kept through a co-creation session structured around the customer journey of the international traveller. By mapping ideas and interventions directly onto the journey (from booking a trip to arriving at the hotel) the focus remains on the experience at each touchpoint rather than on organisational or technical solutions in isolation.

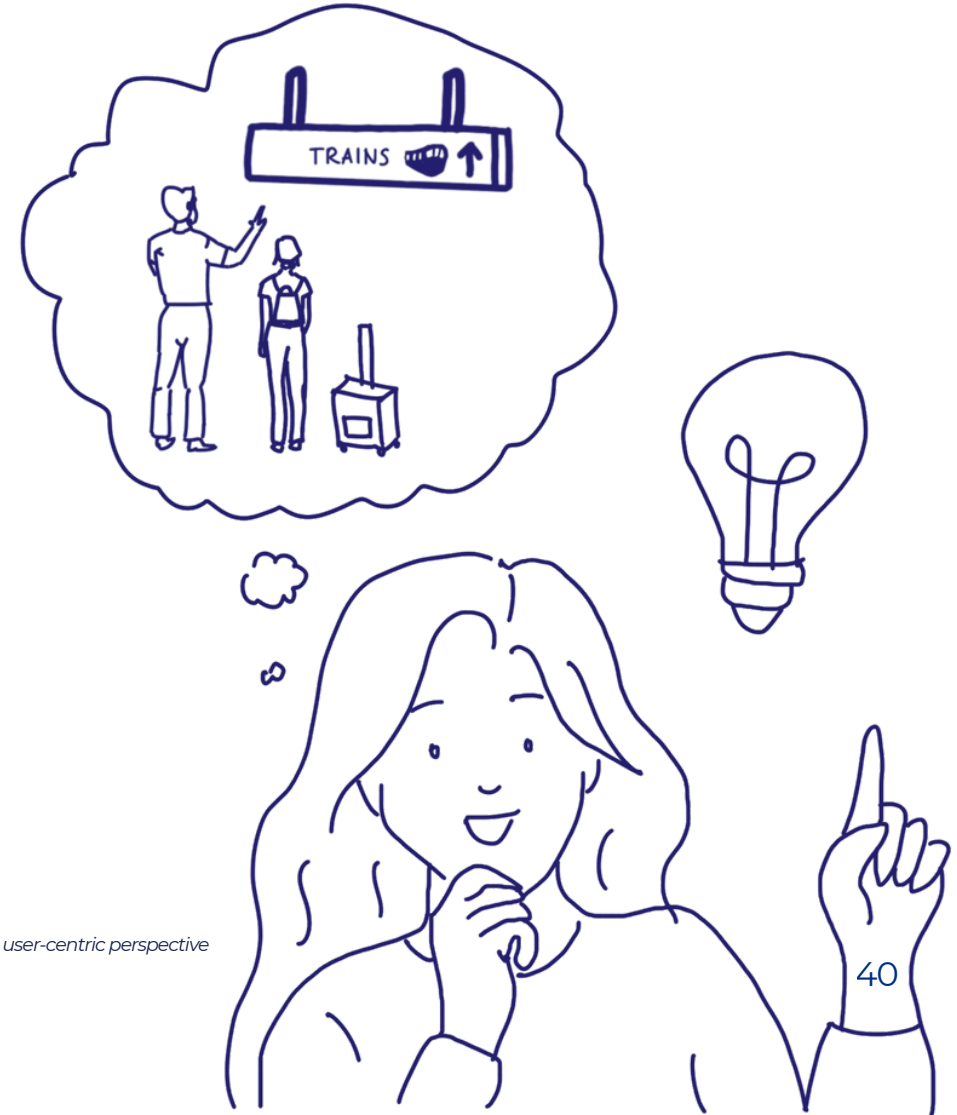


Figure 33 Keeping a user-centric perspective

3.2 Design Brief

Now that the research is done, it is time to shift towards solutions. The project is halfway through the double diamond (figure 34), and the design brief marks the start of the Develop phase. This section translates the identified needs of international travellers and the contextual insights from the research into constraints and design criteria for the Schiphol–Amsterdam Centraal air–rail journey, with a focus on travelling with a valid ticket.

The Initial Research Question asked by NS

"How might the journey at Schiphol be (re)designed so that international travellers understand the check in/check out process without physical gates, thereby increasing revenue for NS?"

The initial design challenge

The initial design challenge that was proposed by NS asked me how they can help international travellers understand check in/check out processes. To design for this challenge I investigated how NS can reduce unintentional fare evasion and improve the travel experience of international passengers at Schiphol Station. The discover phase tries to understand who these first-time international travellers are, how they currently behave during the air–rail journey, what difficulties they encounter, and what information and support NS should provide to help them buy and validate the correct train ticket.

The revised question and challenge

Based on the research I have revised the design question and challenge. NS initially framed this as a comprehension problem: how do we make international passengers understand the Dutch check-in/check-out system without gates? However, if the underlying goal is travellers boarding with a valid ticket, then forcing comprehension of an unfamiliar system is only one possible route. The research shows this is actually quite a big challenge. I therefore widened the question from "help travellers understand CICO" to "help travellers travel with a valid ticket," which leaves open the possibility of a solution that removes the need to understand CICO at all. The original question that was asked also suggests that the redesign would be at Schiphol. However, interventions could also be valuable at other moments and places in the customer journey. To open up the solution space I changed that as well. The new research question is as follows:

"How can NS guide international travellers wanting to take the train from Schiphol to a valid ticket at the right moment in their journey?"

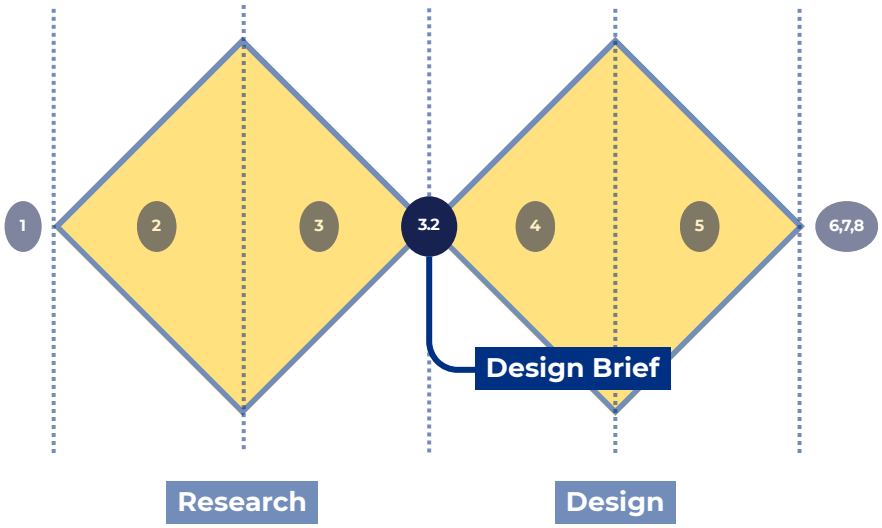


Figure 34: Moment of design brief in the double diamond

Out of scope

This project does not focus on intentional fare dodgers; it concentrates on travellers who aim to follow the rules but fail due to unfamiliarity and system ambiguity. The project also does not redesign the overall physical architecture of Schiphol Plaza or propose the introduction of physical gates, as these are limited by safety, ownership and cost constraints. Furthermore, the work does not cover all possible journeys from Schiphol; the primary scope is the route from Schiphol to Amsterdam Centraal, although proposed ideas may be relevant to other destinations.

Design goal

The design has to serve two goals. The first goal is to design an intuitive intervention in the air–rail journey for international first-time travellers between Schiphol and Amsterdam Centraal. This intervention should help a broad group of travellers, be easy to find and understand, keep cognitive load low, and remain consistent with NS as a brand and service provider. The design focuses on making the ticketing process understandable and actionable, so that travellers can complete the journey in a clear, low-stress, and valid way without physical gates at Schiphol.
The second goal is to develop a design that operates within the spatial, safety, systematical and budgetary constraints established by the stakeholders, while also exploring where compromise may be possible. In doing so, the develop phase aims to validate the constraints and criteria from NS, ProRail, Schiphol, and Bureau Spoorbouwmeester in order to arrive at solutions that are both feasible and implementable.

3.3 Design Constraints

Before I can start the ideation phase, it is necessary to establish the boundaries within which any solution must operate. Roozenburg and Eekels (1995) make a distinction between demands and wishes in design evaluation. Demands are non-negotiable requirements that a concept must meet to be considered at all, the design constraints. Wishes are desirable properties that differentiate concepts from one another, and will be discussed later as criteria.
The constraints for this project are derived from the research phase and are summarised in figure 35. The stakeholder interviews, the analysis of Schiphol Station, and the broader context of NS as an organisation each showed what needs to be respected in any concept.

Acceptable costs
NS still has a great debt from the pandemic so budgets remain tight across the organisation. This emerged explicitly in multiple stakeholder interviews, where for example the infeasibility of gates was partly explained by cost. Secondly, because Schiphol will be redesigned by 2035, it makes no sense to invest a lot of money into something that might be changed not even 10 years later. Any concept that requires significant upfront capital expenditure, and that cannot give a guarantee for revenue increase is therefore excluded from consideration. Cost is a constraint rather than a criterion because a concept that is too expensive is simply not implementable.

Safe
Schiphol Station is an unusually safety-sensitive environment. It is one of the busiest stations in the Netherlands, with 90,000 daily visitors. As mentioned in the interviews, ProRail's primary mandate is safety, and every physical intervention on or near the platforms, escalators, or CICO poles requires their approval against strict safety rules. Any concept that obstructs passenger flow or emergency routes will not be approved by the stakeholders. Safety is a constraint rather than a criterion because there is no degree of safety violation that can be compensated by performance on another dimension.

Compatible
NS, Schiphol, ProRail and Bureau Spoorbouwmeester each operate within their own systems, guidelines and infrastructure. NS's ticketing and CICO system have existing architectures that cannot be altered easily. Any concept that requires a technical or organisational change in infrastructure is therefore out of scope. Compatibility is a constraint rather than a criterion because a concept that is not compatible will the current system, will not receive stakeholder support and therefore will not be able to succeed.

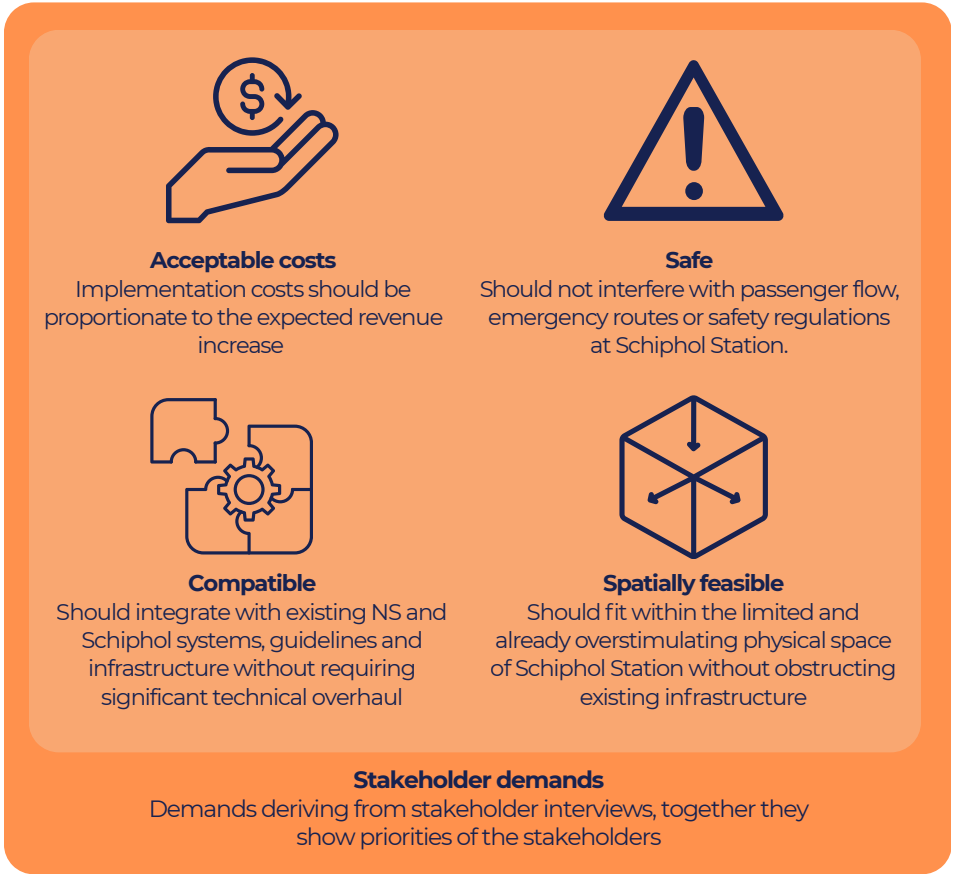


Figure 35: The four design constraints

Spatially feasible
As most interviewees described it, Schiphol Plaza is a very crowded place with many people, communication, shops etc.. In addition, the platforms beneath Plaza are quite small. Schiphol's Plaza also has commercial agreements and interests, and any physical addition to either space must fit within the available space and agreements. Spatial feasibility is a constraint rather than a criterion because a concept that does not physically fit within the station environment cannot be implemented.

Any concept that passes all four constraints is a concept that falls within what each of the primary stakeholders can be asked to support. Stakeholder alignment is therefore not a separate constraint but a consequence of meeting the four constraints mentioned in this section. A concept that is affordable, safe, compatible with existing systems, and spatially feasible gives NS, ProRail and Schiphol no structural reason to not consider it.

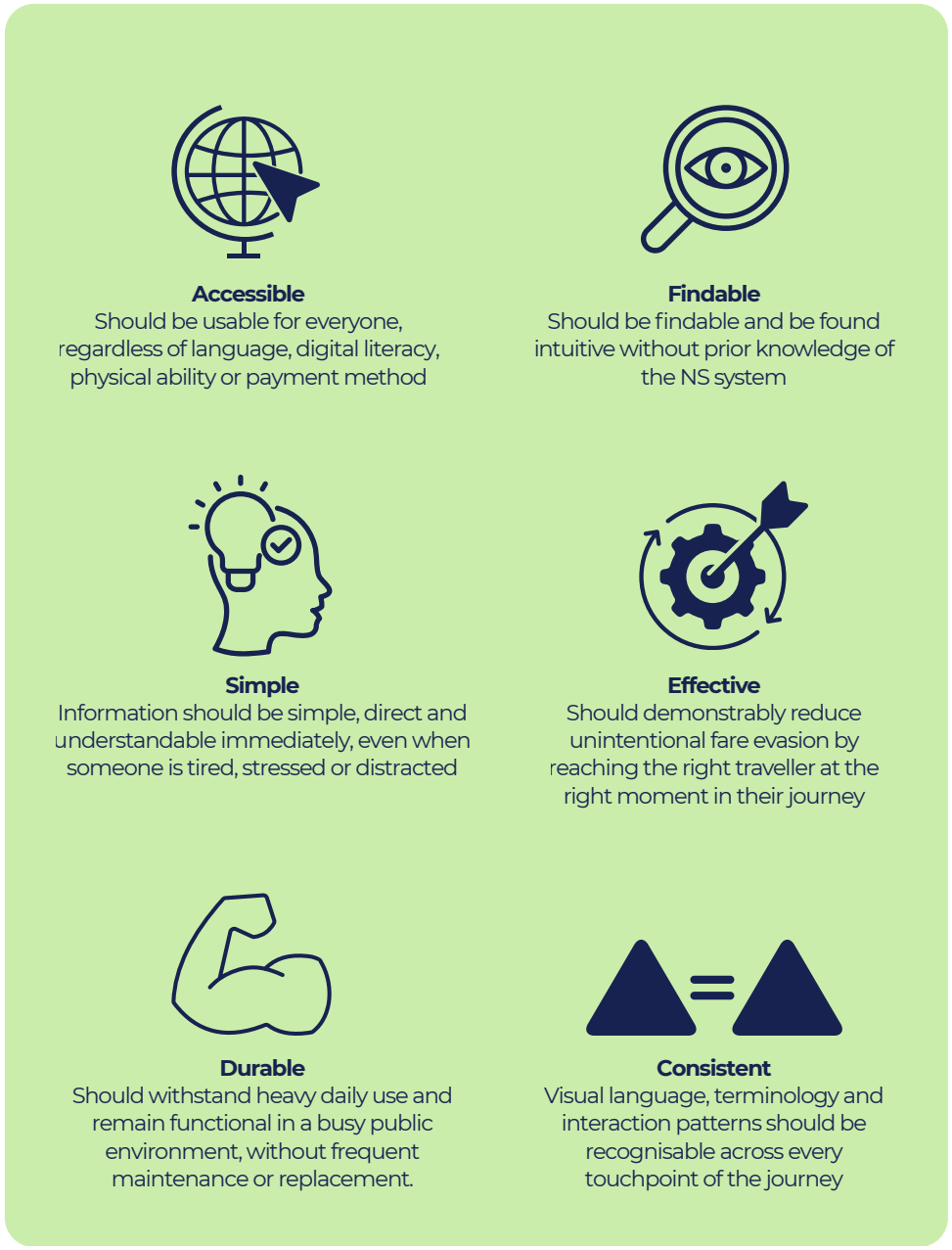


Figure 36: The six design criteria

3.4 The design criteria

Criteria are the properties that make one valid concept better than another (Roozenburg and Eekels, 1995). The six criteria for the design phase (accessible, findable, simple, effective, durable, and consistent) are derived from the research from the first diamond and are summarised in figure 36. They reflect the recurring causes of failure identified in the stakeholder interviews and traveller observations. First, travellers have troubles finding tickets because they can't interact with it, for example because they don't speak English, the solution must therefor be accessible. Secondly, some travellers miss key touchpoints because the they don't recognise NS touchpoints and are not reached at the right moment, the solution must therefore be findable. Third, they sometimes avoid the system because they cannot understand the price or the process, the solution must therefore be simple.
These criteria actually help answering the question proposed earlier in section 3.1 about what should constantly be asked for each idea:
Does this work for a tired, first-time international traveller who has just stepped off a plane and has no prior knowledge of the Dutch public transport system?

The desires of the stakeholders also played a role. NS emphasized effectiveness, low pressure on staff and revenue impact, Schiphol emphasized a smooth experience on Plaza, and Bureau Spoorbouwmeester emphasized consistency and recognisability across the station environment. Schiphol also flagged that low maintenance requirements are important given the high number of daily travellers. This resulted in criteria effective, durable and consistent.

Together, the traveller needs and stakeholder desires form the basis for the six criteria shown on the left.

Before bringing the criteria to the co-creation workshop, I first discussed the definitions and wording with my team at NS, who helped sharpen the criteria to better reflect the realities of the NS context. Because stakeholder alignment is essential for any solution at Schiphol to succeed, the criteria were then not weighted by me alone. In chapter 4.3, the stakeholders ranked the criteria individually during the co-creation workshop, resulting in an aggregated priority order that reflects the opinion of the primary stakeholders.

Conclusion

This chapter translated the research into a focused direction for design. The key take-aways confirmed that the solution must centre on the international traveller while respecting the interests of the stakeholders, and that it should reach the traveller at the right moment rather than rely on them to seek out information. These insights were captured in the design brief, which reframed NS's original question and set clear boundaries on what falls outside the scope of the project.

To make the brief actionable, two sets of requirements were defined. The four design constraints (acceptable costs, safety, compatibility with the existing infrastructure, and spatial feasibility) establish the hard boundaries that every concept must satisfy to be viable at all. The six design criteria (findable, effective, accessible, simple, consistent and durable) then describe the qualities that distinguish a strong solution from a merely acceptable one, and will later be weighted by the stakeholders themselves.

Together, the brief, constraints and criteria form a clear framework for what a good solution should be and how to get there. A co-creation session with stakeholders focused on the customer journey of the international traveller at Schiphol is a great way to start the develop phase.

4

Develop

With the design brief, constraints and criteria in place, this chapter explores the solutions that fit with the problem. First, this chapter generates a broad range of ideas for helping international travellers board with a valid ticket. Afterwards, the most promising concept is chosen through a structured, criteria-based selection. This is the diverging-and-converging work of the second diamond.

The chapter begins with designing the co-creation workshop, including a pilot with design students that led me to the first round of ideas and a redesign of the session around speculative design. The redesigned workshop is then carried out with the stakeholders, producing another set of ideas. These ideas are put through a structured idea selection where they are filtered against the constraints, scored against the stakeholder-weighted criteria, and tested with an assumption log, a sensitivity analysis and an inter-rater reliability check.

Finally, choosing the final concept narrows the strongest ideas down to the direction that becomes the basis for the final design in the chapter deliver.



Figure 37: A platform of Schiphol Station (NS Merkplaats, n.d.)

4.1 Designing the co-creation workshop

To arrive at a broad range of solution directions for creating easy and ticketed travel for international travellers at Schiphol Airport, two workshops were conducted as part of a co-creation process. According to Tassoul (2004), brainstorming goes beyond a simple exercise in quickly generating ideas. It is a diverging phase focused on quantity over quality, in which participants associate on each other's ideas while postponing judgement. This initial diverging phase is then followed by a converging phase in which choices are made (Tassoul, 2004). This diverging and converging forms the second diamond of the double diamond.

The choice for co-creation as a working method is furthermore theoretically grounded. Sanders and Stappers (2008) define co-design broadly as the creativity of designers and people not trained in design working together in the design development process, describing it as a shift from user-centred approaches towards new domains of collective creativity. Co-design can be a way of working that brings together different stakeholders to jointly create solutions that are more relevant and effective. In this research, the co-creation session was therefore conducted with stakeholders from relevant organisations rather than with travellers directly, as their domain expertise and systemic knowledge are essential for generating feasible and implementable solutions to a challenge that spans multiple organisations and touchpoints.

The pilot: a co-creation workshop with SPD students

In order to properly design the co-creation workshop with stakeholders, I first conducted a pilot with other Strategic Product Design (SPD) students that are also doing a graduation project in mobility. The goal of this was to generate a first round of ideas and to test the workshop and see where improvements could be made. Because the pilot participants were all Strategic Product Design students graduating on mobility topics, the pilot workshop is likely to have a redundancy effect and group homogeneity. According to Trypke et al. (2023), redundancy can lead to better understanding and reduce cognitive load for learners with high prior knowledge. However, the shared background and expertise can lead to more overlapping input and fewer diverse perspectives, which can reduce the variety of ideas generated in a co-creation workshop. This limitation was acknowledged and considered when interpreting the pilot results and redesigning the workshop. Figure 38 shows what this workshop looked like and summarizes the things that we have done. Appendix D explains the workshop in detail.

1

Explaining my findings from the first diamond and setting the rules of the session.



2

Warming up the group with an icebreaker and “How Can You?”’s about semi-related topics.



3

Using the customer journey and the personas to design for the Schiphol-problem.



4

Voting for the best ideas and discussing the benefits and challenges of each.



Figure 38: The co-creation session at IDE with students (May, 2026)



Figure 39: Results from the co-creation session pilot

Results

A visual overview of the results from this workshop is figure 39. During the co-creation session, three 'HKJ' questions were used to explore how international travellers at Schiphol Airport can be better guided. The HKJ's (being a good host, making someone's first day easier, and helping someone find the top of the mountain) together formed an overarching design principle: treat the traveller as a guest whom you onboard and guide step by step towards the train.

In the subsequent brainstorm along the customer journey, concrete ideas were generated for each phase, from home to arriving at the hotel. It resulted in 30 unique ideas. The ideas range from digital solutions before departure (email from the airline, integration with Google Maps, train ticket bundled with hotel booking) to physical interventions at Schiphol (signage, footprints on the ground, CICO poles that make a sound, NS staff who receive travellers upon arrival). All these ideas were be included in the idea selection later in this chapter.

Redesigning the co-creation workshop

The pilot workshop with SPD students was an important turning point. While it delivered a first round of ideas, it also exposed limitations. The result from this workshop was not very “out-of-the-box”, which can partly be blamed on the redundancy effect and group homogeneity that I mentioned before. However, the combination of a full, detailed customer journey (with many steps) and multiple personas turned out to be too much at once: participants felt overwhelmed and “froze” at the start of the design phase. Instead of stimulating creativity, the richness of the material pushed them back into narrow, box-like thinking: they immediately started reasoning within existing categories and constraints, rather than exploring new directions. Unintentionally, the workshop narrowed the solution space, precisely where it needed to be opened up. This insight led to a deliberate redesign of the workshop for stakeholders.

Speculative design

Rather than starting from the current journey and personas, the session is now framed through speculative design. In line with Dunne & Raby's work on possible futures (2013), the aim is not to predict the most probable future, but to explore a range of possible futures that help participants question the present and articulate what is actually desirable. By creating enough imaginative distance from today's Schiphol context, non-designers can more easily move beyond existing infrastructural and organisational constraints and focus on how things could be, instead of how they currently are. Figure 40 shows the futures cone that shows how possible, plausible, probable and preferable futures spread out over time.

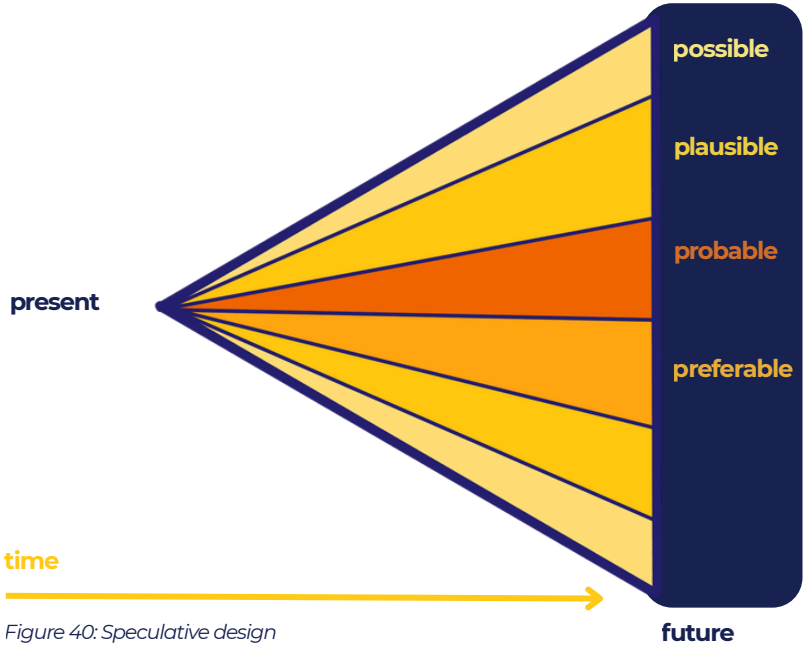


Figure 40: Speculative design

Speculative design research by Auger (2013) shows that this approach can be particularly helpful for stakeholders who are experts in current operations but not necessarily comfortable with future thinking. Speculative scenarios support people with non-technical backgrounds to engage with abstract, technological topics in creative and meaningful ways, and to express their own values, concerns and preferences more clearly (Dunne & Raby, 2013).

In this workshop, speculative concepts for "possible futures" at Schiphol function as a perceptual bridge (Auger, 2013): they make a preferable direction more tangible, without treating it as a fixed endpoint. These possible futures can then be translated back into more probable futures that fit within real constraints such as infrastructure, budgets and organisational responsibilities. Figure 41 shows how the set-up of the ideation now looks less overwhelming and more free.

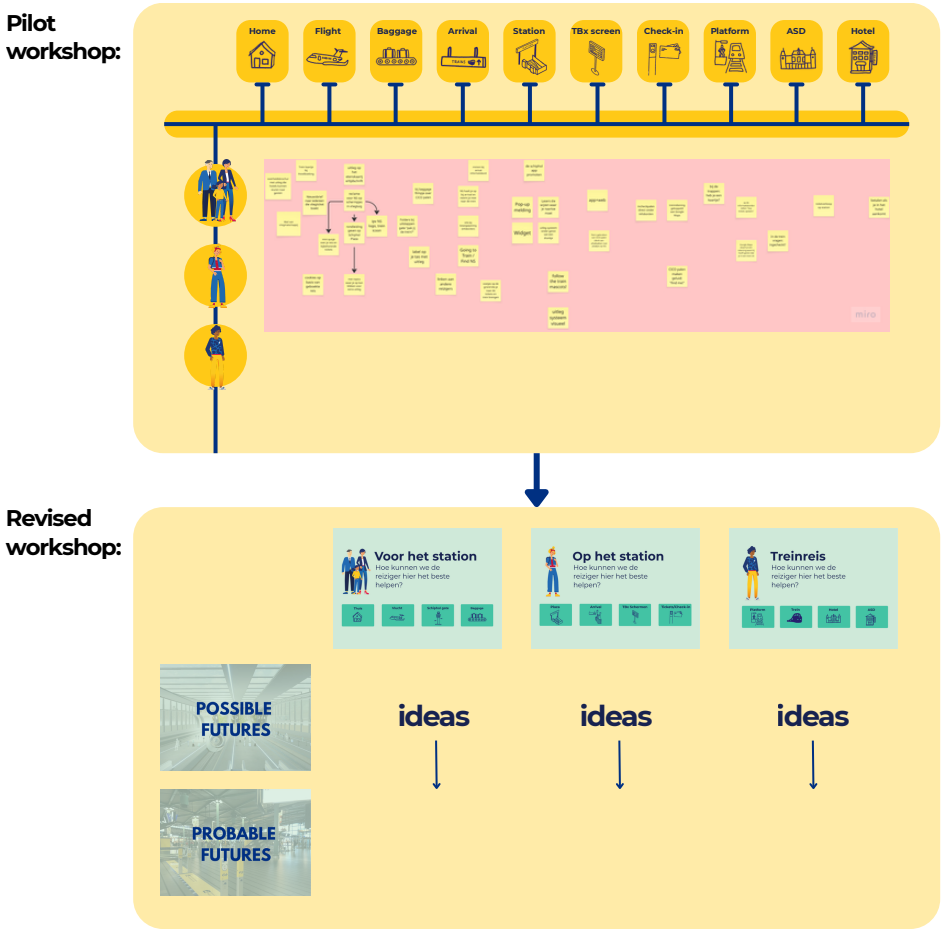


Figure 41: The revised set-up for ideation in the workshop

Consulting Flatland Agency
To prepare me even better for the workshop with stakeholders, I met up with the company Flatland, a visual design consultancy that conducts interactive workshops to help teams clarify complex challenges, align on business strategies, and accelerate innovation through visual thinking. The following take-aways are incorporated into the new format:

Applying dual coding theory
Paivio's dual coding theory suggests that people process information more effectively when verbal and visual channels are used together. The new workshop materials therefore combine concise text with clear visual structures.This is intended to lower cognitive load and prevent the sense of overload that occurred in the pilot.

Stating planning and targets explicitly at the start
At the beginning of the workshop, the planning and expected outcomes are made explicit: what we will do when, and what the session should deliver. This clarity helps stakeholders understand that the goal is not to design a finished solution in 90 minutes, but to spot desirable directions that can evolve over time.

Naming the "elephant in the room"
Their experience in co-design showed the importance of acknowledging frustrations and dynamics in the room rather than brushing them aside. This helps participants feel taken seriously while giving them permission to temporarily suspend those constraints during the speculative phase.

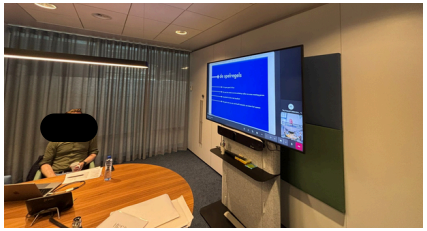
In summary, the co-creation workshop is redesigned from an overly structured, persona-and-journey-driven ideation session towards a speculative, future-oriented session that opens up the thinking space first and later reconnects it to current constraints. I also want the participants to know what to expect, keep focus, and feel taken seriously, without losing valuable time in the workshop.
The new workshop is based on the feedback from the student pilot and is grounded in existing research on speculative design, dual coding and co-creation. It uses possible futures to clarify what is preferable, reduce cognitive overload, make roles and expectations explicit, and then iteratively translate those preferable futures into feasible, probable futures for implementation.

4.2 The co-creation workshop with stakeholders

The set-up of the workshop
The second workshop, done with important stakeholders, was done to get stakeholder insights as well as create a positive mindset for what cán be done, and to generate as many ideas as possible. The different parts of the workshop can be seen in figure 42. The attendees were 2 employees from NS, 2 employees from Schiphol, 1 from NS Stations, 1 from ProRail and 1 from Bureau Spoorbouwmeester. Although this group has prior knowledge of and experience with the subject, their difference in background and roles makes the group more heterogeneous than the group with SPD students. The detailed planning of the workshop can be found in appendix E.

1

Explaining my findings and the process and rules of brainstorming



2

Individually working on HKJ's



3

Speculative design & backcasting together



Figure 42 (part 1): The co-creation workshop with stakeholders (June 2026)

4

Discussing constraints and ranking criteria



5

Voting for ideas and discussing these



FIgure 42 (part 2): The co-creation workshop with stakeholders (June 2026)

Results

This workshop resulted in 45 unique ideas, and these ideas are more focused on active intervention instead of passive information (like signs and brochures). Ideas suggested digital personalisation (push notifications, AI, wallet integration) and human presence and physical redesign of the environment. A visual overview of the result from this workshop can be seen in figure 43. Many ideas from this workshop are more operationally complex than the earlier ones but also have the potential to be more effective. This is because they try to meet the traveller proactively instead of waiting for them to seek the information. Since they are all involved in this specific problem at Schiphol, they probably have some more knowledge on what will and what won't work. I also believe the speculative design approach helped them look for solutions that are a little bit more outside of their comfort zone. At the end we discussed the ideas that were voted as “having the most potential”.



FIgure 43: Resulting HKJ's and ideas from session

Five ideas were discussed in the available time. A brief summary of each discussion is provided below:

Helping people at Amsterdam Central Station fix their mistake
An important topic that some participants felt is really missing is information at ASD about what to do when you have made a mistake. Right now, the only option is asking an employee (who can also be busy doing other things) and will make you feel very uncomfortable. Some sort of information about a plan to fix the mistake you made if you want to, would help people who feel guilty and would like to fix it themselves instead of asking around or sneaking out the station.

Providing information in their own language
At this moment, the information provided online and at Schiphol Station is in English and Dutch. Especially the participants with experience on plaza addressed the need for system explanation in all languages. Many international tourists are not able to understand the information in English.

Using QR codes
Another idea that got good feedback was the use of QR codes at the airport to buy tickets. This is a simple way of buying tickets, and can also solve the linguistical problem mentioned above. In this discussion we also talked about where these QR codes could be placed to have the most effect. Locations that came up were near the train information screens, baggage hall, screens at Schiphol plaza, or in the train.

Combining flight or hotel with rail tickets
The reason this is an attractive solutions, is because it is provided outside of the Schiphol area, where there are many challenges concerning space, safety, overstimulation. However, a concern for this idea was how to test if this will appeal to a large group of international travellers in a pilot, without spending a lot of money first.

Communicating at baggage reclaim
The potential of communicating before entering crowded Schiphol Plaza was also discussed. Some participants voted for the baggage reclaim hall as a good place to communicate. However, other participants spoke from experience that it is hard to reach people this way, because they either don't have luggage and walk right past it or are focussed on their luggage that is about to drop on the baggage band. Participants who had worked on similar communication efforts in this location in previous projects were noticeably less enthusiastic about its potential, because the effect from these projects was very small.

Whilst keeping these discussions in mind, I also did a thorough analysis on how to rank all the ideas produced in the workshops. In the next section I will discuss the criteria and how they were ranked, and how this helped me with the selection of all the ideas.

Conclusion
In this workshop the stakeholders created ideas together, to help the international traveller at Schiphol with ticketed train travel. I had tested an earlier version with students, and learned that "speculative design" would help the participants with a more creative and open mindset. The session started with a short intro and some warm-up questions to get everyone in this creative mindset, then the participants designed ideas for both a "possible" and a more realistic "probable" future across the journey. The session finished by ranking the criteria, voting for the best ideas, and discussing the ideas with the most votes.
The workshop produced 45 ideas, and resulted in active, often digital interventions that reach the traveller directly. Five ideas stood out: helping people fix their mistake at Amsterdam Central, giving information in the traveller's own language, using qr-codes for ticket purchase, combining a train ticket with a flight or hotel booking, and reaching travellers already at baggage reclaim.

4.3 Concept Selection

Theoretical framework

The selection of design concepts is not just done intuitively but is a structured, methodologically grounded activity. Drawing on the systematic design methodology proposed by Roozenburg and Eekels (1995), this chapter uses a multi-criteria evaluation framework to identify the most promising concepts from the ideation phase. According to their theory, a concept can only be evaluated meaningfully against criteria that are derived from the design brief and weighted according to their relative importance. The criteria, already explained in chapter 3.4, were assigned weights that reflect the ranking done by the stakeholders during the co-creation session. This makes the evaluation not just a simple checklist but a weighted decision model, explaning the final idea selection even better.

Filtering concepts through constraints

Before proceeding to weighted scoring, all 75 generated concepts were subjected to a filtering step that eliminates solutions that are infeasible within the given constraints. This go/no-go filter, consistent with Roozenburg and Eekels' notion of boundary conditions, assessed each concept against four constraints (already discussed in chapter 3.3): acceptable costs, compatibility with the existing infrastructure, spatial feasibility and safety. Only concepts meeting all four boundary conditions proceeded to weighted scoring. This filter changed the number of concepts from 75 to 52. Appendix F shows how this filtering was applied.

Criteria scoring

Six evaluation criteria were identified through my research in the first diamond: findable, effective, accessible, simple, consistent, and durable. Representatives from seven stakeholders (ProRail, NS Stations, NS (two departments), Spoorbouwmeester, and Schiphol (two departments)) were each asked to rank these criteria in order of importance to their organisation. To aggregate the individual stakeholder rankings, a Borda count was applied: each rank position was assigned a numerical value (1–6) and scores were summed across all stakeholder groups (Marchant, 1996). Table 5 shows the aggregated scores of all criteria.

Effective (35) and findable (31) score substantially above all other criteria, reflecting the consensus that these are the primary requirements. Durable (9) scores far below all others because stakeholders consistently scored it lowest or second-to-lowest, indicating that long-term durability, while acknowledged, is not a priority concern.

Another significant observation is that accessible and simple produce identical aggregated scores (both 26). This means the quantitative data alone cannot resolve whether accessible should be weighted more heavily than simple. This decision will be made in the next section.

Table 5: The design criteria and the ranking

Criterion	Definition	Aggregated Score	Weight
Effective	Should demonstrably reduce unintentional fare evasion by reaching the right traveller at the right moment in their journey	35	2
Findable	Should be findable and be found intuitive without prior knowledge of the NS system	31	2
Accessible	Should be usable for everyone, regardless of language, digital literacy, physical ability or payment method	26	2
Simple	Information should be simple, direct and understandable immediately, even when someone is tired, stressed or distracted	26	1
Consistent	Visual language, terminology and interaction patterns should be recognisable across every touchpoint of the journey	20	1
Durable	Should withstand heavy daily use and remain functional in a busy public environment, without frequent maintenance or replacement.	9	1

From scores to weights

To translate the aggregated scores into a weighting scheme, a two-tier scale was adopted, where weight 2 means the criterion is ranked more important for the solution than weight 1. These weights are determined by the height of their score.

The classification of effective and findable as weight 2 makes sense, because both score substantially above all other criteria and were consistently described in interviews as threshold requirements.

The classification of accessible is less straightforward given its identical score to simple. Accessible is nonetheless classified as weight 2 on substantive grounds: Accessibility represents a very important limit. If the solution is inaccessible when needed, it has no value regardless of how well it scores in other criteria. Simplicity, by contrast, is a continuous quality attribute that can be partially compensated with other qualities. Simple, consistent, and durable are therefore classified as less important (weight 1).

Concept Scoring
Each idea that passed the constraints, was scored against the six criteria on a binary scale. The full weight of a criterion is assigned if the concept demonstrably addresses it, and zero otherwise. The binary approach avoids false precision and forces a clear evaluative judgement. The total weighted score for each concept is:

Total Score = Σ (criterion score × criterion weight)

Table 6 presents the scores of the evaluated concepts scoring 7 or higher in the base round (weights similar to table 5). The table also shows the scores from two other weighting scenarios explained in the sensitivity analysis.

Assumption Log
For each criterion-concept combination, I kept an assumption log on why I gave the idea a certain score. Three categories of assumptions are documented:

- Stakeholder assumptions: what a stakeholder said about a concept in relation to a criterion. For example, when stakeholders have done pilots around a certain concept before and therefore now what made it unsuccessful. NS knows that helping tourists at ASD is not easy, as explained in chapter 2.4. Schiphol has had some experiences with pilots at Schiphol and therefore knows better how international tourists behave. Or for example, some stakeholders also feel that moving around CICO poles or ticketmachines would still not have the wished outcome, because international travellers would still have the same problem of needing to learn what to do with it. The discussions held at the end of the workshop are included in this.
- Evaluator assumptions: How criteria such as "effective" or "accessible" are defined. These definitions are documented in Table 5 and Chapter 3.4. If the idea does not line up with the way I defined the criterion, the idea will not receive a score for that criterion.
- Scope assumptions: the context in which concepts are evaluated. The most common scope assumptions that I made were Schiphol needs to approve placement on Plaza (which is possible if you include them in the process and have a plan for a pilot), that design guidelines are met, that the international traveller has a smartphone and internet connection at Plaza, and that a data-sharing agreement is possible with third parties like Google., hotels, etc.

Sensitivity Analysis
A sensitivity analysis was done to test whether the ranking of concepts is robust. It should remain stable when the weighting assumptions are varied. Three scenarios were compared:

- Base scenario: weight 2 for effective, findable, and accessible; weight 1 for simple, consistent, and durable.
- Equal-weight scenario: all six criteria have weight 1.
- Elevated simple scenario: simple is elevated to weight 2. This scenario is an important check because simple and accessible produced identical aggregated stakeholder scores (both 26). It tests the sensitivity of the classification decision made earlier in this section: if the ranking does not change when simple is elevated, the choice to treat it as a weight 1 is justifiable. If the ranking does change, that must be reported as a limitation.

The sensitivity analysis changed the number of concepts from 52 to 7, showing only concepts that are scored a 7 or higher in the base round (shown in table 6). An automatic train ticket in your flight ticket is the only concept that achieves the maximum score for all scenarios, making it very robust. Buying a ticket on the train and using a QR code with tickets at the TBx screens both score 8 out of 9 in the base scenario and remain stable across all sensitivity scenarios, making them strong concepts for selection despite each missing the criterion 'consistent', because it is not similar to how things are usually done. The large group of concepts scoring 7 in the base scenario are also stable: all score 5 in the equal-weight scenario and 8 in the elevated simple scenario, except for the 'gates around the CICO pole' concept, which scores a 4 in the equal weights scenario. This idea scores better with criteria that are ranked lower, and therefore is not the best option.

Table 6: The concepts with the highest ranking (including sensitivity analysis)

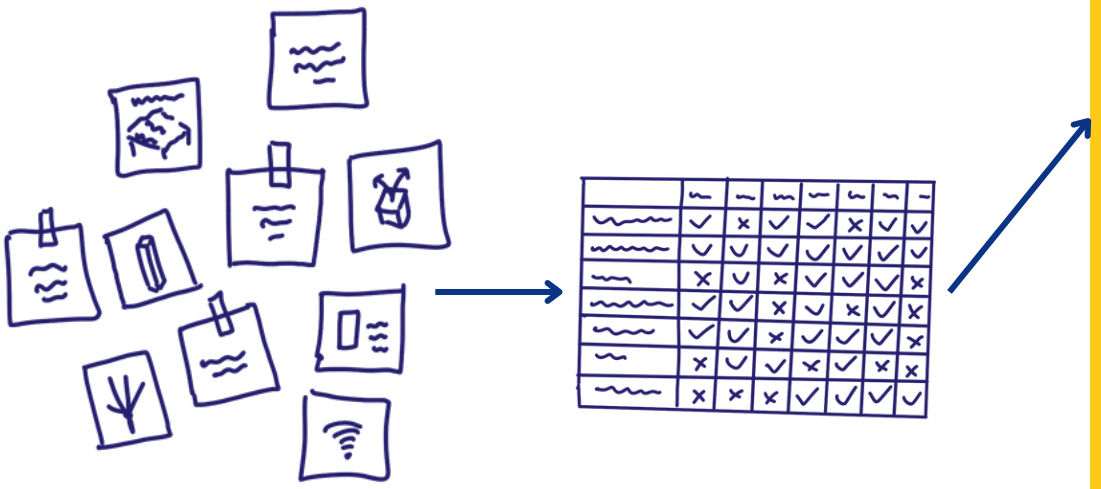
Concept	Base (max=9)	Equal weights (max=6)	Elevated simple (max=10)
Train ticket is automatically included in flight ticket	**9**	6	10
You can buy a train ticket in the train	**8**	5	9
QR-codes with tickets at the TBx screens	**8**	5	8
Train ticket available with hotel booking	**7**	5	8
Pop-up notification on the station about check-in	**7**	5	8
AI in your phone lets you know you don't have a ticket yet	**7**	5	8
AI asks you about your train journey	**7**	5	8
Gates around the CICO poles	**7**	4	8

Inter-rater reliability
The seven participants agreed on the extremes: effective and findable were ranked highest, and durable lowest. The most variation occurred in the middle. Accessible, simple, and consistent were ordered differently across groups, which is why their aggregated scores ended up so close together. This variation reflects genuine differences in stakeholder priorities, which has been mentioned before in chapter 2.7. It is precisely why a sensitivity analysis was conducted.

Final Selection
On the basis of the weighted scores and the sensitivity analysis, concepts are selected for further development if they meet the following conditions:

- A base score of 7 or higher, indicating strong performance across all three weight 2 criteria and at least some of the weight 2 criteria;
- A stable ranking position across the other two sensitivity scenarios; and
- No unresolved scoring inconsistencies in the assumption log.

Applying these criteria, 7 of the 8 highest-scoring concepts from table 6 are taken forward for closer consideration. The one concept that is set aside is 'Gates around the CICO poles': although it scores 7 in the base scenario, it drops to 4 in the equal-weight scenario, meaning its performance depends too heavily on how the criteria are weighted. Because it is not robust across scenarios, it is not considered further. Figure 44 shows an overview of the 7 concepts considered as the final concept, organised into three groups.



7 concepts to consider
The 7 selected concepts can be divided into three groups based on their type of intervention.
The first group introduces buying a ticket on the train itself and at the TBx screens. These concepts reduce friction by meeting the traveller at a moment and location where purchasing feels natural, and by making the purchase as easy as possible.
The second group focuses on combination tickets integrated with other purchases, such as bundling a train ticket with a flight or hotel booking. These concepts prevent the problems at Schiphol entirely by ensuring the traveller already has a valid ticket before arriving.
The third group uses AI and data-driven interventions, such as a pop-up notification about check-in, an AI that alerts the traveller when no ticket is detected, and an AI that proactively asks about the train journey. These concepts personalise the experience by reaching the traveller at the right moment based on their location or travel data.

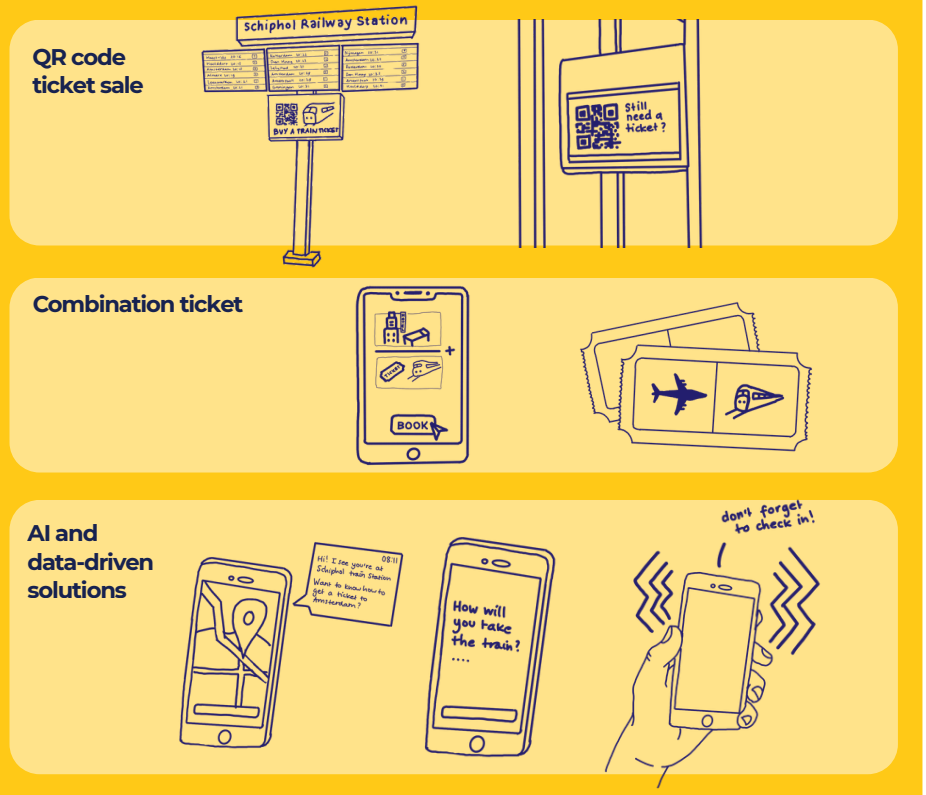


Figure 44: Seven concepts divided in three groups

4.4 Choosing the final concept

Following the concept scoring and sensitivity analysis the ideation phase left me with 7 concepts. It is time to look at how feasible these concepts are, so we can narrow it down to the concept that truly has the most potential. This section explains the reasoning behind the elimination of two concept groups and the selection of the third as the foundation for the final design.

Discussing group 2: Combination Tickets

The first concept I examined is the idea to combine train tickets with a flight or hotel booking. This idea is the highest scoring concept in the evaluation. To properly investigate the potential of this idea I consulted a senior accountmanager for Indirect Online Channels at NS. He said approximately 10% of e-tickets (not all tickets, just e-tickets) is already sold through Booking.com, meaning this is already happening and it is not crucial to create a design intervention here. He also mentioned an attempted collaboration with KLM, which further illustrates the limitations of this approach. KLM was primarily motivated by reputational and sustainability considerations, but did not invest a lot of money into it. Eventually it did not increase revenue for NS, also partially because the technology was not working adequately. Combination ticketing therefore depends heavily on partner alignment, and the design opportunity it represents is already being done in some places. So, although the scoring was high, NS will have a hard time creating a huge impact through this type of concept. In addition, this concept would primarly help the system misinterpreters who usually plan their tickets beforehand, and as mentioned in chapter 2.8 this group is not that big. This solution would therefore not really help the groups wayfinding dependent traveller and assumption based traveller, who together form a bigger target group.

Discussing Group 3: AI and Data-Driven Interventions

The concepts based on AI and personal data such as a phone notification detecting a missing ticket, or an AI that proactively asks about a traveller's onward journey are promising as a future direction. Unfortunately, after consulting with an experienced data engineer, I found these concepts are not viable as design interventions at this stage. These concepts rely on access to personal data from a traveller's device, and this is difficult to pilot. They require technical infrastructure, data agreements, and permissions that cannot be established in the short term.
Furthermore, AI integration in the context of public transport ticketing is not yet sufficiently mature to guarantee a reliable and consistent traveller experience. These concepts are therefore interesting to keep in mind for a future horizon later in this thesis, but not for a final concept on the short term.

Selecting Group 1: QR Code Ticket Sale

The idea to create new, more intuitive places to buy a train ticket by simply scanning a QR code is chosen as the final concept. This direction is actionable, intuitive, and directly addresses the core problem: international travellers arriving at Schiphol that cannot find or navigate the existing ticket infrastructure at the station.

A key insight from the stakeholder and user research and the concept evaluation is that the solution does not need to explain the whole system; it just needs to bring the ticket to the traveller, at a moment and location where they are already present. Rather than redesigning the existing infrastructure at Schiphol Plaza the design introduces a QR-code touchpoint at intuitive places. The Accountmanager for Indirect Online Channels confirmed there is great potential here, because NS already has a partner (Distribusion, see the trends and developments chapter) that can generate white-label ticket links. By scanning the QR code, the page opens in the traveller's own language and lets them pay with their preferred method without the need to locate a ticket machine or CICO pole, and without understanding the check-in/check-out system, because the ticket needs no check-in or check-out.

The idea generation resulted in two locations for this touchpoint: the TBx screens on Plaza and the screens inside the train. I consulted an NS colleague (Product Owner of, among other teams, Service Formulas) to reflect on the potential of these locations. The in-train location is has its challenges because buying a ticket during the journey conflicts with the rule that travellers must hold a valid ticket before boarding, and could complicate inspection, since travellers could claim they "were about to buy one." Still, the in-train option has real merit. Other operators, such as trams, already allow it, and it would specifically help the assumption-based travellers who simply walk in the train without thinking about a ticket before. It is therefore worth keeping as a last resort, and the next chapter looks further into what would be needed to make it work. The location near the TBx screens showed a lot of potential and was encouraged to pilot.

This direction is supported by the sensitivity analysis: both QR touchpoints scored robustly across all three weighting scenarios. The only criterion they do not fully satisfy is consistency, as they introduce a new way of buying tickets that breaks with NS's existing touchpoints. This is a deliberate trade-off: the design is tailored to the international first-time traveller, for whom consistency with the existing Dutch system carries little value. Even so, the touchpoints will be styled to fit NS's visual identity, keeping them in line with ComIt's aim of a consistent digital NS experience (chapter 1.2). A detailed elaboration of the final design, a pilot and its feasibility and viability are presented in the following Deliver chapter.

Conclusion

Of the three concept groups, the combination ticket and the AI-driven interventions were set aside for reasons of feasibility and control. This leaves group 1 with two new, more intuitive places to easily buy a ticket as the strongest direction. This becomes the foundation for the final design: a QR-code ticket sale placed where travellers are already paying attention.

Conclusion

This chapter turned the design brief to 75 ideas through two workshops and resulted with one concept. Designing the co-creation workshop showed the value of reflecting: the pilot with design students was too tightly structured, which led me to redesign the session around speculative design so that participants could think beyond the existing system. Carried out with the stakeholders, this workshop produced ideas that shifted from passive information toward active, often digital interventions.

The idea selection then converged these systematically. Concepts were first filtered against the four constraints, then scored against the six criteria, weighted by the stakeholders themselves through a Borda count. A sensitivity analysis confirmed that the strongest concepts held their position regardless of how the criteria were weighted. In the final section I chose the final concept by discussing the highest scored ideas with experts, eliminating the combination-ticket and AI-driven directions for reasons of feasibility and control.

The result is a clear, defensible design direction: a QR-code ticket sale placed where travellers are already paying attention. The deliver phase develops this direction into a final design, and sets out how it can be implemented, embedded and made viable over time.

5

Deliver

This final chapter turns the chosen direction into a complete, concrete design. Its goal is to show not only what the design is, but also how the stakeholders and the user will benefit from it. This is where the project's research and choices come together into a deliverable solution.

The chapter is structured in three parts. It opens with the final design: the QR-code touchpoint, the benefits for each stakeholder and for the traveller, and how the design plays out along the customer journey for each of the three personas. It then assesses the design's feasibility and viability, showing that it can realistically be built, operated and sustained, and validates its effectiveness through a pilot. Finally, it closes with learnings for the future design of Schiphol Station.



Figure 45: The sprinter at Schiphol Station (NS Merkplaats, n.d.)

5.1 The Final Design: Intuitive and quick ticket sale through QR codes

"How can NS guide international travellers wanting to take the train from Schiphol to a valid ticket at the right moment in their journey?"

The final design introduces a QR-code ticket purchase for international travellers at Schiphol Train Station, placed where travellers are already paying attention. The primary touchpoint is a QR code on the TBx information screens at Schiphol Plaza, the point where a lot of travellers stop to check their platform and departure time. A second touchpoint, a QR code on the screens inside the Sprinter to Amsterdam Centraal, acts as a last-resort safety net for the small group who reach the train without a ticket (figure 46).

Scanning the QR code opens a page (created by Distribusion, a partner of NS) in the traveller's own language, letting them buy a ticket immediately with their preferred payment method. The ticket is added to their e-wallet as a pre-paid, fixed-price e-ticket. It does not need to be checked in and can be used to check out at the gates.

Rather than teaching the international traveller the unfamiliar Dutch CICO system, the design gives them a ticket type that removes the need to understand it at all.

I will first explain what is needed to make the in-train touchpoint work, since it comes with challenges the Plaza touchpoint does not, after that I will set out how the design benefits each of the stakeholders involved.

What the in-train touchpoint needs to work

As mentioned in chapter 4.4, the in-train touchpoint comes with challenges. It is therefore designed as a safety net, and would need the following to work in practice:

- A time-bound prompt. The message should include when the ticket must be bought (for example, "within 3 minutes of the train departure") so travellers and conductors share the same expectation of when a valid ticket must exist.
- Agreed rules with enforcement. NS should define in advance how conductors treat a traveller who is mid-purchase versus one who has made no attempt to pay. This keeps inspection clear and avoids the "I was about to buy one" loophole.
- A strong pilot to value its potential. Because the in-train QR raises questions that the Plaza touchpoint does not, it is recommended to pilot it separately, after the TBx-screen pilot. This second pilot would test it together with conductors and enforcement, measuring how many travellers buy on board, how inspection handles mid-purchase cases, and whether the grace-window rule works in practice. Feedback from conductors and ticket data will show its potential and whether certain risks are legitimate or overlooked. This keeps the main design at the TBx screens validated separately, while giving the in-train safety net a controlled test before any wider roll-out.

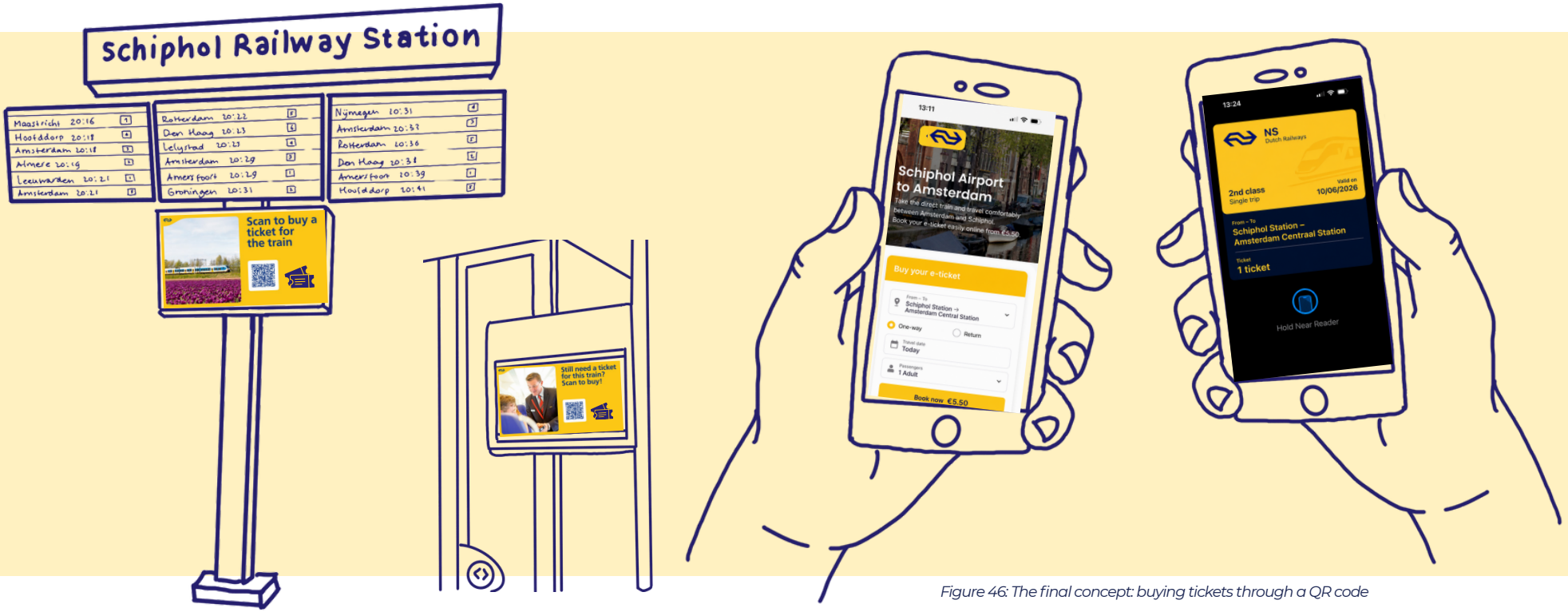


Figure 46: The final concept: buying tickets through a QR code

The design brings clear benefits for each of the stakeholders and, above all, for the international traveller.

Benefits Schiphol
For Schiphol, the design requires no changes to existing infrastructure on Plaza. The effect is also measurably in a pilot: the number of scans and completed ticket purchases indicates the impact. This will help NS with pitching this intervention, because a pilot can be done before the intervention will be there forever. If successful, every additional traveller who takes the train instead of a taxi or ride-hailing service contributes to their sustainability goal.

Benefits ProRail
The design is not on ProRail ground, so they are not directly involved, though they will likely be consulted. Since it introduces no new infrastructure, does not interfere with passenger flows, and poses no safety concerns, ProRail's interests are unlikely to be affected. Both touchpoints are placed where travellers already stop and gather, so no new crowd concentrations are created. If anything, the design reduces a pain point ProRail actively wants to avoid: confused travellers wandering across platforms and escalators looking for a ticket. During the co-creation workshop, the ProRail representative held a positive attitude towards this concept.

Benefits NS
For NS, the design directly reduces revenue loss from unintentional fare evasion while improving the traveller experience. A traveller buys a ticket in an easy, intuitive way, without needing to understand a complex system, and the fixed-price ticket means forgetting to check out carries no financial consequence, removing a source of anxiety. Although travellers do not use the NS app, which is preferred as it builds customer connection, NS still benefits, because Distribusion's technology is far cheaper than building and maintaining its own. According to an expert at NS, the transaction fee is so low that NS could not achieve the same margin by building it at this scale, while NS still retains full access to the data.

User benefits
These interventions help the international traveller with easy, ticketed travel. The design is grounded in a key insight from the Discover phase: international travellers do not fail to buy a ticket because they are unwilling or because the infrastructure is insufficient, but because the system does not reach them at the right moment, in a way they can understand. Observations showed that almost every traveller stops at the TBx screens to check their train information, and the design places a clear call to action at exactly this point, keeping the cognitive load very low.

The design resolves the gap identified in the Discover phase: the moment travellers realise they need a ticket has usually been the moment where they are lost.
Being sure they are doing the right thing, being able to buy tickets for the whole family if needed, and doing it in under a minute makes the traveller confident and relaxed.
Where the customer journey once showed a stressful experience, these interventions give the international traveller an easy, confident way to do the right thing. All the benefits for the user are summarised in figure 47.



Figure 47: The final concept: buying tickets through a QR code

The Customer Journey for each persona

These new ticketing interventions will change and, more importantly, improve the customer journey. The user benefits described on the previous page apply to all international travellers who use the design. However, the design will probably be mostly used by wayfinding dependent travellers. The system misinterpreter usually think they already have the right ticket, and the assumption based traveller will mostly use the QR code in the train. But this doesn't mean that they might not use the QR code at the TBx screens. Their customer journey looks a little bit different and figure 48 on the next page brings these together, showing the experience of all three personas along the journey from Schiphol to ASD with the use of these new QR code touchpoints. Because this final part of the journey weighs so heavily on how travellers remember their arrival (Kahneman, 2011), improving it carries value beyond the journey itself. It shapes the first impression the Netherlands leaves behind and reflects well on NS, Schiphol and even the flight they had.

The systems misinterpreter

The systems misinterpreter benefits least from this design, because they have already made the wrong decision before entering the station and will not be actively looking for a ticket once they arrive. As explained in chapter 2.8, this is also the smallest group. Importantly, the design does not harm them; at best, seeing the ticket sale prompt makes them question their earlier purchase and reconsider whether it is valid.

The wayfinding-dependent traveller

The wayfinding-dependent traveller benefits the most. As they move around Plaza looking for train information, they naturally reach the TBx screens and see the QR code. Within a minute they have bought their ticket, and they walk to the platform and board confidently. At Amsterdam Centraal, they simply scan the e-ticket to open the gates and at destinations without gates, there is no need to check out at all. Their journey shifts from the hesitation and confusion shown in the customer journey in chapter 2.8 to a calm, confident arrival. This is the journey the design is built around, and figure 48 shows how this journey is now a smooth one.

The assumption-based traveller

For travellers who did not stop or act at the TBx screens, the in-train screens show a clear prompt: Still need a ticket for this train? Scan to buy. The same QR flow applies. These travellers are already on the train and may feel hurried, but the purchase is quick, familiar, and in their own language. What was previously a moment of panic (realising too late that they have no ticket) becomes a manageable one, and by the time they reach ASD they have a valid ticket in their e-wallet and know what to do at the gates. This is the group the in-train safety net is designed for, catching those who would otherwise arrive with nothing.

The intentional fare-evader

Travellers who deliberately board without a ticket fall outside the scope of this thesis. Even so, the design helps address them indirectly. If most travellers now carry a valid ticket, the remaining group of intentional fare-evaders becomes small enough for NS to manage. With only a few cases, conductors can issue an UVB on board, or travellers can be directed to buy a ticket in the train, something that is currently impractical precisely because the group is so large.

Together, these journeys show that the design achieves what chapter 2.8 set out: it helps the travellers who need it most and does no harm to the group it helps least. It is turning a stressful arrival into a confident one for the international traveller.

Section conclusion

The design is a multilingual QR-code ticket purchase placed where travellers naturally stop to think. The primary touchpoint is a QR on the TBx screens at Plaza, with a second QR in the train as a safety net that requires a strong pilot. The design benefits all stakeholders, especially the traveller. The wayfinding-dependent traveller benefits most (caught at the TBx screens), the assumption-based traveller is caught by the in-train safety net, and the systems misinterpreter benefits least (they decided at home) but isn't harmed, at most it prompts them to reconsider their ticket.

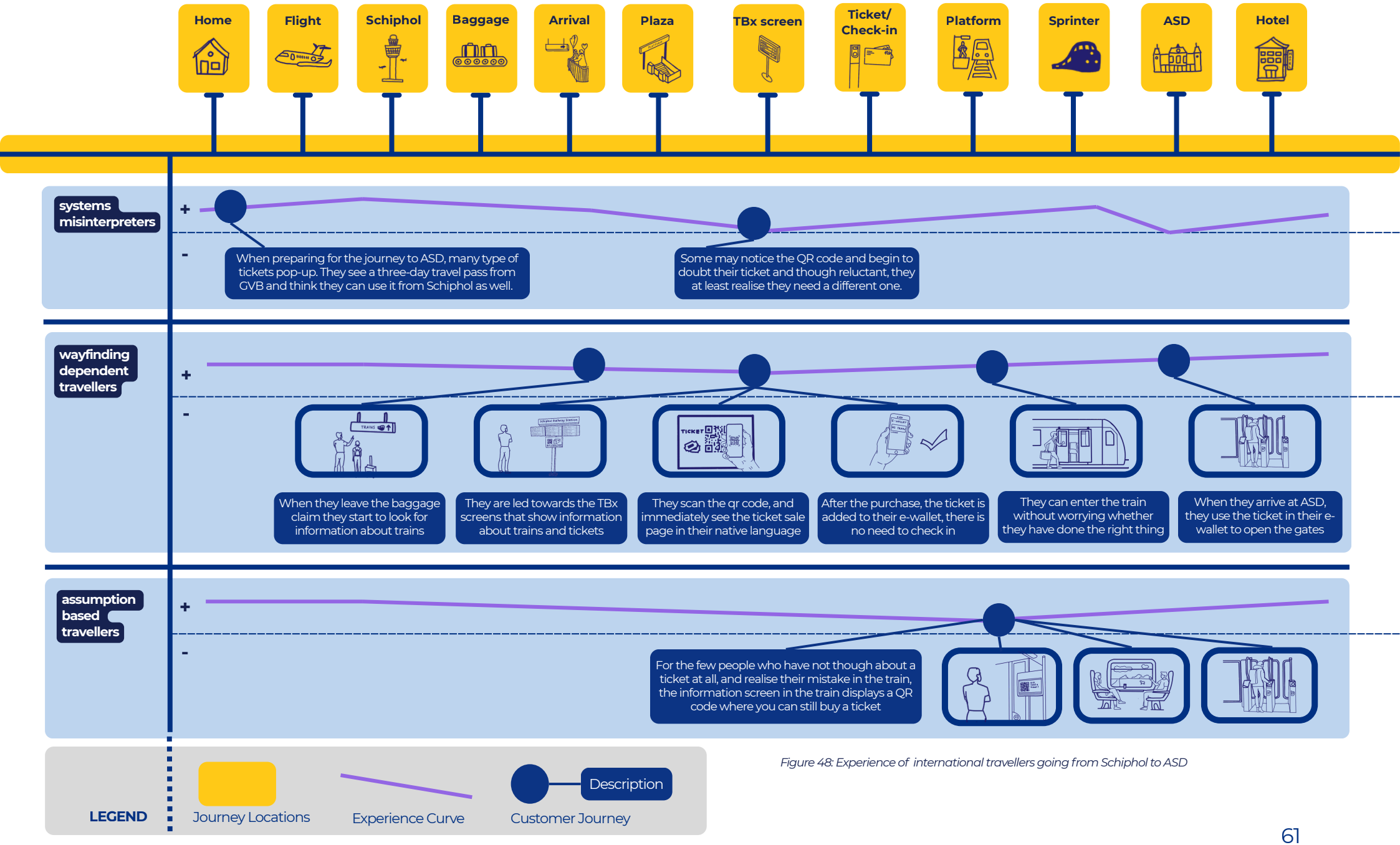


Figure 48: Experience of international travellers going from Schiphol to ASD

5.2 Design and Pilot

Design of touchpoints

o make buying a ticket simple and understandable for the international tourist, the design of each touchpoint matters as much as its placement. Figure 49 shows how the touchpoints are designed to appeal to the right travellers and guide them through the purchase with as little effort as possible. Four elements are shown: the screen at the TBx displays on Plaza (bottom left), the screen inside the train (top right), the ticket sale page that opens after scanning (bottom middle), and the resulting e-ticket in the wallet (bottom right).

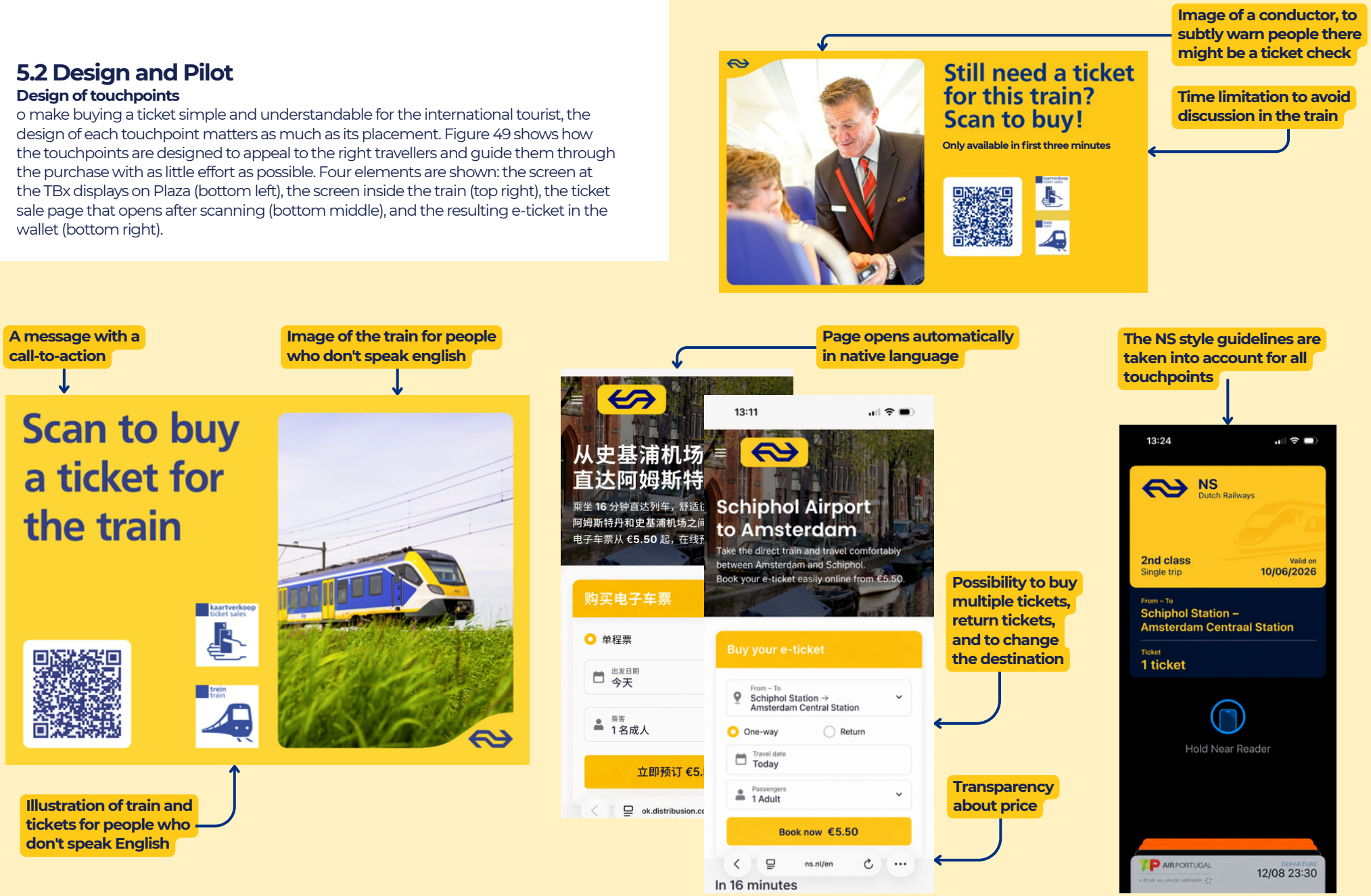


Figure 49: The platform and ticket on your phone (phone interface and ticket created with Claude AI)

Testing the design: the pilot at Schiphol Train Station

To move the design from a well-reasoned proposal to something grounded in real behaviour, the primary touchpoint (the QR code at the TBx screens on Schiphol Plaza) was tested in a pilot. A pilot was essential here because the design rests on one empirical claim: that placing a purchase point at the moment travellers already stop for information will actually convert travellers who would otherwise board without a ticket. Only real scan-and-purchase data can confirm this.

Set-up

The pilot ran on a Wednesday from 10:15 to 14:45 (4.5 hours). A poster carrying the QR code and the message "Scan to buy a ticket for the train" was placed at the TBx information screens as shown in figure 50. I observed from a distance to record what happened without influencing it. When travellers approached me directly, I deliberately gave them the neutral, full set of options (buying at the ticket machine, checking in with a bank card, or scanning the QR). This keeps the observed scans a genuine reflection of the prompt's own pull rather than of my intervention.





Figure 50: The set-up of the pilot: a poster at the location of the TBx sreens

Success criteria

To avoid judging the pilot afterwards, the success criteria were fixed in advance, following the principle that a defensible threshold should be set before the data is seen. Two metrics were defined. The first is a reach metric (scans per hour) indicating whether the poster results in the right action at all. A target band of 20-40 scans per hour was derived by scaling NS passenger data down through a funnel:

total daily travellers at Schiphol: 74.000 (NS dashboard, 2025) → boarding the train: 37.000 → boarders per hour (operational 17 hours): 2200 → first-time international travellers (10%): 220 → those passing this location (50%): 110 → seeing the screen and still needing a ticket (20-40%): 20-40 scans per hour

The above estimate is very rough, but does give some sense of what can be expected. The second and primary metric is task completion rate, the standard measure of usability success. An 80% target aligns with the average completion benchmark of ~78% reported across large samples of usability tasks (Sauro & Lewis, 2016).

Results

The poster produced 101 sessions that reached the purchase page, of which 74 continued to checkout and 42 completed the purchase (figure 51). Over the 4.5-hour window this is approximately 22 scans per hour and 9 completed purchases per hour.

Three behavioural observations stood out. First, the touchpoint attracted a broad range of travellers, young and old (figure 52).Second, use came in peaks. When one traveller stopped to scan, others tended to follow. This is a clear example of social proof: the tendency to look to the behaviour of others to decide what the right action is, especially in unfamiliar or uncertain situations (Cialdini, 2001). Third, and confirming a core assumption of the design, the TBx screens remained a place where large numbers of travellers naturally stopped and stood still, validating this as the right moment to intervene.

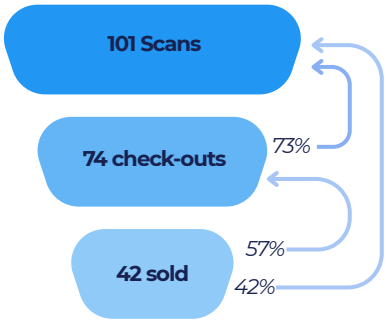


Figure 51: The number scans, check-outs and sold tickets from the pilot

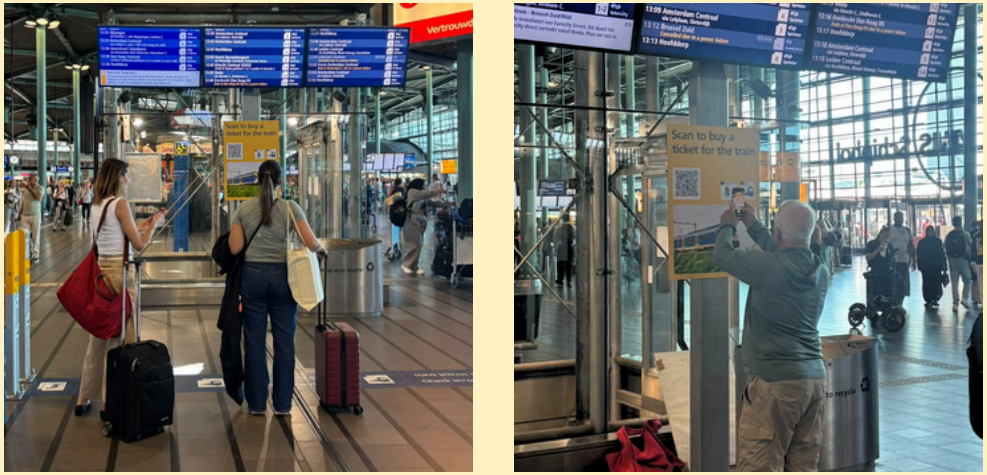


Figure 52: Young (left) and older (right) people using/scanning the QR code at Schiphol

Analysis
Measured against the pre-set criteria, the pilot gives a clear but two-sided result. On reach, it succeeds: around 22 scans per hour sits within the 20–40 target range, confirming that the prompt is noticed and acted on at this location. Even though it's only a static paper poster rather than the intended digital screen.
On task completion, the headline figure of 42% (42 of 101) falls short of the 80% target. However, the shape of the funnel shows where the problem lies. The step from reaching the page to checkout held up well (73%), but the step from checkout to completed purchase dropped to 57%. This step was largely affected by a website error (figure 53). This error blocked return tickets and bookings for more than two passengers, which is what I realised after several travellers approached me with this problem. Since return trips and family or group bookings are common among the international travellers this design serves, it is likely that a substantial share of the 32 travellers lost at checkout were blocked by this fault in the ticketing page. In addition, I got no questions on how to use the QR code or the website, aside from questions about the error.

In other words, the pilot validates the design while isolating a concrete, fixable technical barrier to completion. Corrected, the completion rate would be expected to move substantially toward the target.
Taken together, the pilot demonstrates that a simple, well-placed prompt can convert real travellers into ticket buyers at the right moment, and that the remaining gap is a technical issue rather than a flaw in the design direction.

Limitations of the pilot
Several limitations should be kept in mind when interpreting these results:

- A website error at checkout. Purchases for return tickets or for more than two passengers failed with a "not enough seats available" error, which almost certainly suppressed the completion rate.

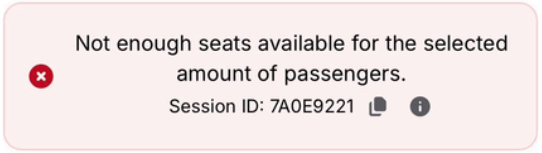


Figure 53: Website error during the pilot

- The use of a static poster instead of a digital screen. The real touchpoint would be considerably more visible, so the observed scan rate is likely a conservative lower bound. A digital screen would also be preferred because it reduces the risk of QR-code fraud.
- The test ran for one 4.5-hour window on one weekday, at one of the TBx screen locations. It therefore captures neither weekend or seasonal variation, peak-versus-off-peak differences, nor the effect of placement at the other TBx screens in the station.
- No baseline or control. Without a counterfactual it cannot be established how many of these travellers would have bought a ticket anyway through another channel, so the figures show gross rather than net conversion.
- My presence and my answers to travellers who approached may have had a small influence on behaviour.

Recommendations for the next step
These limitations point directly to what a next, more robust pilot should include: fixing the website bugs (especially returns and group bookings) before testing; using the intended digital screens rather than a poster; running across multiple days, weekdays and weekends, and at both TBx screen locations in the station; and, ideally, establishing a baseline so the net effect on ticketed boardings can be estimated. As set out in section 5.1, the in-train touchpoint in particular warrants its own separate pilot together with conductors and enforcement, since it raises questions the TBX screen touchpoint does not.

Section conclusion
The pilot at the TBx screens reached around 22 scans per hour which is within the 20–40 target Schiphol agreed beforehand. This confirms that a simple, well-placed prompt reaches international travellers and converts them into ticket buyers. Completed purchases fell short of the target mainly because of a fixable website error at checkout, meaning the result validates the design's concept while pointing to a clear technical improvement for a fuller pilot.

5.3 Feasibility and viability

To further prove the potential of this design, this section discusses the feasibility and viability. Feasibility answers the question 'can it be done?', and viability will answer whether it will survive on the long term. As mentioned in the introduction, in 2035 there will be a completely new station. I finish this section with my recommendation for the new Schiphol Station.

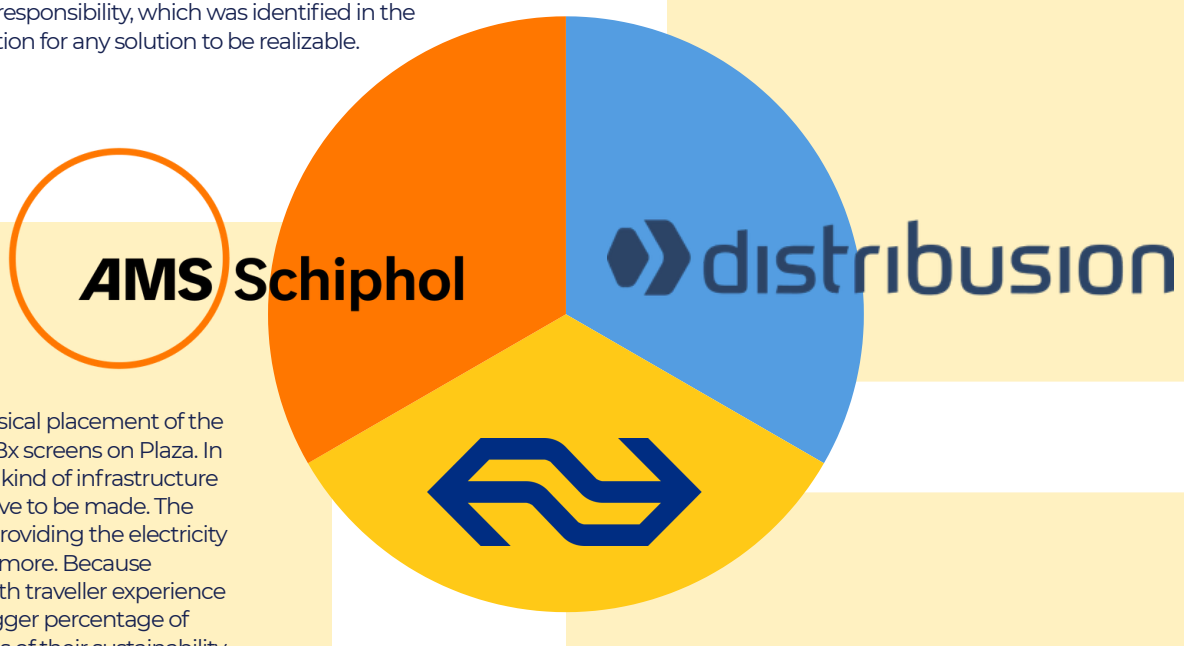
Feasibility

Organisational Embedding

The design is structured around existing responsibilities to minimise organisational friction and maximise the chance of implementation. The three responsible stakeholders are Schiphol, Distribusion, and NS. This three-party structure keeps each organisation within its own domain of responsibility, which was identified in the stakeholder research as a critical condition for any solution to be realizable.

Responsibilities Distribusion

Distribusion is responsible for the underlying technology: the white-label ticket purchase page, the language detection, the payment processing, and the ticket issuance. Distribusion already has an relationship with NS for ticket distribution and operates the infrastructure that makes this design possible. The cost for NS of this arrangement is a very small percentage of each ticket sold, which is how Distribusion benefits from this design. All ticket purchases are visible for NS in real time.



Responsibilities Schiphol

Schiphol is responsible for the physical placement of the QR code communication at the TBx screens on Plaza. In the pilot phase they can test what kind of infrastructure works best, before investments have to be made. The maintenance of the screens and providing the electricity is their responsibillity, but nothing more. Because Schiphol has an interest in a smooth traveller experience at Plaza and would like to see a bigger percentage of travellers taking the train in regards of their sustainability goals, this seems like a reasonable thing to ask.

Responsibilities NS

NS is responsible for the visual design of both touchpoints. NS provides the screen content for the train displays and the visual material for the TBx screen panels. Because NS owns the trains in which QR code is shown, they will also make the arrangements for the screens and communication with the conductors who need to enforce this. NS also determines the conditions under which the ticket is sold through the Distribusion white-label page.

Traveller feasibility
The design asks only one thing of the traveller: the ability to scan a QR code with a smartphone. Which seems like a realistic thing to ask. Around 5.78 billion people, roughly 70% of the world's population, now own a smartphone (DataReportal, 2026). Among air travellers the reliance is even stronger: passengers increasingly manage their whole journey from their phone and want to do it even more. 78% of travellers want a single smartphone that combines payment, identity and travel documents (Márquez, 2026). This shift toward mobile and wallet-based payment is exactly what makes this QR ticket that is added to your wallet valuable to users. My own fieldwork confirms the same pattern locally: all twenty interviewed travellers had access to the internet, and 13 of the 20 intuitively reached for digital navigation.
The interaction itself adds no barrier. A QR code is a globally understood pattern that requires no prior knowledge of the Dutch ticketing or CICO system, and the purchase page opens in the traveller's own language. This removed the linguistic barrier that previous interventions at Schiphol have failed to address.

Although limited, there will always be travellers who won't be using this because they don't have a smartphone, their phone has run out of battery, they don't have a wifi connection or they are just not very confident with digital technology. Travellers like this remain dependent on the existing ticket machines and service staff, who now have more time to help travellers like this. The QR touchpoints are an addition to these channels, not a replacement.

Viability
It is also important to consider whether the design is financially viable, and what improvements could be made in the future. This will show whether the design will survive on the long-term.

Financial viability
First of all, the design has a highly favourable cost structure. There are no upfront technology development costs, since the Distribusion platform is already operational. The only costs are content production (the visual design of the poster and screen material) and the very small transaction fee paid to Distribusion per ticket sold. Using the screen on the train to show this message is free.
Against this, every completed ticket sale generates revenue that NS would otherwise not have captured. Given the minimum of €600.000 yearly revenue loss, even a small conversion rate would be valuable. Let's say 100 people purchase a ticket to ASD through this QR-code everyday, which is realistic based on the pilot, the yearly profit would already be around €200.000. Financially, the design's main advantage is that it does not rely on large-scale uptake because it is profitable from the first ticket sold.

Viability over time
A solution is only viable if it can survive and keep paying for itself well beyond a single pilot. This design is well positioned for that, because it starts profitable and can grow in value without ever requiring a large, risky upfront investment.

Over the coming years, that same foundation leaves room to grow without starting over. The purchase experience can be refined as usage data comes in. For example, the touchpoints can be extended to more locations and moments in the journey and easily be tested through similar pilots. As travellers grow more confident with digital ticketing, a QR-based purchase is likely to become one of the easiest and most transparant ways to buy a single ticket, for groups as well as individuals.
Its viability also depends on staying aligned with the wider system NS is moving towards, in particular the transition to OVpay. Rather than becoming a separate, parallel channel, the design should over time connect to this national infrastructure. Eventually connecting this website to the OVpay infrastructure transfers this solution to a lasting part of how international travellers buy tickets, no longer dependent on a single partner or a single location.

Finally, the long-term horizon is the 2035 redesign of Schiphol Plaza. The current design is deliberately built to work within today's station, but its underlying principles (bringing the ticket to the traveller at the right moment in an easy way) are exactly what a future redesign should build in structurally. The advice for that redesign is set out in the next section.

Designing for 2035: Building the lessons into the station itself
The QR-code touchpoints are designed to work within the station as it exists today. Around 2035, however, Schiphol Plaza is scheduled for a major redesign, and this time gates are likely to be introduced. Gates would remove much of the specific problem this thesis addresses.
Yet the introduction of gates does not make the lessons of this research obsolete. Gates change where the problem occurs, not whether international travellers struggle with an unfamiliar system. The following advice translates the core learnings of this thesis into principles for the 2035 redesign, so that the same mistakes are not simply relocated to a new set of barriers.

1. Bringing tickets to the traveller
A gate forces a traveller to hold a valid ticket, but it does nothing to help them understand how to obtain one. A first-time international traveller who reaches a closed gate without a ticket experiences stress and creates a bottleneck for everyone behind them. The redesign should therefore still bring ticketing to the traveller before the gate, at the moment they are already stopping for information. Gates make a valid ticket mandatory; a good station design makes getting one effortless.

2. Creating a clear station hall
A recurring finding is that Schiphol lacks a space where travellers slow down, orient themselves and prepare. Travellers need this "station hall" to sort out their ticket before they reach the barrier, rather than discovering the problem at the gate itself.

3. Keep it coherent.
Earlier initiatives failed partly because the international travellers do not recognise one clear visual identity for the train. In a full redesign, ticketing, wayfinding, gates and NS's visual identity should form one coherent, consistent language, starting the moment they leave the train so they know when to get a ticket and where. This aligns with Bureau Spoorbouwmeester's aim of a recognisable railway environment and ComIt's goal of a consistent NS experience.

4. Keep it accessible for everyone
Whether this is for people who don't speak English, or for people who don't have a smartphone. There should always be options for people who are not part of the large group. Whether this is the use of a QR code that provides information or tickets in your own language, or the assistance of staff for older people, this will result in a positive experience for everyone.

Together, these principles carry the insights of this thesis beyond my own design. The QR touchpoints solve the problem now, in the gateless station of today; the 2035 redesign, with gates, is the moment to ensure that the traveller's understanding is designed in from the start.

Conclusion
Taken together, the design is both feasible and viable. It is feasible because it can be built and run with existing technology and partners: the touchpoints use screens and systems that are already in place, Distribusion handles the ticketing, payment and language, and the traveller only needs to scan a QR code. It is viable because it starts profitable and stays low-risk: there are no development or infrastructure costs, only content production and a small transaction fee, so every recovered fare is profit from the first ticket sold. The organisational structure is clean, with each party acting within its existing role, and the pilot showed the design is easy to test and validate in practice.
Just as importantly, the design is viable over time. It works within the station as it exists today, while leaving room to grow as usage data comes in and to connect to the wider system NS is moving towards. Its underlying principle, bringing the ticket to the traveller, at the right moment, in a recognisable way, is also one that should be built in structurally when Schiphol Plaza is redesigned in 2035, making it not just a solution for now, but a direction for the station of the future.

From a confusing system to quick and simple steps



From a broad and complex assignment to a solution that fits

Conclusion

This chapter brought the project together into a final design. The final design places QR-code touchpoints at the TBx screens and on the in-train displays. This is where travellers are already paying attention, and immediately lets them take action, without needing to understand the check-in/check-out system. It benefits NS, ProRail and Schiphol, and gives travellers an easy, transparent and reassuring way to board with a valid ticket, as shown in the different customer journeys.

The design and pilot show not only what it will look like, but also that the concept works if technical improvement are done. The feasibility and viability section showed that the design can be built with existing technology and partners, that it is profitable from the first ticket sold. Recommendations for a new Schiphol Station in 2035 show that this thesis is not only valuable for this concept but also for the future of station design.

Together, this answers the research question: NS and its stakeholders can help international travellers board with a valid ticket by bringing the ticket to the traveller, at the right moment, in a way that is simple, intuitive and viable for everyone involved. The remaining chapters reflect on what this means, what it does not yet solve, and where future work should go.

6 Discussion

In this discussion I reflect beyond the design itself, and interpret its wider significance. This thesis tries to answer the question: "How can NS guide international travellers wanting to take the train from Schiphol to a valid ticket at the right moment in their journey?" The research showed that it's not a lack of infrastructure, but a failure of the environment to communicate the right information at the right moment. This design doesn't bring the traveller to the ticket; it brings the ticket to the traveller. I believe this is an important principle: when the goal is a result rather than the understanding itself, designing around a difficult system is often better than explaining it. This is especially true for first-time and stressed travellers facing an unfamiliar environment.

One of the things that made this research interesting is the role that stakeholder complexity played. The stakeholder interviews showed me that the problem at Schiphol Station has been a discussion between the organisations NS, Schiphol and ProRail for years. They each see the problem through their own lens, and the history of failed initiatives at Schiphol reflects the difficulty of translating shared concern into shared action. The co-creation workshop was therefore not just a method for generating ideas; it was an attempt to create common ground. That the workshop produced concepts that all stakeholders could accept as feasible is itself a result, independent of the final design. I believe my role as a neutral and external design student helped break the stuck situation the stakeholders were in.

The choice to use speculative design as a framing device in the workshop also deserves reflection. The shift from a persona-and-journey-driven brainstorm to a possible-futures exercise significantly changed the quality of the output. The pilot workshop with SPD students produced ideas that stayed close to the existing system; the stakeholder workshop that was framed speculatively, produced ideas that moved beyond it. This suggests that for complex, multi-stakeholder problems where participants have deep operational knowledge and therefore strong intuitions about what is not possible, speculative framing is a very useful methodological tool.

The final design, a QR code on a screen and in the airport sprinter, is not a dramatic intervention. But this modesty is a strength, not a weakness. Previous initiatives at Schiphol failed not because they were bad ideas but because they were placed in the wrong moment of the journey, assumed prior knowledge or asked too much from the traveller. The current design does none of these things. It is placed where travellers already stop. It speaks their language. It requires only a smartphone and thirty seconds of their time. It operates entirely within the existing responsibilities of the three parties involved, which means it does not require anyone to take on new and intense tasks. If this design would have been too bold, and if it would ask too much from travellers and stakeholders, it would probably not work.

Although this helps international travellers with simple ticket purchase, it does not mean that the broader confusion around the Dutch public transport system is gone. Travellers who prefer to use their bank card to check in at Schiphol and who still are confused about where to check in are not helped by this design, unless they decide to not use their creditcard and switch to an e-ticket. The scope is to increase the ticket purchase at Schiphol, and the design will help with this, but it is worth acknowledging that it still not explaining the CICO process at Schiphol and this might be a challenge for some tourists. In addition it also does not serve people who are not digitally capable. It does little for travellers without a smartphone, without data, or those who are less digitally skilled. Although this group is small, this is a tension with the "accessible" criterion. As more and more public services become digital-first, this raises a question that reaches beyond Schiphol: at what point does the convenience of a digital solution for the majority come at the cost of leaving vulnerable travellers behind? Keeping a non-digital route available is therefore not a detail, but a condition for a public service to stay accessible to everyone.

Lastly, it is also worth reflecting on the relationship between this design and the broader trend towards barrier-free travel described in the Visiedocument Mobiliteit Schiphol (2018). That document envisioned a future where travellers move from plane to train without any deliberate ticketing action. This design does not achieve that vision, but it moves in the same direction, by reducing the number of deliberate steps required and by meeting the traveller in channels they already use. The QR code at these intuitive places is a step towards barrier free travel and it is interesting to see where this will go in the future.

7 Recommendations

In this chapter I discuss the recommendations, that are there to translate the thesis findings into concrete next steps for relevant stakeholders, so that the design can actually be implemented and built on after the project ends.

For NS
The most immediate recommendation is to arrange what is needed to take the design from the pilot to the next step. The negotiations with Schiphol and Distribusion need to be finalised. Importantly, Schiphol confirmed beforehand that 20–40 scans per hour would indicate success and since the pilot reached this, NS can expect Schiphol's support in the next steps. An elaborate pilot with digital screens, touchpoints at both TBx screens and for several weeks will show exactly how well the design reaches international travellers and how many complete the purchase. After this a follow-up study can refine which messages and illustrations appeal most to tourists.

The in-train QR code deserves its own dedicated pilot, as described in chapter 5.1. Although it is the secondary touchpoint, more like a last-resort, it still holds value, and because it raises questions around inspection and enforcement, it should be tested separately, together with conductors, before any wider roll-out.

NS should also consider how the design fits its broader digital strategy. The Distribusion page currently exists as a standalone flow, separate from the NS app and website. In the longer term, bringing these tickets into the NS digital environment would build brand connection and reduce dependence on Distribusion. This is not urgent, but it aligns with ComIt's goal of one consistent digital experience across app and web.

For Schiphol
Schiphol's involvement in this design is quite low. Besides checking from time to time if the technology works on plaza, they are not expected to do much. They should consider however whether the information density on Plaza could be decreased. This is a thought they are already playing with, and I think that this would really work in making the station less overwhelming. The commercial interests that generate this density are legitimate, but they actively work against the traveller experience that Schiphol also wants to provide. A structural conversation between Schiphol and NS about what information deserves prominence on Plaza and where, would benefit both stakeholders.

For future research
There are a few follow-up researches based on this design that could be very interesting.

First of all, the AI concept group identified in the idea selection phase where interventions proactively reach travellers based on location or travel data is interesting to further look into. The current design creates the commercial infrastructure and the stakeholder alignment that a more proactive intervention would require. Future research should investigate the technical and legal conditions under which anonymised boarding data or location signals could be used to trigger a targeted notification before the traveller reaches the TBx screens.

Research into the specific travel behaviour of British tourists is also interesting. The service employee interviews identified British travellers as the most commonly encountered group making ticketing mistakes, they also are the most common tourists in Amsterdam in general. Making a design that is largely focused on this group and trying to understand where they get their information could be very valuable.

Another interesting research would be to investigate whether this would improve situations at other stations in the Netherlands as well. For example at Amsterdam Central Station, where there are also many tourists who want to buy tickets for the train.

8 Limitations

The limitations of my thesis are discussed in this section because it is important to understand the boundaries of this work. There are some things that this research couldn't cover or prove and it is important to know how far the findings can be trusted and where caution is needed.

The first limitation that should be mentioned is the sample size of the traveller interviews. The field interviews conducted at Schiphol Station and Amsterdam Centraal involved 20 international travellers in total. While this is appropriate for a qualitative study aimed at understanding experiences and behaviours, it is not strong enough for a reliable claims about the distribution of traveller types or the occurrence of specific mistakes. The three traveller types are analytically useful categories, but their relative proportions in the actual traveller population at Schiphol are based on estimates. Future research with a larger and more systematically sampled group would strengthen the empirical foundation for traveller-type-specific design decisions.

Secondly, travellers who agreed to be interviewed at Schiphol and ASD might not be representative of the broader population. Travellers who were in a hurry, who felt embarrassed about their situation, or who did not speak sufficient English were not people that I spoke with although they are part of the group of international travellers who make this mistake. This means the interview data may underrepresent some cognitively overloaded and linguistically isolated travellers who would have been of great value for my research.

Finally, the design addresses the ticket purchase problem for travellers on the Schiphol–Amsterdam Centraal route. Although it does help international travellers going to other destinations as well, it does not address the check-in and check-out problem for travellers using OVpay. It also does not include the intentional fare dodgers because they are such a small group and hard to design for. This intervention will not prevent them from taking the train without a ticket, so this design will never be able to completely avoid the problem. However, once more people have purchased a ticket, ticket control in the sprinter from Schiphol to ASD will be useful again and probably happen more often than they do now.

AI Statement

In line with TU Delft's guidelines on the responsible use of artificial intelligence, this section describes how AI tools were used in this thesis. All research, design decisions, analysis, and conclusions are my own. AI was used only as a supporting tool. Every AI-assisted output was reviewed, verified, and edited by me, and I take full responsibility for the final content. These are the four purposes for which I have used AI:

- Transcription. The recorded interviews were transcribed using MacWhisper, an AI-based speech-to-text tool.
- Transcript cleaning. To correct minor transcription errors, each raw transcript was processed once with chatNS (NS's internal large language model) using a prompt that limited the model to fixing phrasing, spelling, and consistency of terms. The cleaned transcripts were checked against the recordings.
- Writing and editing support. A general-purpose large language model (Claude, Anthropic) was used to support the writing process. This was done for language editing (mainly as a spelling check), restructuring and tightening of my own text, summarising my own drafts, and feedback on clarity, structure, and consistency. It was not used to generate research findings or design ideas; the substance of this thesis originates from my own research, analysis, and design work.
- Image generation. Claude was used to illustrate certain images, which has been credited in the description.

Concluding statement

Every day, thousands of international travellers step off a plane at Schiphol and take the train to start their journey in the Netherlands. For too many, that journey starts with confusion. There is a system they do not understand, a ticket they did not know they needed, and a stressful first impression of the country they came to visit.
This thesis set out to change that, and it shows that the change does not have to be big to matter. A QR code, in the right place, at the right moment, in the traveller's own language, is enough to turn a moment of uncertainty into one of confidence. The pilot at Schiphol proved that travellers will use it. A simple, well-placed intervention can solve a problem that has persisted for years, recover revenue NS was losing, and, above all, make arriving in the Netherlands feel a little easier.
More than a ticketing solution, this is a reminder of what design can do: not by rebuilding stations or reinventing whole systems, but by creating interventions together with stakeholders and a focus on the user. Meeting people where they already are and quietly helping them do the right thing, is sometimes all you need.

References

Abd El-Hakim, H. (2025). Phygital tourism: An integrated model for designing and optimizing the tourist experience. SSRN. https://doi.org/10.2139/ssrn.5790882

Abenoza, R. F., Cats, O., & Susilo, Y. O. (2019). How does travel satisfaction sum up? An exploratory analysis in decomposing the door-to-door experience for multimodal trips. Transportation, 46, 1615–1642. https://doi.org/10.1007/s11116-018-9860-0

Auger, J. (2013). Speculative design: Crafting the speculation. Digital Creativity, 24(1), 11–35. https://doi.org/10.1080/14626268.2013.767276

Beneder, L., et al. (2022). Evaluatie Programma MaaS. TwynstraGudde.

Bureau Spoorbouwmeester. (n.d.). Spoorbeeld: Ontwerp- en vormgevingsbeleid van de spoorsector. Retrieved June 10, 2026, from https://www.spoorbeeld.nl

van den Broek, L. (2026, June). De ov-chipkaart verdwijnt, OVpay verschijnt. Wat gaat er veranderen? Kassa, BNNVARA. https://www.bnnvara.nl/kassa/artikelen/de-ov-chipkaart-verdwijnt-ovpay-verschijnt-wat-gaat-er-veranderen

Case, A. (2024). Calm tech principles. Calm Tech Institute. https://www.calmtech.institute/calm-tech-principles

CBS. (2026). Passagiers luchtvaart. https://www.cbs.nl/nl-nl/visualisaties/verkeer-en-vervoer/personen/passagiers-luchtvaart

Cialdini, R. B. (2001). Influence: Science and practice (4th ed.). Pearson. https://www.researchgate.net/publication/229067982_Influence_Science_and_Practice

DataReportal. (2026). Digital 2026 global overview report. https://datareportal.com/reports/digital-2026-global-overview-report

Dauletova, E., Alpysbayev, B., & Ilamanov, Z. (2025). The future of the cashless economy: Trends in digital payments. In Proceedings of the 9th International Scientific Conference "Research Retrieval and Academic Letters" (pp. 72–76). Publisher.agency. https://doi.org/10.5281/zenodo.15461091

DeCuir-Gunby, J. T., Marshall, P. L., & McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. Field Methods, 23(2), 136–155. https://doi.org/10.1177/1525822X10388468

De Nederlandsche Bank. (2025, January 21). Cash nog steeds populair in Europa, maar gebruik neemt verder af. https://www.dnb.nl/algemeen-nieuws/nieuws-2025/cash-nog-steeds-populair-in-europa-maar-gebruik-neemt-verder-af/

Delft design guide. (2013). Delft University of Technology.

Dunne, A., & Raby, F. (2013). Speculative everything: Design, fiction, and social dreaming. MIT Press.

Dutch Payments Association. (2026, February 26). OVpay in public transport. Betaalvereniging.nl. https://www.betaalvereniging.nl/en/knowledge-base/card-payments/ovpay-in-public-transport/

Ferreira, M., Ferreira, C., & Dias, T. (2021). Towards strategies to capture and retain mobile ticketing customers. EAI Endorsed Transactions on Smart Cities, 5(15). https://doi.org/10.4108/eai.9-4-2021.169182

Festileaks. (2025, October). Recordaantal bezoekers voor Amsterdam Dance Event 2025. https://festileaks.com/2025/10/recordaantal-bezoekers-voor-amsterdam-dance-event-2025/

Gheyle, N., & Jacobs, T. (2017). Content analysis: A short overview [Internal research note]. https://www.researchgate.net/publication/321977528_Content_Analysis_a_short_overview

Gutierriz, I., Ferreira, J. J., & Fernandes, P. O. (2025). Digital transformation and the new combinations in tourism: A systematic literature review. Tourism & Management Studies. https://doi.org/10.1177/14673584231198414

Hiemstra-van Mastrigt, S. (2018). Visiedocument: Optimaliseren Mobiliteit rondom Schiphol. Schiphol naadloos verbonden met Nederland (Versie 0.4) [Concept document]. TU Delft, faculteit Industrieel Ontwerpen

Hill, H., & Mullen, M. (2024, September 24). Bridging the gap: The future of intermodality between airports and rail. International Airport Review. https://www.internationalairportreview.com/bridging-the-gap-the-future-of-intermodality-between-airports-and-rail/465947.article

Inspiration Grid. (2015, August 5). Narita Airport wayfinding system by Nikken Sekkei. https://theinspirationgrid.com/narita-airport-wayfinding-system-by-nikken-sekkei/

Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux.

Knipscheer, K. M. (2024). Seamless transitions from plane to train: Designing a 'phygital' journey to improve the transition of international tourists from Schiphol Airport to Amsterdam with NS (Dutch Railways) [Masterscriptie, Technische Universiteit Delft]

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. Journal of Personality and Social Psychology, 77(6), 1121–1134. https://doi.org/10.1037/0022-3514.77.6.1121

Larco, N., et al. (2024). Public mobility: The next evolution of MaaS. TNO.

Lehr, L. Q. (2016). OV-betalen for international travellers arriving at an airport in the Netherlands: Analysis report [Master's thesis, Delft University of Technology].

Liu, M. (2019). Enhancing mobility around Schiphol Airport for international passengers [Master's thesis, Delft University of Technology].

Liu, X., Zhu, Y., et al. (2025). The influence of social media attributes on impulsive travel intentions: Integrating the stimulus–organism–response theory and information adoption model. Sustainability, 17(10), 4404. https://www.mdpi.com/2071-1050/17/10/4404

Marchant, T. (1996). Valued relations aggregation with the Borda method. Journal of Multi-Criteria Decision Analysis, 5, 127–132.

Márquez, C. (2026, January 17). The four most impactful travel tech trends in 2026. be bolder. https://www.bebolder.co/the-four-most-impactful-travel-tech-trends-in-2026/

De Mascia, S. (2012). Project psychology: Using psychological models and techniques to create a successful project. Gower.

Maxwell, J. A. (2013). Qualitative research design: An interactive approach. In L. Bickman & D. J. Rog (Eds.), The SAGE handbook of applied social research methods (2nd ed., pp. 214–247). SAGE Publications.

National Rail. (n.d.). Smart tickets. https://www.nationalrail.co.uk/tickets-railcards-and-offers/buying-a-ticket/smart-tickets/

Nederlandse Spoorwegen. (n.d.-a). Geschiedenis van NS. https://www.ns.nl/over-ns/leren-over-ns/geschiedenis

NS Dashboard (2025). Reizigersgedrag: Schiphol Airport. https://dashboards.nsjaarverslag.nl/reizigersgedrag/schiphol-airport

Nederlandse Spoorwegen. (2026). NS jaarverslag 2025. https://www.nsjaarverslag.nl/jaarverslag-2025/voorwoord-presidentdirecteur

van Nijen, N. P. (2024). Explaining access mode choice for passengers and personnel travelling to Schiphol Airport (Redacted version) [Master's thesis, University of Twente]. University of Twente Student Theses. https://essay.utwente.nl/fileshare/file/101572/Nijen_MA_ET.pdf

NOS. (2012). Splitsing NS-ProRail. NOS. https://nos.nl/nieuwsuur/artikel/340896-splitsing-ns-prorail

NU.nl. (2024). Ov-chipkaart verdwijnt eind 2027 en wordt vervangen door ov-pas. https://www.nu.nl/economie/6383328/ov-chipkaart-verdwijnt-eind-2027-en-wordt-vervangen-door-ov-pas.html

Patterson, R. E. (2017). Intuitive cognition and models of human–automation interaction. Human Factors, 59(1), 101–115. https://doi.org/10.1177/0018720816659796

Patton, M. Q. (2015). Qualitative research & evaluation methods: Integrating theory and practice (4th ed.). SAGE Publications.

Plonski, P. E., Patel, P., Ossenfort, K. L., Taylor, H. A., Brunyé, T. T., Urry, H. L., & Markostamou, I. (2025). How much time to figure out how to get where? Route planning and subjective stress under time pressure. PLOS ONE, 20(1), e0316382. https://doi.org/10.1371/journal.pone.0316382

ProRail. (n.d.). Wat doet ProRail? https://www.prorail.nl/over-ons/wat-doet-prorail

Roozenburg, N. F. M., & Eekels, J. (1995). Product design: Fundamentals and methods. John Wiley & Sons.

Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. CoDesign, 4(1), 5–18. https://doi.org/10.1080/15710880701875068

Sauro, J., & Lewis, J. R. (2016). Quantifying the user experience: Practical statistics for user research (2nd ed.). Morgan Kaufmann. https://books.google.nl/books/about/Quantifying_the_User_Experience.html?id=USPfCQAAQBAJ&redir_esc=y

Schiphol. (n.d.). Strategy. https://www.schiphol.nl/en/schiphol-group/strategy/

Schiphol. (2025). Facts and figures.

Symonds, P. (2017). Wayfinding signage considerations in international airports. Interdisciplinary Journal of Signage and Wayfinding, 1(2), 60–80.

Tassoul, M. (2004). Creative facilitation. VSSD.

Toet, A., Van Kuijk, J., Boersma, K., & Van Mastrigt, S. H. (2025). On the move: Understanding passenger experience and journey integration in multimodal travel at Europe's airports. Transportation Research Interdisciplinary Perspectives, 34, Article 101730. https://doi.org/10.1016/j.trip.2025.101730

Toet, A. S. (2025). Where it connects: Towards passenger oriented multimodal transport at airports [Doctoral dissertation, Delft University of Technology]. TU Delft Repositories. https://doi.org/10.4233/uuid:c96d17bc-24cd-4bec-9faf-cf443ec5ee36

Trypke, M., Stebner, F., & Wirth, J. (2023). Two types of redundancy in multimedia learning: A literature review. Frontiers in Psychology, 14, 1148035. https://doi.org/10.3389/fpsyg.2023.1148035

Valtech. (n.d.). Arlanda Express case study: MACH transformation. https://www.valtech.com/work/arlanda-express/

Volkskrant. (2025). Brussel sleept Nederland voor de rechter vanwege monopolie NS. https://www.volkskrant.nl/economie/brussel-sleept-nederland-voor-de-rechter-vanwege-monopolie-ns~bf46d006/

Zitrický, V., Bulková, Z., Gašparík, J., & Abramović, B. (2025). Digital transformation of public transport through travel applications. Transportation Research Procedia, 91, 688–695. https://doi.org/10.1016/j.trpro.2025.10.088

Appendix A - Interviews

Interviewee 1

[redacted] van NS

Introductie en rol

- Kun je kort uitleggen wat jouw functie is binnen NS en wat jouw verantwoordelijkheden zijn?
- In hoeverre ben je betrokken bij Schiphol en station Schiphol Airport?
- Wat is jouw rol in het ontwerpen of coördineren van branding, routing en signing op Schiphol?

2. Het Schiphol-probleem

- Kun je het probleem rondom internationale treinreizigers op Schiphol kort uitleggen vanuit jouw perspectief?
- Waarom is dit volgens jou een belangrijk aandachtspunt voor NS?
- Op welk moment in de reizigersreis zie je dat het probleem meestal ontstaat?
- Wat zijn volgens jou de grootste oorzaken van dit probleem?
- Waarom denk je dat dit probleem nog steeds bestaat?

3. Bestaand onderzoek en eerdere oplossingen

- Welke inzichten zijn uit eerdere onderzoeken gekomen?
- Wat is er in het verleden al gedaan om het probleem te verminderen?
- Welke maatregelen of aanpassingen hebben goed gewerkt?
- En welke oplossingen bleken minder effectief?

4. Wayfinding, branding en signing

- Hoe is de routing voor treinreizigers vanaf de aankomsthal naar het station ontworpen?
- Hoe wordt via signing duidelijk gemaakt waar reizigers een ticket kunnen kopen of moeten inchecken?
- In hoeverre wordt er rekening gehouden met internationale reizigers die het Nederlandse OV-systeem niet kennen?
- Waar zie je dat reizigers in de praktijk het meest vastlopen?

5. Samenwerking met stakeholders

- Hoe verloopt de samenwerking met ProRail rondom routing en signing op het station?
- Hoe verloopt de samenwerking met Schiphol Airport?
- Wat is de rol van de Spoorbouwmeester in dit soort vraagstukken?
- Wat maakt de samenwerking tussen deze partijen soms ingewikkeld?
- Op welke vlakken gaat de samenwerking juist goed?

6. Toekomst en verbeterkansen

- Waar zie jij de grootste kansen om de reis voor internationale treinreizigers vanaf Schiphol te verbeteren?
- Als je één ding zou mogen aanpassen in de huidige situatie, wat zou dat zijn?

Afsluiting

- Zijn er nog andere stakeholders of experts met wie het nuttig zou zijn dat ik spreek?

Appendix A - Interviews

Interviewee 2

[redacted] van Schiphol

1. Rol en verantwoordelijkheden

- Kun je kort toelichten wat jouw functie is en wat jouw verantwoordelijkheden zijn binnen Schiphol?
- In hoeverre ben je betrokken bij station Schiphol Airport en de reizigersstromen richting het spoor?

2. Huidige situatie op Schiphol

- Kan je in eigen woorden omschrijven wat voor probleem er is voor internationale reizigers op Schiphol?
- Welke rol speelt het station binnen de totale luchthavenervaring?
- Hoe wordt de route van aankomsthal naar station momenteel gefaciliteerd?

3. Ontwikkelingen

- Welke ontwikkelingen spelen er momenteel rondom station Schiphol?
- Waar denk je dat de internationale reizigers op Schiphol behoefte aan hebben?
- Hoe verwacht jij dat de toekomst van de air-rail transitie er uit zal zien?

4. Doelen en prioriteiten

- Welke doelen staan voor Schiphol centraal op het station?
- Wanneer is de reizigerservaring op Schiphol in jouw ogen geslaagd?

Reizigers

- Hoe zou jij verschillende reizigers op Schiphol omschrijven?
    - Hoe gaan deze anders om met hun reis?
- Wat zijn manieren om het gedrag van de reiziger het beste te sturen/beïnvloeden?

5. Uitdagingen en beperkingen

- Wat zijn volgens jou de grootste uitdagingen rondom het begeleiden van reizigers van de luchthaven naar de trein?
- Waar zie je dat reizigers (met name internationale reizigers) het meest vastlopen?
- Wat maakt dit probleem lastig om op te lossen binnen de Schiphol-context?
- Wat zijn volgens jou belangrijke beperkingen (bijv. ruimte, regelgeving, verantwoordelijkheden)?

6. Samenwerking met stakeholders

- Hoe ervaar je de samenwerking met NS rondom station Schiphol?
- Hoe verloopt de samenwerking met ProRail en andere betrokken partijen?
- Wat maakt samenwerken in deze omgeving soms complex?
- Op welke vlakken gaat de samenwerking juist goed?

8. Verbeterkansen en mogelijkheden

- Wat zijn dingen die jij graag zou willen verbeteren of implementeren op Schiphol?
- Waar zie jij de grootste kansen om de reis richting de trein te verbeteren?
- Hoe denk je dat er het beste op de korte termijn een verbetering kan komen?
- En wat zijn meer structurele of lange termijn oplossingen?

9. Projecten en best practices

- Zijn er projecten of samenwerkingen op Schiphol waar je tevreden over bent?
- Wat maakte deze projecten succesvol en welke lessen kunnen daaruit worden meegenomen?

10. Afsluiting

- Zijn er nog dingen die ik volgens jou over het hoofd zie in dit vraagstuk?
- Zijn er andere stakeholders of personen die jij zou aanraden om te spreken?

Appendix A - Interviews

Interviewee 3

[redacted] van Bureau Spoorbouwmeester

1. Rol en verantwoordelijkheden
   - Kun je kort uitleggen wat jouw functie is binnen het Bureau Spoorbouwmeester?
   - Wat zijn jouw belangrijkste verantwoordelijkheden binnen deze rol?
   - Wat is de rol van het Bureau Spoorbouwmeester binnen het spoor- en stations domein?
2. Waarden en ontwerpvisie
   - Wat zijn voor het Bureau Spoorbouwmeester de belangrijkste waarden als het gaat om stations ontwerp?
   - Welke rol spelen ruimtelijke kwaliteit, duidelijkheid en wayfinding hierin?
   - In hoeverre wordt er rekening gehouden met reizigers die het Nederlandse OV-systeem niet kennen?
3. Schiphol en internationale reizigers
   - In hoeverre is het Bureau Spoorbouwmeester betrokken bij station Schiphol Airport?
   - Wat maakt Schiphol volgens jou een bijzondere of complexe stationsomgeving?
   - Waar denk je dat internationale reizigers op Schiphol het meest vastlopen wanneer ze de trein willen nemen?
4. Uitdagingen
   - Als je naar het hele systeem kijkt: waar zit volgens jou de kern van het probleem?
     - Is het meer een informatieprobleem, een ontwerpprobleem of een systeemprobleem?
   - Welke beperkingen spelen een rol (bijv. ruimte, regels, verantwoordelijkheden)?
   - Wat zijn voor jou persoonlijk of voor het Bureau Spoorbouwmeester de grootste uitdagingen bij het Schiphol project?
   - Welke factoren maken het lastig om veranderingen door te voeren in een complexe omgeving zoals Schiphol?
5. Samenwerking met stakeholders
   - Hoe ervaar je de samenwerking met NS, ProRail en Schiphol?
   - Wat maakt samenwerken tussen deze partijen soms ingewikkeld?
   - Op welke vlakken gaat de samenwerking juist goed?
6. Projecten en voorbeelden
   - Zijn er projecten of samenwerkingen op Schiphol waar je tevreden over bent?
   - Wat maakte deze projecten succesvol?
   - Zijn er voorbeelden van stations of projecten waar wayfinding voor internationale reizigers goed werkt?
7. Toekomst en verbeteringen
   - Waar zie jij de grootste kansen om de situatie voor internationale reizigers te verbeteren?
   - Wat zou volgens jou een quick win zijn?
   - En wat zou een meer structurele oplossing zijn?
   - Als je één ding zou mogen veranderen op het station, wat zou dat zijn?

Appendix A - Interviews

Interviewee 4

[redacted] van NS Stations

1. Rol en verantwoordelijkheden

- Kun je kort toelichten wat jullie rollen zijn?
- Waar zijn jullie verantwoordelijk voor op het station?
- In hoeverre ben je betrokken bij de reizigerservaring van internationale reizigers?

2. Schiphol als station (unieke context)

- Wat maakt station Schiphol anders dan andere stations in Nederland?
- Hoe verhoud het station zich tegenover de luchthaven?
- In hoeverre is de focus van het station op internationale reizigers?

3. Het probleem in de praktijk

- Hoe ervaar jij in de praktijk de situatie rondom internationale reizigers die de trein willen nemen?
- Waar zie je dat reizigers het meest vastlopen?
- Komt het vaak voor dat reizigers moeite hebben met het vinden van een ticket of het begrijpen van het systeem?

4. Observaties en gedrag

- Wat voor gedrag zie je bij internationale reizigers op het station?
- Wat voor emoties zie je bij internationale reizigers op het station?
- Hoe proberen reizigers dit probleem zelf op te lossen?

5. Wat gebeurt er nu al?

- Wat wordt er op dit moment gedaan om reizigers te helpen bij het vinden van de trein en het kopen van een ticket?
- Welke oplossingen of initiatieven zijn er al geweest?
- Wat werkt goed in de praktijk?
- En wat werkt minder goed?

6. Samenwerking (heel belangrijk!)

- Hoe verloopt de samenwerking met Schiphol Airport?
- Hoe werk je samen met ProRail en andere partijen op het station?
- Wat maakt samenwerken op Schiphol soms complex?

7. Systeem en knelpunten

- Als je naar het hele systeem kijkt: waar zit volgens jou de kern van het probleem?
- Welke beperkingen spelen een rol (bijv. ruimte, regels, verantwoordelijkheden)?

8. Verbeterkansen

- Waar zie jij de grootste kansen om de situatie voor internationale reizigers te verbeteren?
- Wat zou volgens jou een "quick win" zijn?
- En wat zou een meer structurele oplossing zijn?
- Als je één ding zou mogen veranderen op het station, wat zou dat zijn?

Afsluitvragen

- Zijn er nog dingen die ik volgens jou over het hoofd zie in dit vraagstuk?
- Zou ik vrijdag 3 april (goede vrijdag) op Schiphol vragen kunnen stellen? de hele ochtend (uiteraard help ik de toeristen met het vinden van ticket/trein nadat ze vragen hebben beantwoord)

Appendix A - Interviews

Interviewee 5

[redacted] van ProRail

1. Jouw taken en verantwoordelijkheden

- Kun je vertellen wat jouw functie bij ProRail precies inhoudt?
- Welke projecten of thema's vallen onder jouw verantwoordelijkheid?
- Hoe raak jij betrokken bij de reizigerservaring op stations zoals Schiphol?

2. Verantwoordelijkheden van ProRail

- Wat zijn de kernverantwoordelijkheden van ProRail ten opzichte van een station als Schiphol?
- Waar houdt ProRail op, en waar begint bijvoorbeeld de verantwoordelijkheid van NS of Schiphol zelf?
- Hoe wordt afgestemd wie wat doet richting de reiziger?

3. Belangrijkste doelen van ProRail

- Welke strategische doelen heeft ProRail als het gaat om station ontwikkeling en reizigersstromen?
- Hoe verhouden die doelen zich tot gebruiksgemak of overzicht voor de reiziger?
- Wordt er ook gekeken naar 'wayfinding' (bewegwijzering, oriëntatie, gebruik van digitale informatie)?

4. Gedrag van reizigers

- Zijn er specifieke punten op Schiphol waar de reiziger vastloopt?
- Hoe probeert ProRail daarin te ondersteunen?

5. Uitdagingen op Schiphol

- Wat maakt Schiphol Station anders dan andere stations in Nederland?
- Welke praktische of technische uitdagingen spelen er bij de inrichting en het beheer van het station?
- Waarom staan de paaltjes bijvoorbeeld niet op het perron of naast de roltrappen?
    - En waarom staat de toeslag paal daar bijvoorbeeld wel?
- Wat zijn dingen die volgens jou het inchecken op Schiphol makkelijker zouden maken?
- Zijn er andere potentiële verandingen die van ProRail echt een no-go zijn?

6. Belangen van ProRail op Schiphol

- Wat zijn de belangrijkste belangen van ProRail op deze locatie?
- Waarin verschillen die belangen van NS?
- Waarin verschillen die van Schiphol?

7. Projecten op Schiphol

- Kun je vertellen over projecten die gericht waren op het verbeteren van de reizigerservaring?
- Welke oplossingen hebben goed gewerkt, en wat bleek minder effectief?
- Worden er pilots gedaan met nieuwe technologieën (zoals slimme bewegwijzering of real-time reizigersinformatie)?

8. Samenwerkingen met andere partijen

- Hoe werkt ProRail samen met NS, Schiphol, en eventueel het ministerie of gemeenten?
- Hoe worden gezamenlijke beslissingen genomen over aanpassingen in het station?
- Waar liggen volgens jou de grootste kansen in die samenwerking?

9. Kansen rondom deze uitdaging

- Waar zie jij, persoonlijk of als organisatie, kansen om de reiziger op Schiphol beter te helpen de juiste trein, ticket en incheckpaal te vinden?
- Zijn er ideeën of ontwikkelingen waar ProRail nu al over nadenkt?

Appendix B - Interviews

International travellers at ASD

Interview Amsterdam Centraal Reizigers

Did you get her with the train from Schiphol Airport?
I am doing a research for the Dutch Railways to improve the experience for international tourists at Schiphol travelling to Amsterdam. Can I ask you some questions?
Was this your first time travelling from Schiphol Airport with the train?
How did you experience the journey from your flight to the train?
How did you prepare for your travel from the airport to your accommodation?
How did you book your flight tickets?
Why did you decide to travel to Amsterdam by train?
Did you get any tickets for the train? If so, where?
What were your assumptions about this train travel to Amsterdam?

What are the things that felt unclear (regarding your train travel)
Finding the platform: What train: How to get a ticket: Checking in/checking out system: Other:
What digital tools have you used for your journey to Amsterdam
What physical tools have you used for your journey to Amsterdam
What did you miss that would have made your journey to Amsterdam better
Other remarks
AGE / NATIONALITY
Closing (thank you/assistance)

Appendix B - Interviews

International travellers at Schiphol

Interview Schiphol reizigers

I am doing a research for the Dutch Railways to improve the experience for international tourists at Schiphol travelling to their final destination by train. Can I ask you some questions?
Is it your first time arriving at Schiphol?
Were you able to find the train station?
Are you planning to take the train and why?
How did you book your flight tickets?
How did you prepare your travel from the airport to your final destination?
Do you already have a ticket for the train?
What were your assumptions about the train travel to the final destination?
What do you struggle with the most at this station?

What digital tools have you used for your train journey?
What physical tools have you used for your train journey?
What would help you at this station to prepare for your train travel?
Other remarks
AGE / NATIONALITY
Closing (thank you/assistance)

Appendix B - Interviews

Service Employees at ASD

Interview NS Servicemedewerkers Amsterdam Centraal

Introductie: onderzoek voor NS naar internationale toeristen die reizen van Schiphol naar Amsterdam
Wat zijn veelvoorkomende vragen van internationale toeristen?
Waarom denkt u dat deze vragen veel gesteld worden?
Wat zijn veelvoorkomende aannames die door internationale toeristen worden gedaan?
Is er een bepaalde doelgroep (leeftijd/nationaliteit) die vaak vragen stelt?
Wat is de beste manier om deze toeristen te helpen?
Wat zou er op Schiphol gedaan kunnen worden om internationale toeristen te helpen?
Wat zou er online gedaan kunnen worden om internationale toeristen te helpen?
Wat zou er voor u kunnen worden gedaan om uw baan gemakkelijker te maken?

Appendix C - DUTCH INTERVIEWS QUOTES

“mensen kennen het openbaarvervoersysteem in Nederland niet, en daarmee ook het in- en uitchecken niet.” (interviewee 1)

“De poorten hebben we niet; het zijn palen. Die worden door de internationale reiziger slecht herkend. We hebben nu die stickers, maar de herkenbaarheid is, denk ik, het belangrijkste punt: de herkenbaarheid van het station is onvoldoende.” (interviewee 5)

“Het gaat meer om: hoe werkt het in het land van herkomst van de reiziger? In sommige landen stempel je je kaartje pas in het voertuig zelf, zeker bij stads- en streekvervoer. Dan verwacht je stempelmachines in het voertuig, of op het perron.” (interviewee 2)

“Dus: hoe kom ik aan de informatie dat ik meteen weet hoe de reis werkt? Waar moet ik uitstappen of overstappen? Hoe werkt het? De vindbaarheid én de niet-vindbaarheid van de trein en van de informatie zijn een issue.” (interviewee 2)

“Ja, en zeker als je alleen reist, geen kinderen, dan is een bankpas superhandig. Je moet alleen even van tevoren weten wat je moet doen.” (interviewee 3)

“En ik heb het idee dat er een groep is die wel weet hoe dat moet maar niet wil gebruiken omdat ze dan ook wel willen weten wat dat kost.” (interviewee 4)

“maar Plaza is een kakofonie met informatie.” (interviewee 4)

“Je ziet dat het door die verschillende belangen soms lastig is om het overalbelang – het reizigersbelang – voorop te zetten, omdat er nog zoveel andere belangen spelen.” (interviewee 5)

“Je moet er wat mee, anders wordt het probleem groter: meer mensen zonder geldig vervoerbewijs in de trein, meer ontevreden klanten.” (interviewee 1)

“Ons belangrijkste doel is het waarborgen van een veilige transfer.” (interviewee 5)

“Die grote reclamedingen die er hangen boven Plaza leiden enorm af. Die willen we het liefst ook weg. Maar ja, Schiphol heeft daar natuurlijk inkomsten van.” (interviewee 5)

“Dat gaat sowieso niet gebeuren. Ik zal je ook vertellen waarom: heel praktisch. Poortjes zijn plekken waar mogelijk mensen zich achter kunnen verschuilen.Ze willen gewoon vrij, ja, het klinkt natuurlijk... maar ze willen vrij zicht.” (interviewee 4)

“die Plaza, wat een soort commerciële plek is met allemaal kruisende loopstromen van parkeerplaats, vliegtuigen, noem maar op ..... Als daar wat verandert, is dat meestal ook wel heel duur. Het is heel druk. Dus alles wat je doet, is kostbaar.” (interviewee 3)

Wat uniek is, is dat het voor 80% toch een ander publiek is. Want daar komt het een en ander terug: dat is namelijk de toerist.” (interviewee 4)

Reizigers/Servicemedewerkers

“Mensen lopen meteen naar beneden als ze op Schiphol zijn (wat gek is, er staan 56 incheckpalen die ze missen), ze geven vaak aan "niks gezien te hebben"”

“Er zijn veel ticketautomaten, veel incheckpaaltjes, daar ligt het niet aan. Maar mensen vragen het niet als ze iets niet kunnen vinden. Soms kopen ze de verkeerde kaartjes.”

Appendix D - PLANNING CO-CREATION WORKSHOP STUDENTS

1. Introduction (10 minutes)

The workshop started with a short presentation. In this presentation I quickly shared my findings (a summary of the first diamond) and the rules of the session formulated with the use of the book “creative facilitation” by Marc Tassoul:

- There is no right or wrong idea
- We will not share our opinions untill the end of the session
- Quantity of ideas is more important than the quality of ideas
- It's not about who “owns” an idea, it's a collective process

2. HKJ's: “How might we?” (20 minutes)

To not immediately start with the main problem, but instead create a positive and solution-oriented mindset, we started with HKJ questions (how can you/how might we). As an icebreaker, participants were asked to: "Think of as many ways as possible for a hamster to cross a river in 5 minutes."
After this I introduced three additional HKJ questions that were semi-related to the topic. This helped participants shift into a problem-solving mindset while also inspiring them for the next phase by encouraging them to look at the problem from a different perspective.

- HKJ - be a good host?
- HKJ - help someone on their first day at work?
- HKJ - help someone find the top of the mountain?

3. Designing with the customer journey and persona’s (40 minutes)

Now that we have warmed up, it's time to address the real problem: How can we help international travellers at Schiphol travel by train with a valid ticket?
Using the three personas I identified in my research, along with the customer journey for these travellers, I want to maintain a user-centered approach throughout the workshop. Together, we will explore possible ways to support the different types of personas across various stages of their customer journey, considering barriers and opportunities at key touchpoints (e.g., arriving at Schiphol, finding the train station, purchasing a ticket, boarding the train).

4. Selecting and discussing ideas (20 minutes)

In this final stage, it is finally allowed to comment on ideas. First, all participants can individually choose the, in their eyes, most promising ideas by giving it a sticker. The ideas with the most stickers are discussed. All participants are asked to mention what they think the big challenges are and what the benefits are. This way, we can understand each others views and I can learn what ideas are worth looking in to.

Appendix E - PLANNING CO-CREATION WORKSHOP STAKEHOLDERS

1. Introduction (10 minutes)

The workshop started with a short presentation. In this presentation I went through my research to give them an update on my findings. I also explained the rules of the session, especially important because they are not that familiar with brainstorming:

- There is no right or wrong idea
- We will not share our opinions until the end of the session
- Quantity of ideas is more important than the quality of ideas
- It's not about who "owns" an idea, it's a collective process

2. HKJ's: "How can you?" (15 minutes)

To not immediately start with the main problem, but instead create a positive and solution-oriented mindset, we started with HKJ questions (how can you?).
These questions were semi-related to the topic and helped the participants shift into a problem-solving mindset while also inspiring them for the next phase by encouraging them to look at the problem from a different perspective. These were the questions:

- HKJ - be a good host?
- HKJ - help someone on their first day at work?
- HKJ - help someone find the top of the mountain?

Figure 42 shows the results from the HKJ's.

3. Designing for the possible and the probable future (2x 20 minutes)

Now that we have warmed up, it's time to address the real problem: How can we help international travellers at Schiphol travel by train with a valid ticket?
I decided to categorize the customer journey into three sections: before the station (inlcuding planning at home, the flight, arrival at the airport and baggage claim), at the station (the plaza with TBx screens, CICO poles, ticket machines) and the train journey (entering from the platform, the train ride and arrival at ASD and Hotel). I also shortly discussed the persona's and how they are helped at different moments in the customer journey. After also briefly explaining speculative design, the first 20 minutes the participants desigined for the possible future. After this, the participants designed for the probable future the other 20 minutes. With the use of possible futures and the HKJ's the participants were exposed to new ways of approaching the design challenge.

4. Discussing and ranking the design criteria (5 minutes)

In order to make a good selection out of all the ideas, i created design constraints and criteria to evaluate ideas with. Since the acceptance of stakeholders is so important, i first discussed the design constraints to see if they are complete. After checking these, i discussed the design criteria. To evaluate the ideas properly, a ranking of these criteria is necessary. All the stakeholders evaluated these criteria individually from 1-6. I also asked them to give suggestions for criteria that need to be altered or were missing.

5. Selecting and discussing ideas (20 minutes)

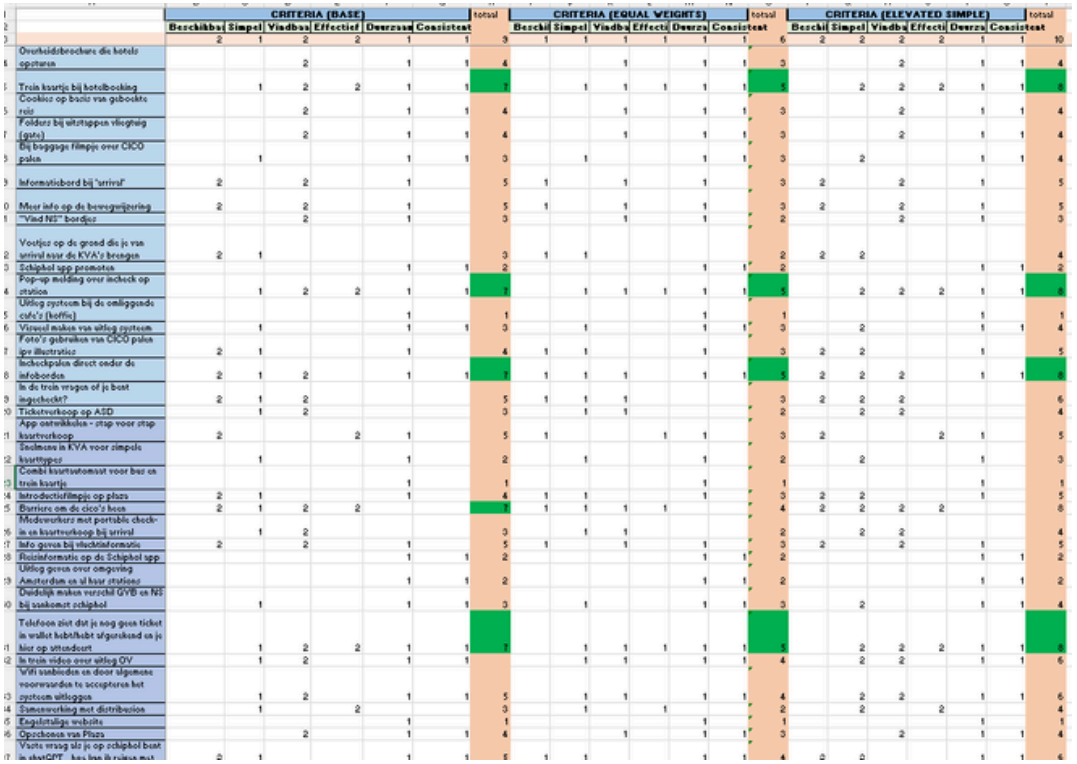
In this final phase I asked all the participants to go through all the post-its and give the ideas with the most potential a sticker, with three stickers in total. Afterwards, I was able to pick out the ideas with the most potential. We discussed four ideas in total.
Figure 43 shows the result from the brainstorm.

Appendix F - IDEA SELECTION PROCESS

	RANDVOORWAARDEN			
CONCEPT	Acceptable Cos	Compatible	Spatially Feasible	Safe
Overheidsbrochure die hotels	x	x	x	x
Trein kaartje bij hotelboeking	x	x	x	x
Mail van vliegtuigmaatschappij		x	x	x
Uitleg ov-systeem op etenskaartje		x	x	x
Reclame NS op schermpje in		x	x	x
Cookies op basis van geboekte reis	x	x	x	x
Folders bij uitstappen vliegtuig	x	x	x	x
Bij baggage filmpje over CICO	x	x	x	x
Labels op je tas met uitleg	x	x	x	x
Informatiebord bij 'arrival'	x	x	x	x
Connectie app met andere reizigers (elkaar helpen)	x	x	x	
Meer info op de bewegwijzering	x	x	x	x
NS neemt je mee van arrival naar		x	x	x
"Vind NS" bordjes	x	x	x	x
Voetjes op de grond die je van arrival naar de KVA's brengen	x	x	x	x
Schiphol app promoten	x	x	x	x
Pop-up melding over incheck op	x	x	x	x
Lasers die wijzen waar je naartoe	x	x		x
Uitleg systeem bij de omliggende cafe's (koffie)	x	x	x	x
Follow the train - mascottes		x	x	x
Visueel maken van uitleg systeem	x	x	x	x
Foto's gebruiken van CICO palen ipv illustraties	x	x	x	x
Incheckpalen direct onder de	x	x	x	x
treinrekening gekoppeld aan Google Maps	x		x	x
Bij de trappen: heb je een kaartje?	x	x	x	
Treininformatie op perron: buy tickets upstairs	x	x	x	
CICO palen maken geluid	x	x		
In de trein vragen of je bent	x	x	x	x
Ticketverkoop op ASD	x	x	x	x
Betalen als je in het hotel aankomt	x		x	x
App ontwikkelen - stap voor stap kaartverkoop	x	x	x	x
Snelmenu in KVA voor simpele	x	x	x	x
Combi kaartautomaat voor bus en trein kaartje	x	x	x	x
Introductiefilmpje op plaza	x	x	x	x
Treinmiddelen in "natuurlijk zicht" plaatsen	x	x		x
Barriere om de cico's heen	x	x	x	x
Medewerkers met portable check-				

CONCEPT	Acceptable Cos	Compatible	Spatially Feasible	Safe
Info geven bij vluchtinformatie	x	x	x	x
Reisinformatie op de Schiphol app	x	x	x	x
Uitleg geven over omgeving Amsterdam en al haar stations	x	x	x	x
Duidelijk maken verschil GVB en NS bij aankomst schiphol	x	x	x	x
Telefoon ziet dat je nog geen ticket in wallet hebt/hebt afgerekend en je hier op attendeert	x	x	x	x
In trein video over uitleg OV	x	x	x	x
Tijdschrift met OV info in vliegtuig		x	x	x
Wifi aanbieden en door algemene voorwaarden te accepteren het systeem uitleggen	x	x	x	x
Samenwerking met distribusion	x	x	x	x
Engelstalige website	x	x	x	x
Opschonen van Plaza	x	x	x	x
Vaste vraag als je op schiphol bent in chatGPT - hoe kan ik reizen met OV	x	x	x	x
Box in box: omkluis de stijgpunten en maak twee hoofdingangen met medewerkers		x	x	
Persoonlijk welkom heten bij de		x	x	x
Borden boven de incheckpaaltjes	x	x	x	x
Pushbericht bij uitchecken (in taal van de reiziger)	x	x	x	x
Bord met QR code, wat leidt naar info over treinreizen in NL	x	x	x	x
Standaard treinkaartje in vliegticket	x	x	x	x
Treinkaartje kopen in trein	x	x	x	x
Videodisplay Ovpay boven KVA's	x	x	x	x
Vloermarkering als Narita Airport (gekleurde atletiek baan), leidingd naar CICOS		x	x	x
Reiziger opvangen op ASD	x	x	x	x
De reizigersstromen onderscheiden	x	x	x	x
Al in telefoon vraagt hoe je reis (vlucht) was en vraagt daarna door of je nog vragen hebt over de trein/taxi	x	x	x	x
Infobalie bij baggagereclaim		x	x	x
KVA op perron	x	x	x	
QR-code bij TBx schermen waarmee je meteen kaartje kan kopen	x	x	x	x
CICO palen herkenbaar maken	x	x	x	x
Video op perron over uitleg check-in en check-uit	x	x	x	x
Overkoepelende website voor al het OV in Nederland (leidend)	x	x	x	x
Personeel op vloer tijdens pieken	x	x	x	x
Digitale reiskaart in wallet	x	x	x	x
Vliegticket + GVB + treinkaart in 1	x	x	x	x
Duidelijkheid op AMS CS hoe je je fout kan terugdraaien?	x	x	x	x
In het vliegtuig een trein kaartje kopen			x	x

Appendix F - IDEA SELECTION PROCESS



	CRITERIA (BASE)						totsal	CRITERIA (EQUAL WEIGHTS)						totsal	CRITERIA (ELEVATED SIMPLE)						totsal
	Beschikbaa	Simpel	Viadbaa	Effectief	Duurzaa	Coexistent		Beschik	Simpel	Viadbaa	Effecti	Duurza	Coexistent		Beschik	Simpel	Viadbaa	Effecti	Duurza	Coexistent	
	2	1	2	2	1	1	9	1	1	1	1	1	1	6	2	2	2	2	1	1	10
Overheidsbrochure die hotels opsturen			2		1	1	4			1		1	1	3			2		1	1	4
Train kaartje bij hotelboeking		1	2	2	1	1	7		1	1	1	1	1	5		2	2	2	1	1	8
Cookies op basis van geboekte reis			2		1	1	4			1		1	1	3			2		1	1	4
Folders bij uitstappen vliegtuig (gate)			2		1	1	4			1		1	1	3			2		1	1	4
Bij bagage filmpje over CICO palen		1			1	1	3		1			1	1	3		2			1	1	4
Informatiebord bij "arrival"	2		2		1		5	1		1		1		3	2		2		1		5
Meer info op de bewegwijzering	2		2		1		5	1		1		1		3	2		2		1		5
"Vind NS" bordjes			2		1		3			1		1		2			2		1		3
Voetjes op de grond die je van arrival naar de KVA's brengen	2	1					3	1	1					2	2	2					4
Schiphol spp promoten					1	1	2					1	1	2					1	1	2
Pop-up melding over incheck op station		1	2	2	1	1	7		1	1	1	1	1	5		2	2	2	1	1	8
Uitleg systeem bij de omliggende cafe's (koffie)					1		1					1		1					1		1
Visueel maken van uitleg systeem		1			1	1	3		1			1	1	3		2			1	1	4
Foto's gebruiken van CICO palen ipv illustraties	2	1			1		4	1	1			1		3	2	2			1		5
Incheckpalen direct onder de infoborden	2	1	2		1	1	7	1	1	1		1	1	5	2	2	2		1	1	8
In de trein vragen of je bent ingecheckt?	2	1	2				5	1	1	1				3	2	2	2				6
Ticketverkoop op ASD		1	2				3		1	1				2		2	2				4
App aantrekkelijker - stap voor stap kaartverkoop	2			2	1		5	1			1	1		3	2			2	1		5
Snelmenu in KVA voor simpele kaarttypes		1			1		2		1			1		2		2			1		3
Combi kaartautomaat voor bus en trein kaartje					1		1					1		1					1		1
Introductiefilmpje op plaza	2	1			1		4	1	1			1		3	2	2			1		5
Barriere om de cico's heen	2	1	2	2			7	1	1	1	1			4	2	2	2	2			8
Medewerkers met portable check-in en kaartverkoop bij arrival		1	2				3		1	1				2		2	2				4
Info geven bij vluchtinformatie	2		2		1		5	1		1		1		3	2		2		1		5
Reisinformatie op de Schiphol spp					1	1	2					1	1	2					1	1	2
Uitleg geven over omgeving Amsterdam en al haar stations					1	1	2					1	1	2					1	1	2
Duidelijk maken verschil GVB en NS bij aankomst schiphol		1			1	1	3		1			1	1	3		2			1	1	4
Telefoon ziet dat je nog geen ticket in wallet hebt/hebt afgerukend en je hier op attendeert		1	2	2	1	1	7		1	1	1	1	1	5		2	2	2	1	1	8
In train video over uitleg OV		1	2		1	1			1	1		1	1	4		2	2		1	1	6
Wifi aanbieden en door algemene voorwaarden te accepteren het systeem uitleggen		1	2		1	1	5		1	1		1	1	4		2	2		1	1	6
Samenwerking met distributeurs		1		2			3		1		1			2		2		2			4
Engelstalige website					1		1					1		1					1		1
Opschonen van Plaza			2		1	1	4			1		1	1	3			2		1	1	4
Vaste vraag als je op schiphol bent in chatGPT - hoe kan ik reizen met	2	1				1	5	1	1				1	4	2	2				1	6
Borden boven de incheckpaaltjes	2			2	2		6	1			1	1		3	2			2	2		6
Pushbericht bij uitchecken (in taal van de reiziger)	2	1	2			1	6	1	1	1			1	4	2	2	2			1	7
Bord met QR code, wat leidt naar info over treinreizen in NL	2	1				1	5	1	1				1	4	2	2				1	6
Standaard treinkaartje in vliegticket	2	1	2	2	1	1	9	1	1	1	1	1	1	6	2	2	2	2	1	1	10
Treinkaartje kopen in trein	2	1	2	2	1		8	1	1	1	1	1		5	2	2	2	2	1		8
Videodisplay Orpay boven KVA's	2	1			1		4	1	1			1		3	2	2			1		5
Reiziger opvragen op ASD	2	1	2		1		7	1	1	1		1	1	5	2	2	2		1	1	8
De reizigersstromen onderscheiden						1	1						1	1						1	1
Al in telefoon vraagt hoe je reis (vlucht) was en vraagt daarna door of je nog vragen hebt over de trein/taxi reis		1	2	2	1	1	7		1	1	1	1	1	5		2	2	2	1	1	8
QR-code bij TBx schermen waarmee je meteen kaartje kan kopen via distribution	2	1	2	2	1		8	1	1	1	1	1		5	2	2	2	2	1		9
CICO palen herkenbaar maken	2		2		1		5	1		1		1		3	2		2		1		5
Video op perron over uitleg check-in en check-uit		1	2	2	1		6		1	1	1	1		4		2	2	2	1		7
Overkoepelende website voor al het OV in Nederland (leidend)	2				1	1	4	1				1	1	3	2				1	1	4
Personeel op vloer tijdens pieken		1	2			1	4		1	1			1	3		2	2			1	5
Digitale reiskaart in wallet	2	1			1	1	5	1	1			1	1	4	2	2			1	1	6
Vliegticket + GVB + treinkaart in 1	2	1		2	1		6	1	1		1	1		4	2	2		2	1		7
Duidelijkheid op AMS CS hoe je je fout kan terugdraaien?	2	1	2		1	1	7	1	1	1		1	1	5	2	2	2		1	1	8
Reistijd en prijs beter zichtbaar	2	1			1	1	5	1	1			1	1	4	2	2			1	1	6