EXPERIENCING
STATION LOCATIONS

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TU Delft

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A holistic assessment of Dutch station locations to identify crucial elements that relate to the enhancement of the traveller experience

Bart Simkens

COLOPHON

Experiencing station locations
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PREFACE

Do you know the feeling of visiting a new place, a city that you have never been to before? You probably pictured yourself what it might look like, what the people are like, how tall the buildings are, and so on. In The Netherlands, it is conceivable that you visit this new place by using the train, since it is fast, you avoid traffic jams, you don't need to find a parking spot and above all, it brings you directly to the city centre. When you get off the train, the first encounter with this new city, is the railway station and its environment. You may be amazed by the spectacular architecture, or the beautiful classical building. But you may also be disappointed, because the place is old-fashioned or just not very attractive. The first encounter is not what you had pictured in your mind.

I have always been fascinated by this phenomenon. The railway station can really give a good or bad first impression of a city, especially nowadays. They are becoming the new centres of activity in the modern city, not only where train arrive and depart, but also where a lot of other things happen. Around them, homes, offices, retail facilities and many other amenities are being built. The area is becoming more popular to live, since people realise that they can really be a part of the epicentre of the city.

This thesis discusses the station location extensively. From the perspective of the main user, which is the train traveller, it approaches multiple cases around the Netherlands to define which elements do really make the difference in terms of quality. Is it the train schedule, the bicycle facilities, the shops, or the quality of the area that matters? These aspects, and many more, have been mapped in this study and compared to the opinion of the traveller about the station. The results were discussed with multiple actors that operate in station location developments, to find out what the implications of this study can be.

This study required me to take a very detailed look at station location developments. What better place to do so than the real estate department of the Dutch Railways, NS Stations. I am very grateful that I got the opportunity to conduct this research in collaboration with them. NS Stations provided me with essential data that was needed to bring this study to a successful end.

I would like to thank my supervisors Herman Vande Putte and Wouter Jan Verheul for the accurate feedback and contribution to this study. The guidance and critical questions from their personal and professional perspectives have helped me to constantly improve and reflect on my work. Furthermore, I would like to thank my external supervisor Daan Klaase for the dedication with which he has guided me along the process. I appreciate it very much that I was so involved in the operations of NS Stations and was able to get a sincere look behind the scenes. Lastly, I want to thank all other involved experts and interviewees that inspired me and gave me the chance to validate my results and take this thesis to a higher level.

Bart Simkens

Delft, January 2020

EXECUTIVE SUMMARY

Introduction

The station location is typically characterised by its dual nature as a semi-public piece of real estate. On the one hand, it is used by its developers to achieve its corporate objectives. On the other hand, it is a place which is accessible to all and serves the societal and urban needs in terms of transport, activities, encounters and many more. In current urban developments, these places in the city are changing rapidly. The concept of transit-oriented development describes the reason why this is happening. Due to the high demand for space in the city, the quest for available land often leads to places that are both available and well accessible. Station locations are examples of these places.

Consequently, many new stakeholders are engaged in station location developments, but many rather often follow their own aims and objectives, and substantiate their decisions with own interpretations and assumptions. This leads to uncoordinated collaborations with conflicts of interests. This study wants to clear some of the air in this respect. However, from which perspective should one observe the station location to decide which elements deserve attention? The user has a central position in this regard. Most importantly, their demands should be taken into consideration in order to provide successful real estate. Therefore, this study positions the user of a station location as a central point of attention. More specifically, the definition of the user has been narrowed down to the traveller which encounters various elements at the station location during their door-to-door journey.

Actors crowding station location development processes.

This study aims to identify critical elements at station locations that relate to the enhancement of the traveller experience. To do so, characteristics of both the railway station and the station environment are assessed by using measurable variables. Certain characteristics or means that show a relationship with the traveller experience might be supportive, others might be disruptive. Once critical elements have been identified, this knowledge can be used by stakeholders to substantiate their program of requirements of a station location. The central research question is as follows:

Which elements at Dutch station locations can be identified that relate to the enhancement of the traveller experience?

Research framework

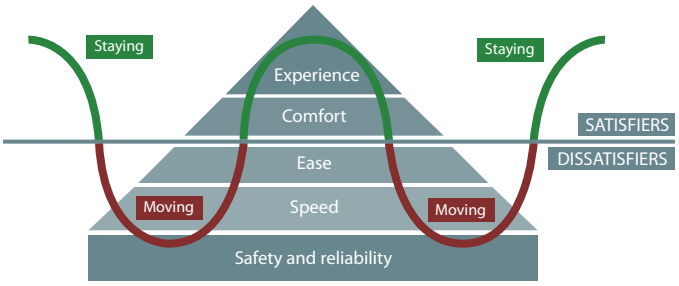
The conceptual model of this study can be introduced in a very simple manner. Two main concepts are being compared to each other: the station location and the traveller experience. Before this comparison can be made in the empirical research, both concepts need to be understood. This is done in the literature review. First of all, the existing theories about the traveller experience are analysed. Secondly, theories about the station location are consulted to be able to define the station location. This literature review forms the foundation on which the operationalisation of this research is based. The operationalisation of both the station location and the traveller experience allows to acquire data of multiple case studies. In the empirical research, the collected data is compared to each other to see if any interesting relations can be found, which are then presented in the conclusion. In the discussion, the findings are placed in a broader societal context.

Theoretical framework

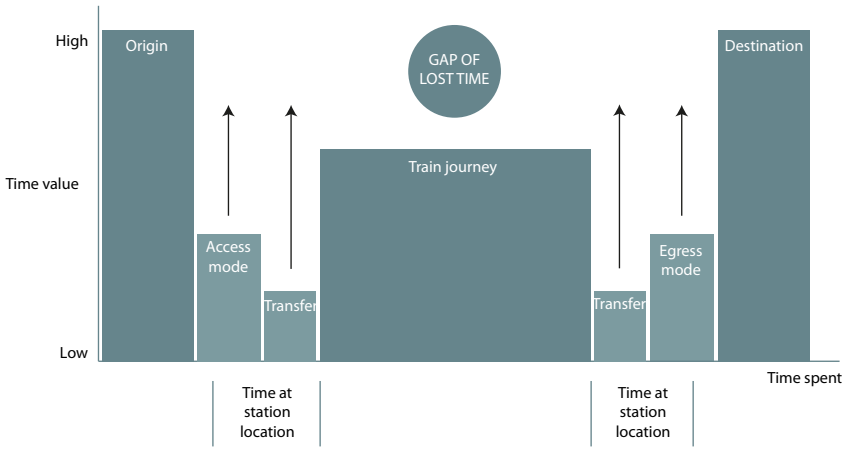
>> traveller experience

According to Van Hagen (2011), the station is part of the door-to-door journey. The moment when the traveller is at the platform, boards the train and has to find a seat is represented as the lowest satisfaction in the overview (Van Hagen & Exel, 2012). This finding is supported by the graph of van Hagen (2011) in which the *door-to-door appreciation of time* has been visualised (fig. X). This graph shows the transfer time is valued significantly lower than other parts of the journey (Loehlin, 1959; Mackie, Fowkes, Wardman, Whelan & Bates, 2001; Wardman, 2004). Consequently, the time spent at the station location is the least useful way to spend time. This can be improved in two ways: by decreasing the time spent, the traveller experiences less wasted time (Van Hagen, 1998; 2003). However, by making the station location a more pleasant place, the time spent here can be perceived as more useful and pleasant (Peek, 2010).

While spending time at the station location, the traveller has certain demands. The wishes of the traveller can be visualized based on the Maslow hierarchy and stacked in order of importance in a pyramid shape. This pyramid is called the 'customer demand pyramid' (fig. X). It reflects the perception of quality that is offered during a train journey. The base part of the pyramid is formed by the basic requirements of *reliability and safety*. A lack of time is a typical feature of train travellers. As a result, *speed* is a main customer requirement, and is placed one level higher in the pyramid. If the condition of a fast journey and transfer is fulfilled, the traveller subsequently wishes that a transfer is *easy* or *convenient*. The next layer in the pyramid is aimed at *comfort*. The traveller expects a certain level of comfort at the station. Lastly, the traveller expects to have a certain degree of *experience* during its journey. This can be achieved by providing visual aspects, architectural design, layout and cleanliness. The themes *safety, reliability, speed* and *convenience* can be referred to as *dissatisfiers* (Herzberg, Mausner and Snyderman, 1959); these quality aspects are valued negatively when they receive an insufficient amount of attention. *Comfort* and *experience* are *satisfiers* (Herzberg et al., 1959); these aspects are noticed at stations where they positively contribute to the atmosphere.



Customer demand pyramid for railway stations (Van Hagen, 2011)



Appreciation of time during the door-to-door journey (Van Hagen, 2011).

>> *station location*

As a central point of attention, the two concepts the staton as a *node* and a *place* are discussed in this section. Since station locations are both nodes in various transport networks and places of activity in the city, they can be perceived in many ways (Bertolini, 1996). Different views on the station location can be connected to different disciplined in society (Peek, 2006). Because this approach still leaves much room for own interpretations, the various components of the station location are viewed in detail.

The *station building* is described by Kandee (2004) and typically contains three main areas. The core area is where the main entrance is situated and where traveller can find ticket handling and travel information. The transition area, in which most retail functions and other facilities can be found, is most often the connection between the core area and the peripheral area. The latter is where the platforms and railway tracks are located.

For the *station area,* Pojani & Stead (2012) defined eight main components of the station area that attention should be paid to in modern station location developments. The concept of transit-oriented development is explicitly included in this theory. These are the eight main components defined by Pojani & Stead:

1) scale and density;
2) public spaces for human use;
3) safety;
4) variety and complexity;
5) connections;
6) pedestrian/cyclist orientation;
7) transit in the urban pattern;
8) car movement and parking.

Besides, Brouwer (2014) explains the importance of a vital connection between the railway station and the city centre. She states that often this connection is broken and should be restored while paying attention to the following four concepts:

1) Liveliness
2) Human scale
3) Legibility
4) Safety & comfort

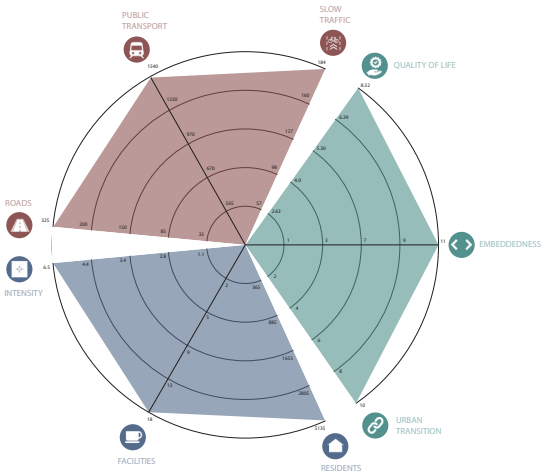
Station as a node in various transport networks.

Station as a place of activity in the city.

Operationalisation

>> *station location*

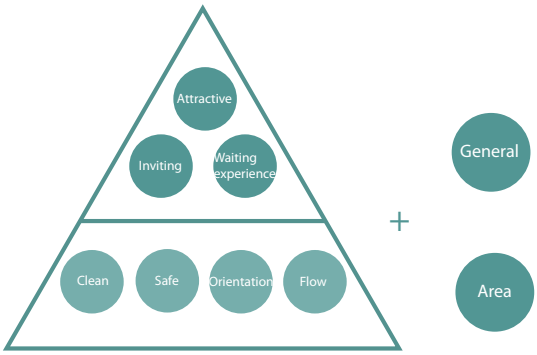
Based on the Bertolini's theories, Vereniging Deltametropool (2013) introduced the butterfly model, in which the node- and place value are operationalised. Each value is divided in three themes, which incorporate multiple parameters. According to the butterfly model, a station location can be assessed in an objective manner. For this study however, the composition of the butterfly model was not completely suitable. Therefore, some adjustments have been made in order to incorporate some aspects of the station location that were found to be relevant in this study. Most importantly, a third value, the contextual value, has been added in the model. This was done in order to explicitly incorporate important station area aspects in this study. The parameters that were added are based on the analysed theories by Pojani & Stead (2012) and Brouwer (2010). As a result, the *holistic assessment model* was introduced to serve as main tool to acquire data about multiple station locations.



The holistic assessment model for station locations (own ill.)

>> *traveller experience*

As a tool to acquire the data about traveller experience, the *stationsbelevingsmonitor* (SBM - station-experience monitor) by NS and ProRail was used. At every Dutch station, surveys are conducted on a regular basis in order to gain information and provide a score for the station. The questions in the SBM-surveys can be clustered into seven important themes, which are derived from the customer demand pyramid theory by Van Hagen (2011). In addition, travellers are asked to give a general opinion about the station as well as an opinion about the area surrounding the station (fig. X).



Themes that are assessed in the SBM (own ill.).

Empirical research

The study is executed by reviewing thirty Dutch station locations and statistically compare them to each other and to the experience of travellers at those stations. As a sample, the collection of type-2 stations in The Netherlands have been assessed accordingly. These are thirty large stations in the centre of medium sized cities. These station locations are relevant to assess, because of their connection with the city centre and the attention that is currently received by them with regard to spatial developments.

>> *quantitative analysis*

Each station location has been mapped and assessed according to the previously introduced *holistic assessment model*. For the same station locations, the data from the SBM has been collected and processed. These two datasets have been compared to each other by performing a correlation analysis. Significant correlations were analysed and, based on this, relations between elements at a station location and the enhancement of the traveller experience scores have been determined.

>> *qualitative analysis*

A second step in the empirical analysis is the qualitative analysis. A limited selection of station locations were analysed by means of *reviewing qualitative data* that is collected among the travellers at these stations. This analysis is performed, not only to support the quantitative findings, but also to gain new insights that were not covered by the quantitative analysis. Firstly, comparable station locations were placed in four clusters. Within these clusters, the stations with the highest- and lowest traveller experience score were selected to analyse in greater detail. To do so, the '*open answers*' from the SBM survey were used, in which travellers can leave their remarks concerning the station. Accordingly, the *best* and the *worst* station from each cluster were compared to each other.

Conclusion

This study attempted to find an answer to the central research question that was posed in the introduction: *Which elements at Dutch station locations can be identified that relate to the enhancement of the traveller experience?* In the empirical research, which includes both quantitative and qualitative aspects, some interesting relations have been found.

First of all, it can be concluded that the provision of bicycle parking places at the analysed railway stations moderately relates to the extent to which travellers appreciate

the station. In general, stations with relatively more *unguarded* bicycle parking facilities are appreciated lower by the traveller, while stations with relatively more *monitored* bicycle parking facilities are rated higher.

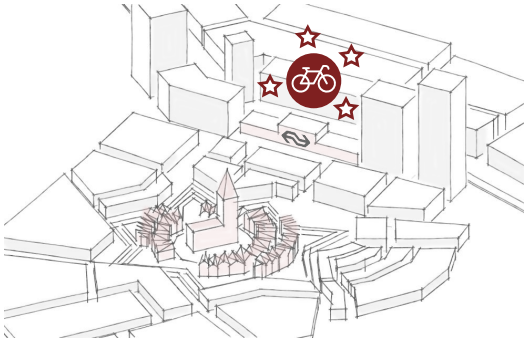
A second key element that strongly relates to the enhancement of the traveller experience is the *variety of facilities* offered at a station. Here, it concerns the retail offer within the station building. Both the quantitative and the qualitative analysis indicate that a broader range of the retail offer means that travellers can spend their time better at the station.

Thirdly, the quality of life in the station area is determined to have a significant relation with the traveller experience. Here it concerns the combination of the variables l*iveability of the area* and *amenities around the station* that relates to a greater perception of safety.

Discussion

The conclusions were found within the framework and according to the assumption made in this research. The application in practice can show whether the measures that are prescribed in this study are indeed useful or not. For this reason, several findings were discussed with specialists in station development to test the validity of the results. Firstly, an expert panel from the planning department of the Dutch Railways was consulted to criticize the results that were found in this study. Secondly, the findings of the research were reviewed by the representatives of two municipalities: Almere and Heerlen.

>> NS expert panel
According to the NS expert panel, some remarks can be made in the light of this study. First of all, because of the prominence of the bicycle culture in the Netherlands, it is expected that the general opinion of the traveller may be influenced so heavily by their opinion on bicycle facilities, that it can be perceived as a *dissatisfier* on its own. When the bicycle facilities are not arranged properly, this may seriously affect the satisfaction of the traveller, regardless of the other qualities of the station location (fig. X).



Bicycles at Dutch station location (own il.).

Secondly, experts comment on the addition of retail at the station location. According to them, this should always be critically considered, because of the growing retail vacancy in many Dutch city centres. The addition of retail facilities around the station may compete with the retail offer in the city centre and have a disturbing effect.

Lastly, the expert panel comments on the theory that railway tracks should be placed underground or on a viaduct as to not form a barrier in the city. From the perspective of the traveller, this is not desirable at all according to the specialists. Underground stations often have a disorientating effect on travellers. Moreover, it leads to unpleasant places that are often perceived as unsafe. The same applies to urban voids underneath railway viaducts.

>> Almere and Heerlen municipality
Together with the representatives of two municipalities, a specified assessment of the station location in the concerning city was discussed.

In Almere, station *Almere Centrum* was discussed. The developing parties are in the initial phase of a large renovation project, in which the renewal of the station area is seen as a complement to a new station design. The municipality wants it to become a pleasant place to stay. The assessment of Almere Centrum in this study is found to be very striking. Moreover, it is agreed that despite individual objectives of developing parties, us-them-thinking makes no sense, since you are doing it for the same user: the traveller. It must be a joint effort.

In Heerlen, the recently opened station of *Heerlen* was discussed. What used to be the most unsafe station location of the Netherlands, is now a modern new city district, called the Maankwartier. After completion, commercial spaces prove difficult to rent out. However, homes were rented out and sold very fast. Maankwartier has been an incentive for surrounding developments. Without the project, that would not have happened. The liveliness in mind has not yet been realised, this will have to happen in the coming years. Now, pop-up events take place to show the potential.

What can be concluded from these expert consults, is that liveliness at the station location is something that is always pursued, but turns out to be difficult to establish. In Almere, the municipality hopes to create a pleasant place to stay after the developments have taken place. In Heerlen, the developments have been finished, but creating a lively atmosphere also proves to be a lot of effort after completion. Small measures such as pop-up events and residents' initiatives can be helpful and show the potential.

Finally, this research brings forward multiple measures for stakeholders to implement at station locations to increase the experiential value. These measures vary from monitoring bicycle facilities to creating a safer station area. Different station locations are in need of different measures. This is where the difficulty of these developments lies. One thing must be however be always pursued. How divergent the objectives of the parties involved may be, they are jointly responsible for providing that one traveller with a pleasant experience; it must be a joint effort. Nobody can develop a successful station location on their own.

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INTRODUCTION

CHAPTER 01

A distinctive character

They organise the transition between the origin, journey and destination in a logical and coherent way: functional, spatial and with an eye for the perception of travellers. They have two faces: one for the arriving and one for the departing travellers. They are places of rest and movement, of coming and going, of meeting and saying goodbye. They have their own dynamics and audience, dependent on its location. Their users determine the atmosphere. Stations therefore have a distinctive character.

CHAPTER 01
INTRODUCTION

1.1 Problem field

1.1.1 Context

In the 19th century, the rail network became an important means of transport worldwide. As a result, the railway station became a new type of building in the city. Not only were station buildings built with daring structures, they were also places where architecture and engineering met. Large spans were needed to cover train tracks, while the building had to exude allure. Materials, texture, light and space were used to give a modern impression (Kandee, 2004). Railway stations flourished in appearance around the end of the 19th and the beginning of the 20th century. The Beaux-Arts style, which had its origins in France, determined the design of major stations around the world. The Grand Central Terminal in New York City and the Gare D'Orsay are well-known examples of this (Kandee, 2004).

In the Netherlands, stations were traditionally constructed outside the city core (fig. 1.1.1). The main entrance was oriented towards the centre, which created a clear front side of the station (fig. 1.1.2 - 1.1.3). This side usually functioned as a gateway between the city and the train (Van der Spek, 2003). At the back side however, the development lagged behind. Here, marshalling yards and storage sites were built by the railway companies (Van de Coevering et al., 2009).

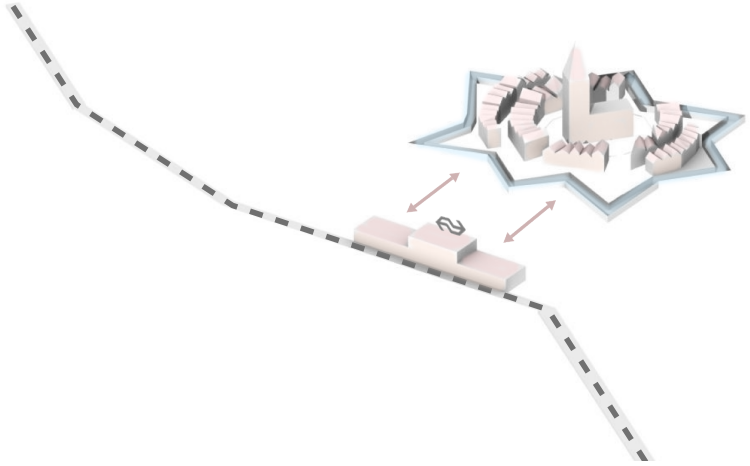


Fig. 1.1.1: Railway station outside city core (own ill.).

Fig. 1.1.2: Station Rotterdam Delftsche Poort in 1858.

Fig. 1.1.3: Station Amsterdam Centraal in 1888.

After the Second World War, car and air traffic became more important modes of transport, partly at the expense of train traffic. Cities started to grow extensively (fig. 1.1.4) and new neighbourhoods were designed with a strong focus towards the network of motorways (fig. 1.1.7) and no longer on the railway tracks. The city centre and station area decayed fairly quickly (Govers et al., 2012).

Moreover, industrial and residential real estate were developed at the backside of the railway tracks (Coevering et al., 2009). This caused the station to become a barrier between different parts of the city (fig. 1.1.5 - 1.1.6). Many large stations fell into disrepair and had to close the doors (Kandee, 2001).

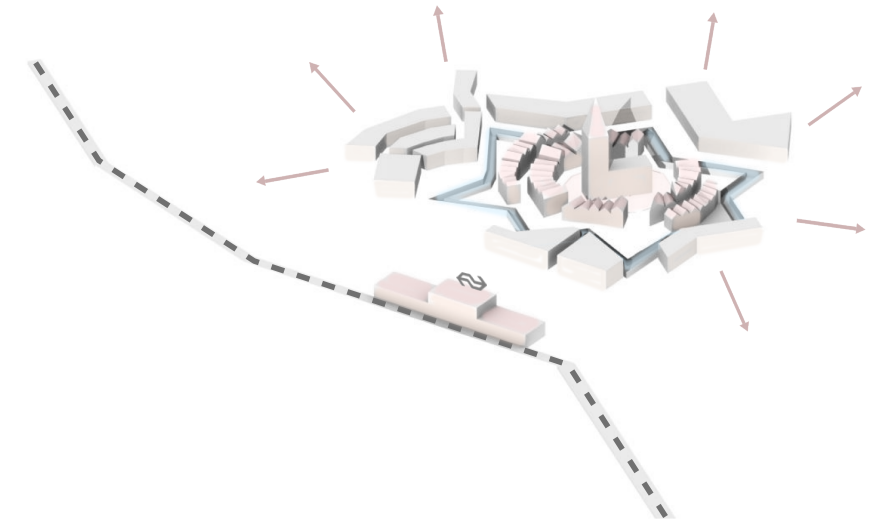


Fig. 1.1.4: Growth of cities from the core (own ill.).

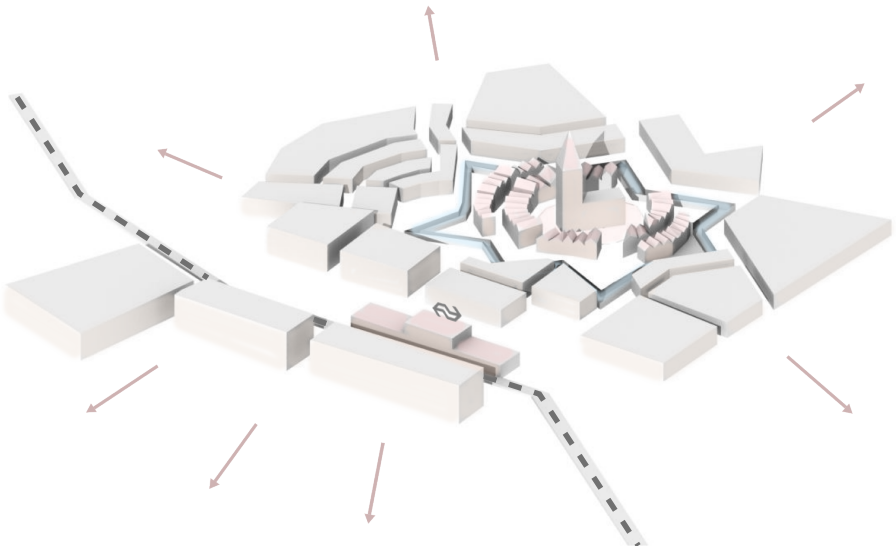


Fig. 1.1.5: Development at the backside of the railway tracks (own ill.).

Fig. 1.1.6: Railway tracks in Delft as a barrier in the city.

Fig. 1.1.7: Focus on motorised vehicles at station Heerlen in the 70s.

Fig. 1.1.8: Station of Heerlen from 1985 to 2013.

In the end of the 20th century, train traffic regained its prominent position among transport modes thanks to the introduction of the high-speed line in the 1980s (Kido, 2013) (fig. 1.1.9). International train traffic caused an increase in use and renewed attention for the station buildings. Many buildings were renovated and adapted to modern requirements. New technologies were used to build daring designs that also set the tone for train stations in the 19th century. New materials, such as lightweight steel and glass were used to construct the large train sheds. This created the typical late 20th century image of station buildings (fig. 1.1.10).

Fig. 1.1.9: Intercity Brussel at station Bruxelles-Midi.

Fig. 1.1.10: The use of steel structures at station Leiden Centraal.

At the same time, the first VINEX neighbourhoods were developed to accommodate the increasing Dutch population. The aim was to make the neighbourhoods easily accessible by car and public transport. Many city centres regained attention, were restructured and became popular places to live and work (Govers et al., 2012) (fig. 1.1.11).

The historical context of stations shows that networks are not only oriented towards the city, but that the city also focuses on the available physical networks. In the 1960s, the city was mainly focused on the motorway network. People now like to live in the centre of the city again, which has caused the railways and station locations to regain attention (Bertolini & Spit, 1998; Bertolini, 1999; Peek et al., 2006) (fig. 1.1.12). Spek even calls the station location a "valuable place" (2003). Verheul (2010) describes the station location as a gate of the modern city, a place that can potentially act as an 'urban business card' (fig. 1.1.13).

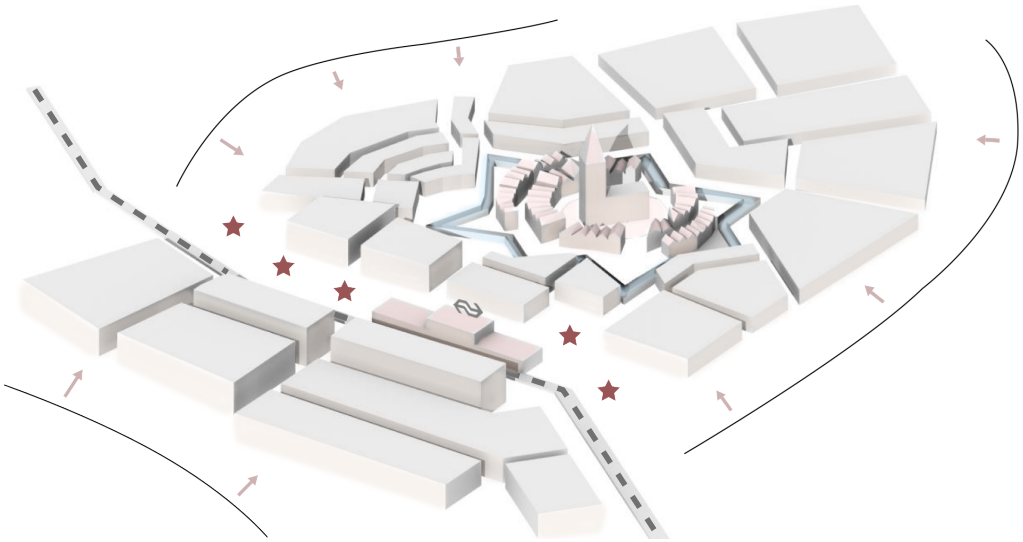


Fig. 1.1.11: City reaches its borders, city centres regain attention (own ill.).

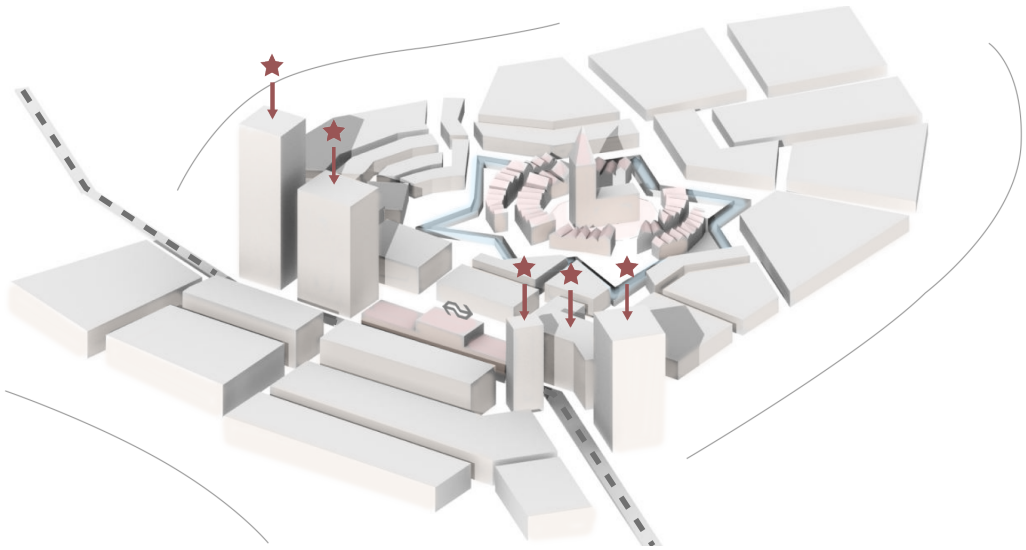


Fig. 1.1.12: Station locations become favourable places in the city to develop (own ill.).

Fig. 1.1.13: Station Rotterdam Centraal as a gateway to the modern city.

The revived appreciation of station locations has led to the addition of various functions at the node itself (e.g. restaurants, shops, package services). In addition, they are interesting places for spatial developments (living, working, facilities). Nodes must therefore be viewed in conjunction with their environment and role in public space (Rijksoverheid, 2019). In view of the current urbanization task (De Beer, Ekamper & Van der Gaag, 2017), spatial and mobility developments must be considered in their entirety. To be able to cope with the growth in mobility while keeping cities liveable and attractive, appropriate (spatial) policy is required, for example in the field of parking bicycles and cars, environmental zones and designing public spaces (Rijksoverheid, 2019).

Consequently, a station location is more than only the railway tracks, the platform and the station building. The traveller encounters many more aspects during its journey, of which each contributes to the perceived experience of the traveller. This does not only involve aspects within the station building, but also from the environment of the station.

1.1.2. Research gap

The regaining of attention for station locations results in a multifarious array of actors crowding station area redevelopment processes (Peek, Bertolini, De Jonge, 2006). Examples of stakeholders are the municipality, ProRail, NS, landowners, users of real estate, investors, visitors and residents (fig. 1.1.14). The objectives of these various actors are often contradictory and uncoordinated. They can vary from transforming the station area to a smooth transfer machine for passengers, or to a lively business centre for the city. Others want it to become a node connecting all transport networks of different scales, or a new kind of marketplace that offers opportunities for all kinds of public interaction.

In current station location developments, the contradiction between involved parties is still a common problem. The amount of involved parties is increasing and each party has its own demands towards the development (Peek, 2008; Verheul, 2014). Often, their demands are not well founded or can be classified as assumptions and tradition-based. One can refer to this as 'fixation', which entails that parties firmly believe in their own views and do not like to deviate from them. Collaboration between parties that are each too fixated can lead to difficulties.

From a real estate management point of view, the various parties that are involved in these developments, should take note of one important goal: meeting the demands of the user. They should consider whether the current real estate supply is sufficient to satisfy the current, but also future user demand (De Jonge et al., 2008). Therefore, it is wisely advisable to thoroughly investigate this user demand. At station locations, the types users can vary greatly, from residents, visitors, employees to the most obvious one: the train traveller. The latter is the main focal point of this research. This has been decided, not only in order to keep the research executable, but also because the great majority of the users of station location is also a train traveller. As an example, figure 1.1.15 shows the station of Utrecht Centraal on the May 28th, 2019. On this day, the Dutch trade unions announced a major public transport strike. As a result, there were no operating trains at all, resulting in completely empty stations.

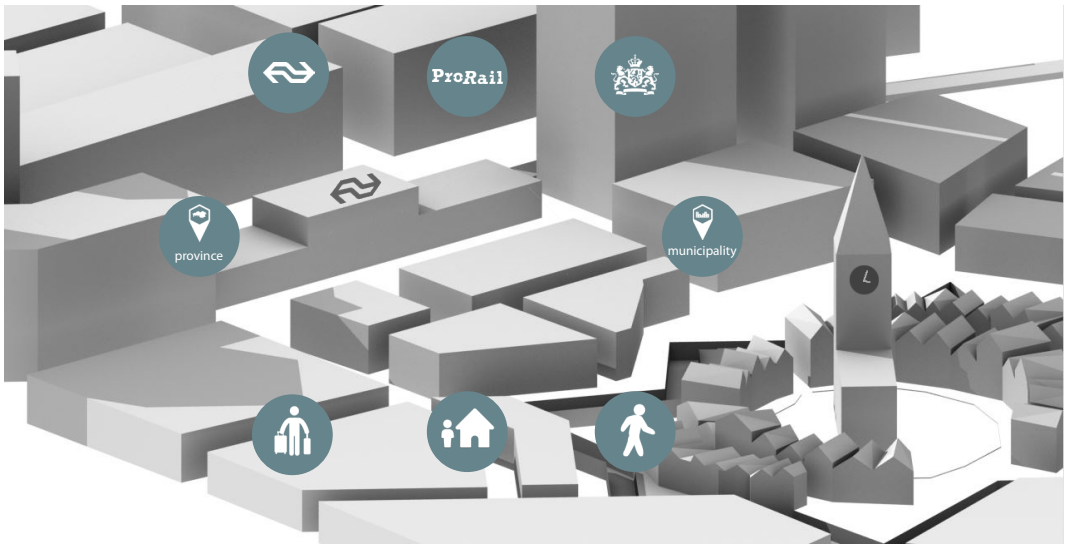


Fig. 1.1.14: Stakeholders crowding station location development porcesses (own ill.).

Fig. 1.1.15: Station Utrecht Centraal during the public transport strike on May 28, 2019.

Subsequently, the traveller is, as the main user of station locations, an important one to analyse. When is this user satisfied? And how do the involved parties collectively ensure that the traveller has a high quality experience when arriving at or departing from the station location? These are questions that arise in this field of study.

Figure 1.1.16 visualizes the value that a traveller attaches to time during the various parts of the journey. The transfer-zone appears to be less appreciated than other elements of travel, which also means that there is potential to increase the value that a traveller attaches to this aspect.

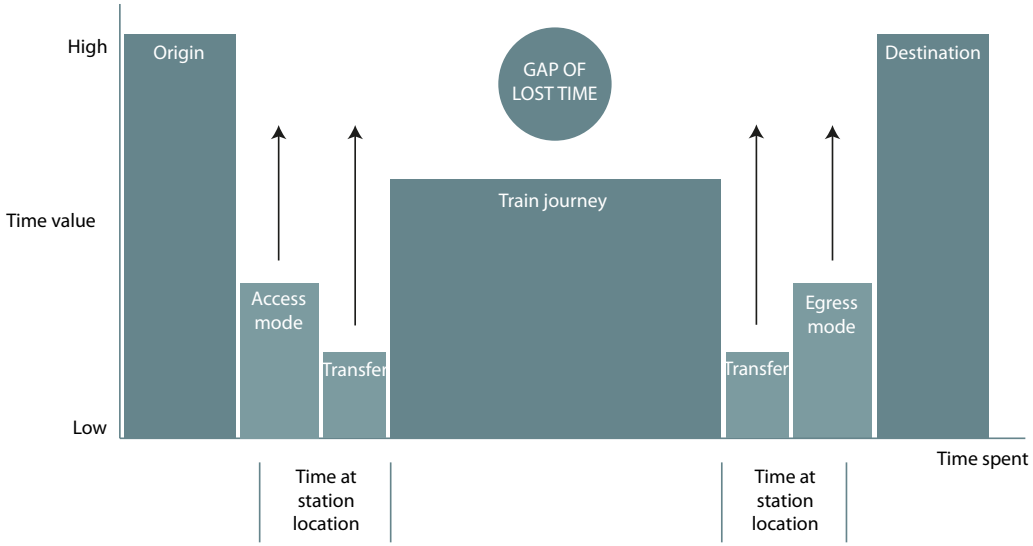


Fig. 1.1.16: Appreciation of time during the door-to-door journey (edited ill., based on Van Hagen, 2011).

The experience-aspect is frequently discussed in literature. The term 'atmosphere' is defined as to often have a positive contribution to the urban image, although an urban atmosphere can just as well be destructive, non-inviting or repelling. Klingman (2007) discusses the concept of positive atmospheres in her book 'Brandscapes' and explains that the focus of architecture has shifted from 'what is has' and 'what is does' to 'what you feel' and 'who you are'. The book 'The experience economy' (Pine & Gilmore, 1999) presents inventories, recipes and tools for organizing a qualitative atmosphere. One of the striking features in this literature is the powerful 'hands-on' approach. Experiences might seem like somewhat vague and fleeting phenomena, but the "tool chests are full of hardware words from the construction trade: building a brand, producing an event, crafting an aura, constructing a flair of place or staging a mood. Such craftsmanship is often very detailed" (Löfgren, 2014). These theories confirm that research into traveller experience not only has relevance, but can also be used in design processes to create a physical environment that can indeed enhance the experience.

Insight in elements that relate to the enhancement of the traveller experience is crucial in order to improve station locations as a whole. However, a scientific substantiation on the most contributory factors often seems to be missing. Given the many developments in and around railway stations in the Netherlands, there is relevance for doing scientific and specific research on this subject. In particular it is interesting to know more about the role of the station environment in relation to the traveller experience, since, as mentioned in this introduction, it cannot be viewed separately from the railway station itself. Therefore, this study assesses station locations in an holistic way and researches which elements can be identified that relate to the enhancement of the traveller experience.

NB. For some involved parties, offering a good traveller experience is not the only important motive, and other purposes such as profitability or political issues may also have a significant importance. However, this study merely focuses on the enhancement of the experience of the traveller.

1.1.3 Research aim

This study aims to identify critical elements at station locations that relate to the enhancement of the traveller experience. To do so, characteristics of both the railway station and the station environment are assessed by using measurable variables. Certain characteristics or means that show a relationship with the traveller experience might be supportive, others might be disruptive. Once critical elements have been identified, this knowledge can be used by stakeholders to substantiate their program of requirements of a station location.

1.2 Research question

1.2.1 Main research question

Which elements at Dutch station locations can be identified that relate to the enhancement of the traveller experience?

1.2.2 Sub-questions

Which theories that revolve around traveller experience can be distinguished?

Since this study focuses on traveller experience, this question is answered in order to define what the role of the station location is in the door-to-door journey. Moreover, existing theories about traveller experience are researched into further detail. This provides a broader understanding about elements that are normally considered to be important regarding traveller experience.

Which theories that revolve around station locations can be distinguished?

Station locations are complex environments that have been researched extensively. This question is posed in order to elaborate on the most useful theories that can be applied in this study. Among other things the node- and place theories are discussed in this section.

How can a station location be assessed in a holistic manner according to the theories discussed in the literature review?

The first two research questions compose the theoretical framework. Consequently, the described theories are applied to distinguish different station locations from each other. By doing this, it becomes clear which specific characteristics each station location has to offer.

How can the traveller experience be assessed according to the theories discussed in the literature review?

In a similar manner as the previous question, this question posed in order to see how the traveller experience can be assessed a Dutch station locations.

Which patterns can be recognised when comparing the data on both the station location and the traveller experience?

Subsequently, datasets about both the station location and the traveller experience are compared with each other. This quantitative analysis will point out patterns that can be seen between the collected data about the station locations and traveller experience.

How can the quantitative findings be supported by qualitative data on traveller experience?

The previous question deals with quantitative patterns between experience profiles and traveller experience, this question is posed to provide more in-depth information. Based on the station location assessment, station locations are placed in clusters together with other station locations that offer comparable characteristics. Accordingly, station locations which show scores that deviate most from the average score within one cluster, are researched into greater detail. The goal is to provide qualitative support on the quantitative results that were found.

Which kind of measures should stakeholders implement at station locations to improve traveller experience?

Based on the findings that are presented in response to the previous two questions, critical elements that relate to the enhancement of the traveller experience at station locations can be distinguished. However, in order to answer this question correctly, a critical judgement towards the empirical findings is necessary.

1.3 Research framework

PHASE	P2	P3			P4
TYPE	DESK RESEARCH	EMPIRICAL RESEARCH			SYNTHESIS
RESEARCH QUESTIONS	Which theories that revolve around traveller experience can be distinguished?	Which theories that revolve around station locations can be distinguished?	How can both the station location and the traveller experience be assessed according to the theories discussed in the literature review?	Which patterns can be recognised when comparing the data on both the station location and the traveller experience?	How can the quantitative findings be supported by qualitative data on traveller experience?	Which kind of measures should stakeholders implement at station locations to improve the traveller experience
METHODS	LITERATURE REVIEW		DATA COLLECTION	STATISTICAL ANALYSIS	QUALITATIVE DATA REVIEW	KNOWLEDGE IMPLEMENTATION
OUTPUT	Role of the station location in the door-to-door traveller experience	Station location variables	Data sets on station location and traveller experience	Quantitative patterns between experience profiles and station experience	Reasoning behind traveller's experience of station location	Ideal program of requirement 'profile' that enhances the traveller experience

Fig. 1.3.1: Research overview (own ill.).

1.4 Research scope

In order to set the scope of the research, this part discusses the main concepts and defines some terms that are used frequently.

Station location: The term station location is chosen to define the station building and the immediate surroundings of the station. As the research studies the traveller experience, all stages that are passed by the traveller are considered to be relevant. Therefore, this does not only concern the station building, but also the immediate surroundings, such as the station square, adjacent facilities, bus and tram stops and public spaces around the station. In a more practical view, the station location could be referred to as the area from which the station building is directly visible (fig. 1.4.1).

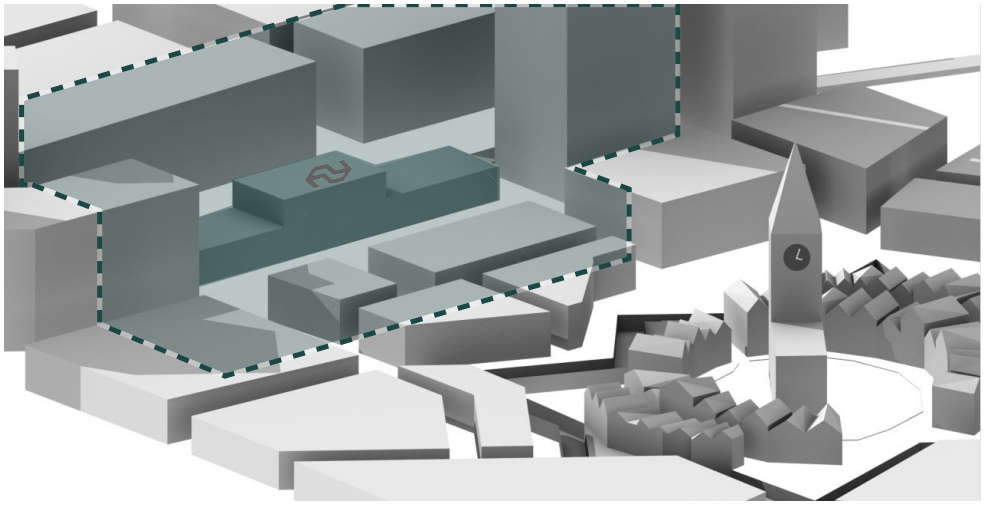


Fig. 1.4.1: Visual definition of the station location in the city (own ill.).

Traveller experience

The research wants to identify critical elements at station locations that relate to the enhancement of the traveller experience, in order to provide substantiation for decisions made by involved stakeholders. Parties may also take other variables into account in their decision making process. However, this study merely focuses on the aspect of experience, since it can provide valuable information based on data that is already partially available.

CHAPTER 02
TRAVELLER EXPERIENCE

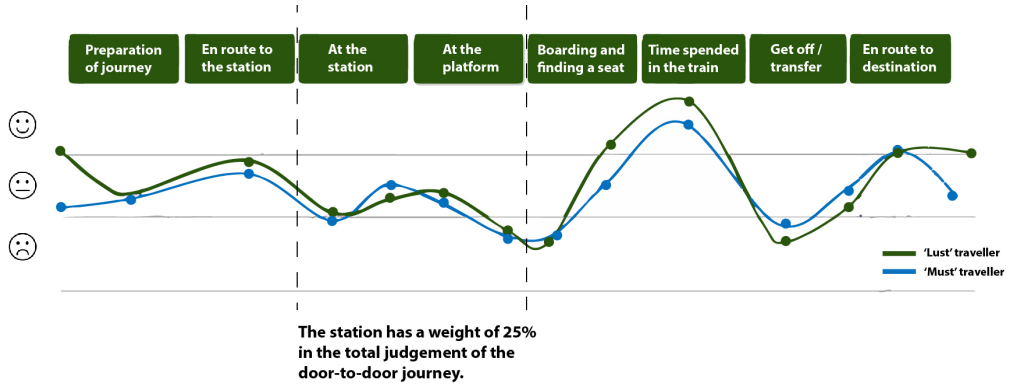
CHAPTER 02

As this research is aimed at enhancing the traveller experience, a broader understanding of the traveller is necessary. Multiple studies are consulted to find out more about demand from the traveller. The traveller's perceptions are influenced by many aspects, of which the most important are discussed in this chapter.

CHAPTER 02
TRAVELLER EXPERIENCE

2.1 Door-to-door journey

According to Van Hagen (2011), the station is part of the door-to-door journey. On average, the station is represented for 25% in the overall traveller assessment of the door-to-door train journey. This does not include the 'en route to the station' part, in which the traveller crosses the station environment in one of the many possible ways. Including the station environment, the share is even higher than 25%. The overview in figure 2.1.1 shows the steps the traveller makes and the associated emotion. Here, a distinction is made between travellers who travel functionally ('must' travellers) and travellers who travel for leasure ('lust' travellers) (Van Hagen & Exel, 2012). According to figure 2.1.1, it can be said that the 'lust' travellers show a slightly more satisfied pattern during their journey. This is most probably due to their intentions, as their motive to travel is leisure.



Figuur 2.1.1: Steps the traveller makes on the door-to-door journey and the corresponding emotion (own illustration, based on Van Hagen, 2011).

Also striking is the relatively low satisfaction of the traveller when it crosses the station. The moment when the traveller is at the platform, boards the train and has to find a seat is represented as the lowest satisfaction in the overview. This finding is supported by the graph of van Hagen (2011) in which the door-to-door appreciation of time has been visualised (fig. 2.1.2). This graph shows that the 'in train time' is valued the highest, while the 'access and egress time' are valued twice as low. Moreover, the transfer time is valued three times as low (Loehlin, 1959; Mackie, Fowkes, Wardman, Whelan & Bates, 2001; Wardman, 2004). Consequently, the time spent at the station location is the least useful way to spend time. This can be improved in two ways: by decreasing the time spent, the traveller experiences less wasted time (Van Hagen, 1998; 2003). However, by making the station location a more pleasant place, the time spent here can be perceived as more useful and pleasant (Peek, 2010).

Both figures 2.1.1 and 2.1.2 indicate the urgency to make effort to improve the traveller experience at the station location.

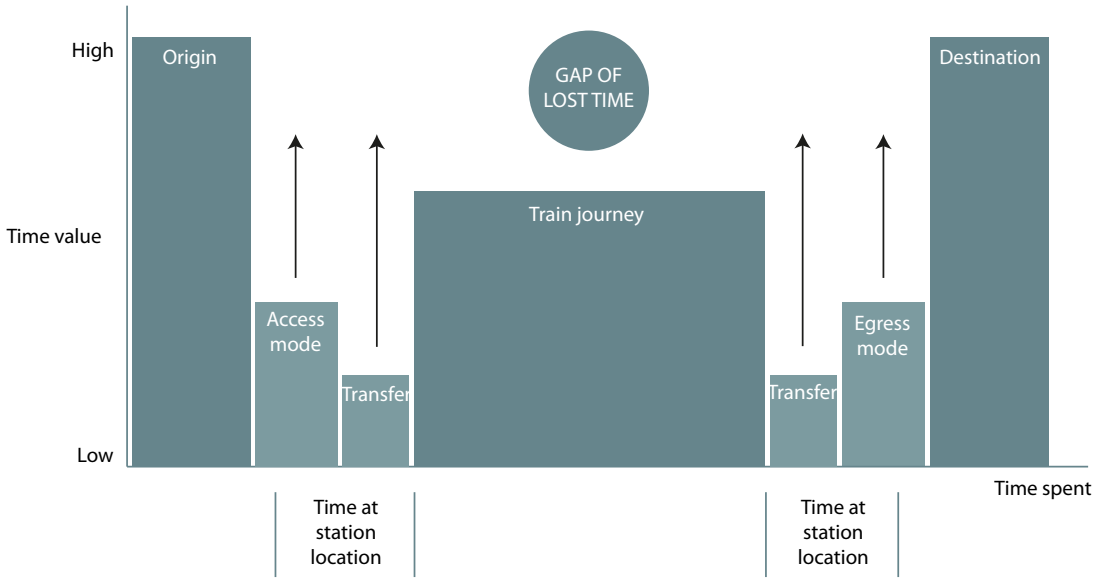


Fig. 2.1.2: Appreciation of time during the door-to-door journey (edited ill., based on Van Hagen, 2011).

2.2 Hierarchy of needs

It is important to develop a clear overview of the expectations of travellers for public transport and a station location. In order to encourage the use of public transport, its qualities should meet the wishes of the traveller (Van Hagen & Exel, 2012). The wishes of the traveller can be visualized based on the Maslow hierarchy and stacked in order of importance in a pyramid shape. This pyramid is called the 'customer demand pyramid'. It reflects the perception of quality that is offered during a train journey. Figure 2.2.1 shows the customer demand pyramid for railway stations.

The base part of the pyramid is formed by the basic requirements of reliability and safety. With regard to safety, this applies to both physical and social aspects. It is an absolute condition for the functioning of a station as a public space. When travellers do not feel safe at the station, they will avoid it. The reliability theme indicates to what extent travellers experience their journey according to their expectations. If a certain service does not comply with the traveller's expectations, this will cause dissatisfaction.

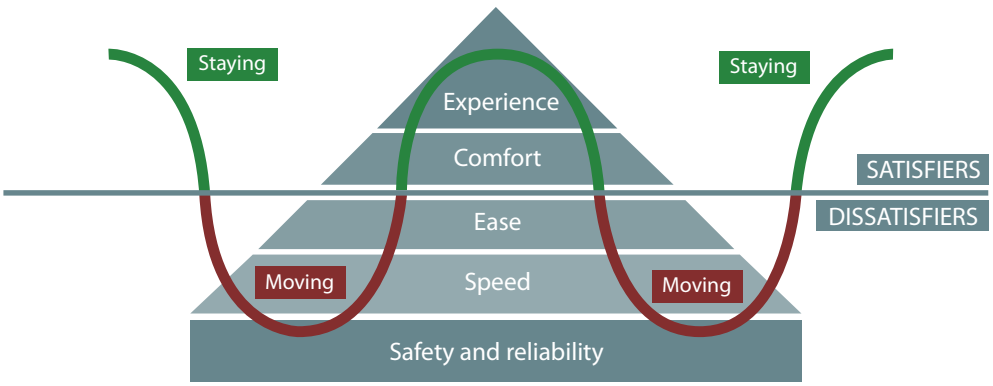


Fig. 2.2.1: Customer demand pyramid for railway stations (Van Hagen, 2011).

A lack of time is a typical feature of train travellers. As a result, speed is a main customer requirement, and is placed one level higher in the pyramid. Travellers want the shortest possible travel time from origin to destination, and prefer not to wait at the station. If the condition of a fast journey and transfer is fulfilled, the traveller subsequently wishes that a transfer is easy. Clearness plays an important role in this regard. Qualitative and clear travel information and signposting can contribute to a better experience. The information that is presented must be logical and unambiguous.

The next layer in the pyramid is aimed at comfort. The traveller expects a certain level of comfort at the station, such as seating areas and facilities where food and drinks can be purchased. Lastly, the traveller expects to have a certain degree of experience during its journey. This can be achieved by providing visual aspects, architectural design, layout and cleanliness. Less tangible variables also play a role, such as (day) light, scents and music. Shops, hotels and restaurants and the presence of staff also contribute to the experience value. When travellers move through the station, speed and convenience play the most important role, but when they stay in a station, for example when they are waiting, comfort and experience can be considered more essential. The themes speed and convenience can be referred to as dissatisfiers (Herzberg, Mausner and Snyderman, 1959); these quality aspects are valued negatively when they receive an insufficient amount of attention. All travellers attach great importance to a safe, reliable, easy and fast journey. These conditions are part of the core business of moving; they are generic and apply at every station. Comfort and experience are satisfiers (Herzberg et al., 1959); these aspects are noticed at stations where they positively contribute to the atmosphere.

Groenendijk (2015) describes that a transfer consists of an active and passive part. During the active part, travellers attach more value to speed and convenience, but during the passive part (waiting time), travellers find comfort and experience more important (Wakefield & Blodgett, 1994). This results in the importance of different needs at different times. To improve the entire experience, it is therefore important to focus on each of these wishes.

CHAPTER 03
THE STATION LOCATION

CHAPTER 03

The traveller encounters many different elements at a station location, of which each possibly influences the traveller experience. This study wants to identify crucial influential elements, and therefore it is necessary to analyse multiple station locations and compare them to each other. However, it is impossible to cover every element in detail, since the complexity, caused by the many different aspects, does not allow this.

In order to get a grasp on the main differences between various station locations, a measurement based on main characteristics must be performed. This chapter will elaborate on the definition of the station location, in order to define measurable variables that can be used to assess various station locations.

CHAPTER 03
THE STATION LOCATION

3.1 General definition

In this chapter the inner city station location is defined on the basis of a number of theories. This is considered important, in order to create a clear image on basis of which an operationalization can take place. Peek (2006) provides a definition of the station location on an integral basis in his dissertation. According to him, inner city station locations should be seen as nodes located in the network city, spatially limited by a walkable distance of ten minutes from the station entrance(s), possibly extended for function concentrations with a clear relationship with the station, even if they are further away. Peek elaborates on this definition on the basis of a number of concepts.

The station location can be regarded to as a transfer point. These are locations in the network city where lines of infrastructure and transport intersect. At these places it is also possible to change modality. However, station locations are not only nodes in transport networks, but also places (fig. 3.1.1) of activity in the city and can thus be considered as both parts of networks and as independent locations.

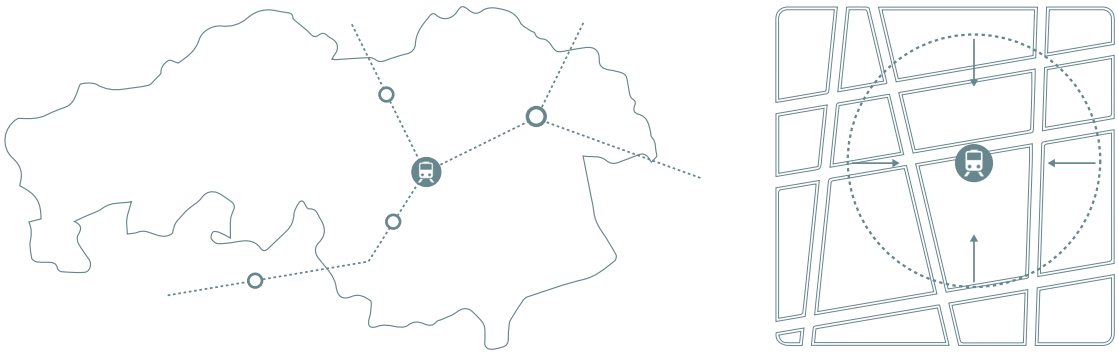


Fig. 3.1.1 Station location as a node and place (own ill.).

Different disciplines use different views; this has led to different discourses around the expectations regarding added value by combination of place, node, network and location at inner city station locations (fig. 3.1.2). The difference between the discourses is expressed in the orientation on the one hand on node or place and on the other hand on network or location. In the transport planning discourse, the inner-city station location is primarily a connection link (node-network). In the engineering-technological discourse it is a transfer-machine (node -location). In the urban-urban-economic discourse, it is an urban centre (place-network). And in the cultural policy-sociological discourse it is a meeting place (place-location).

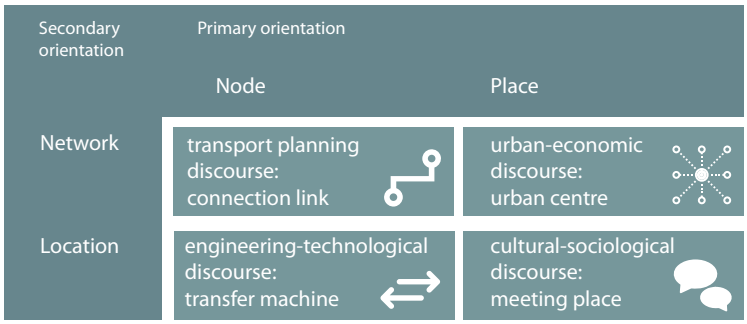


Figure 3.1.2: Four discourse interpretations of the station location (Peek, 2006).

In each of the four discourses, a different added value of the combination of place, node, network and location expected. A balanced situation between the four perspectives contributes to the creation of cohesion between the elements of the node and place, which can lead to added value. This balance is location-specific and depends on the conditions and potential of the location.

Figure 3.1.3 shows the interrelation between the definitions that Peek presents.

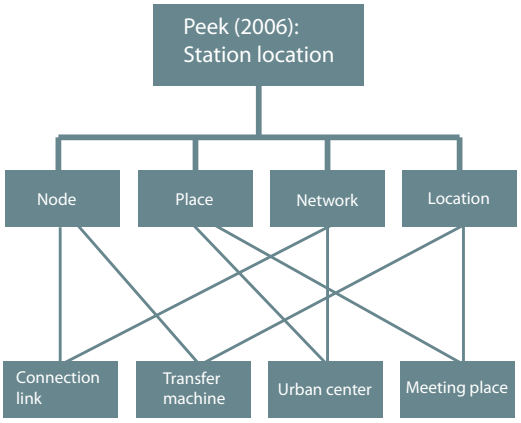


Figure 3.1.3: Station location interrelations (Peek, 2006).

According to Peek, the station location must be seen as a spatially limited distance to be walked within at least ten minutes from the station entrance(s). This can be extended for function concentrations hat have a clear relationship with the station, even if they are located beyond these limits. The definitions that follow from the four disciplinary discourses do not provide a clear spatial definition of an inner-city station location. That is why point of view has been chosen, which is derived from the use of the location by the traveller who goes on foot to or from the station. In the literature, a ten minute walk is seen as the action radius of a traveller who travels by train. If the origin or destination is further away, a traveller typically chooses a different means of transport, unless walking is more reliable, more pleasant or safer.

3.2 Station location components

In the previous section, a general definition of the inner-city station location has been provided. This overarching definition leaves little space for details concerning different components of the station location. Therefore, the next three sections will discuss the functioning of different parts of the station location, starting with the railway station itself (fig. 3.2.1). Subsequently, the station environment (fig. 3.2.2) is discussed according to some striking theories.

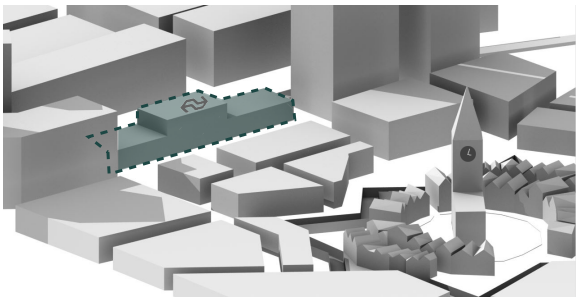


Figure 3.2.1: Indication of the station building (own ill.).

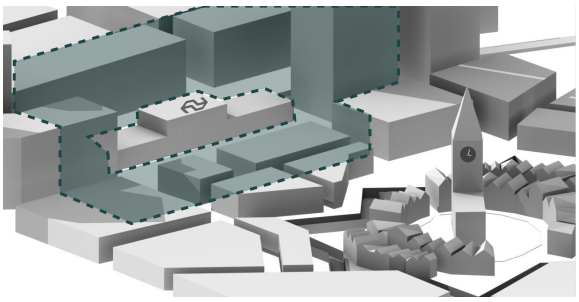


Figure 3.2.2: Indication of the station area (own ill.).

3.2.1 Railway station: intermodal design

In addition to the new design of station buildings, a functional shift is also noticeable in the 20th century. Until this moment, different transport modes were not or hardly connected to each other. In the years following, this became a major point of attention. Facilitating a good connection between train, bus, metro, tram and taxi has a high priority in current railway station developments. Accordingly, a new layout of the station emerged to ensure that travellers can transfer effortlessly from one means of transport to another. As a result, new types of railway stations emerged, such as airport stations and metro or light rail stations (Kandee, 2004). These station types were each impacted by the concept of 'intermodal design'. In particular, intermodal design pays attention to the interior spaces of the station. According to Kandee (2004), the interior space of the station can be divided into four main functional areas: core, transition, peripheral and administrative areas. These four areas represent the major physical and functional elements that are necessary while establishing an intermodal station. In the next part, these four functional areas will be discussed shortly.

Core areas are focused on the processing of passengers. These areas are often surrounded by basic facilities such as ticket sales, information facilities and waiting areas. The main hall is an example of a core area, where passengers enter the building and check the train schedule.

Transition areas connect the core areas to the transportation modes and include secondary facilities, such as commercial spaces and toilets. These areas provide the main circulation where passengers can use public facilities before boarding the train. This area usually takes the form of a passage over or under the platforms.

Peripheral areas support the circulation outside of the main building. These areas consist of the platforms, railway tracks and vehicle service areas. The number of platforms and tracks are derived from the capacity of the passenger terminal. Vehicle service areas include bike and car parking spaces. Maintenance services are usually only provided at large stations.

Administrative areas control both traffic and station management. This area is often represented as a management office or traffic controlling office. These locations may be isolated from the other services or inserted among facilities in every area.

Figure 3.2.3 shows the main concepts that Kandee presents in his definition of the railway station.

Figure 3.2.4 shows a conceptual image of the relations between the four areas (the intermodal prototype).

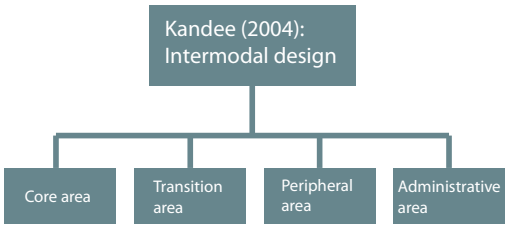


Figure 3.2.3: Main intermodal concepts (Kandee, 2004).

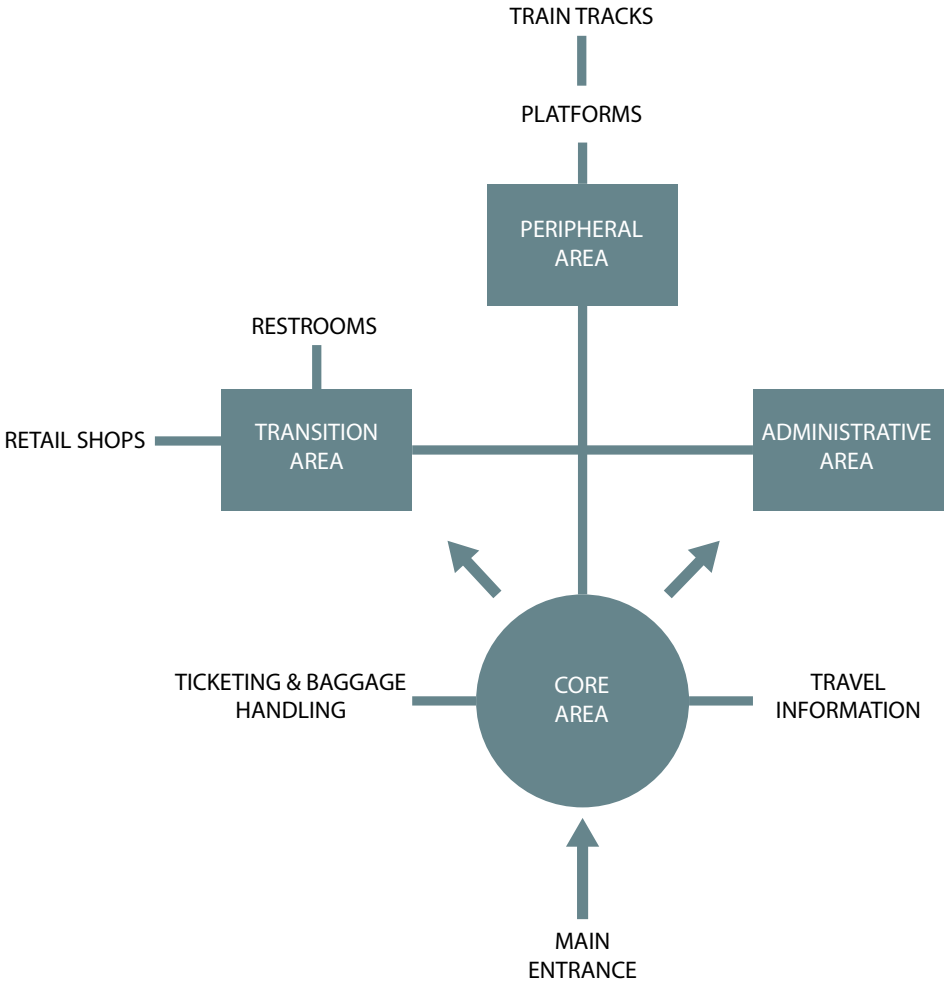


Figure 3.2.4: The intermodal prototype (own illustration, based on Kandee, 2004).

3.2.2 Station environment: transit-oriented development

The potential of recently (re)developed railway stations is only used to a limited extent, according to the Netherlands Environmental Assessment Agency in October 2014; the amount of housing and commercial space is still underdeveloped at these easily accessible locations. Planners and urban geographers talk about transit-oriented development (TOD) to indicate that urban development can best be concentrated around large nodes (Verheul, 2014).

According to TOD, the railway station is the place in the city where developments are likely to be initiated. This is because of a couple of reasons, which will now be discussed. There are four sets of factors that ensure that station areas are in demand for the development of urban projects (Bertolini, Peek, De Jonge, 2006).

First of all, there is increasing concern about the degree of sustainability of urbanization patterns that focus on expansiveness and car dependence. For that reason, opportunities to develop according to a more sustainable, non-motorized principle are widely investigated. Developments around nodes in rail networks are thus seen as locations that contribute to a concentrated urbanization pattern that also takes sustainability requirements into account. Not only environmental considerations argue for these developments, local authorities and citizens also see public transport as a mobility alternative that counteracts the aggravation of traffic congestion.

Fig. 3.2.5: Conceptual intermodal station with seperate areas.

Fig. 3.2.6: Intermodality at station Den Haag Centraal.

Fig. 3.2.7: Transit-oriented development at station Amsterdam Sloterdijk.

Secondly, new development opportunities at station locations are offered by transport innovations. An example that applies for the Netherlands is the high-speed line that provides better connections with neighbouring countries. In addition, distribution and production activities are moving away from station locations to more peripheral locations.

Thirdly, there is the desire to improve the competitive position of cities by implementing large-scale urban projects. These projects typically include a mix of offices, shops, leisure activities and dwellings around stations. This has happened in many European high-speed train station areas in recent years. A striking example is Euralille in the French city of Lille, where the high-speed lines from London, Paris and Brussels cross.

Lastly, the current privatization process and increased market orientation of transport companies are mentioned. One consequence of this is the effort that these companies make to recapture the accessibility they help to create. This is accompanied by commercial activities in and around stations.

3.2.3 Station environment: transit-oriented design

The quest for sustainable development patterns and the shifting spatial dynamics of the contemporary society have caused that the concept of TOD has been rediscovered in Europe (Bertolini, Curtis, and Renne, 2012). Besides, TOD is seen as a contributor to good urban design, as it focuses on coordinating transportation modes, mixed land uses and creating attractive public space within a limited area. However, attention to the urban design challenges related to TOD is still quite limited. The research that exists mainly originates from the United States. Although for Dutch practices this provides a solid starting point for TOD design challenges, the applicability of the finer details is somewhat limited, due to contextual differences (Pojani, Stead, 2015). Ultimately, the uses and perceptions of urban design practice is a local matter. Therefore, Pojani and Stead (2015) researched how the "ideal" internationally formulated TOD principles and models can be used in Dutch circumstances and perceptions. Therefore, they used the international literature concerning design theories and guidelines related to TOD and assessed these for the Dutch context by making use of a Group Decision Room approach, involving TOD experts from The Netherlands. As a result, specific 'ideal' design aspects related to TOD in The Netherlands were defined. In the next part, these design aspects will be evaluated.

The main design principles can be divided in two main topics: '*place-making*' and '*facilities/ logistics*'. A subdivision of these topics was made according to eight dimensions. These are (1) scale and density; (2) public spaces for human use; (3) safety; (4) variety and complexity; (5) connections; (6) pedestrian and cyclist orientation; (7) transit in the urban pattern; and (8) car movement and parking. The findings on each dimension are shortly discussed.

NB. The following explanations are all based on the research by Pojani & Stead.

Scale and density

For the 'scale and density' theme, the radius of the TOD area in the Netherlands is ideally larger than described in the international models. This is because the Dutch cycle more often to the station instead of walking, which causes the TOD area radius to be between 2 and 3 kilometres. In addition, the 'wedding cake' principle applies, which means that the density is highest in the immediate station environment and decreases as the distance to the station increases. For the Dutch situation, a ribbon development alongside the railway tracks is considered desirable, because it can also serve as a noise barrier. It is further stated that the density in the rest of the TOD zone must be high, but that the building heights must remain limited (fig. 3.2.8)

Public spaces for human use

Within the 'public space for human use' dimension, the theme of pedestrian friendliness is frequently mentioned. In addition, covering public space, outdoor dining, trees, spatial orientation, openness of the station and the human scale of the station area are aspects

Fig. 3.2.8: Scale & density at the station location Utrecht Centraal.

Fig. 3.2.9: Public spaces for human use at station location Utrecht Centraal.

Fig. 3.2.10: Typical Dutch '*gezelligheid*' at station location Utrecht Centraal.

that have an important value (fig. 3.2.9). In addition, there is one aspect that particularly returns. The Dutch term 'gezelligheid' represents an aspect that is highly appreciated in all kinds of Dutch public spaces, causing that the term is deeply rooted in Dutch culture (fig. 3.2.10). That is also the reason that the word has no literal translation. The English word 'cozy' comes close to it, but it can also refer to other concepts such as conviviality, fun, quaintness, and a charming or picturesque atmosphere. A pedestrian-oriented public space is thus important, but a comment is also made on the amount of public space. A public space that is too large can give an impersonal impression outside peak times or during bad weather. This can also have negative consequences for property prices. That is why the amount of public space must always be in balance with the environment. Small quantities of public spaces are therefore considered appropriate.

Safety

Safety is a less discussed topic, as The Netherlands less often face problems in this regard. A possible explanation is the Dutch crime rates, which are lower, compared to those of other countries such as the United States. However, what need to be considered are the design of enclosed, mixed-use blocks and the proper installation of lighting. For public spaces, attention must be paid to the size, and there must be some kind of social control (fig. 3.2.11).

Variety and complexity

According to the most common contemporary Dutch practice, the development of multiunit housing projects is assumed to be the most economically efficient. To counter visual homogeneity in TOD, the idea of employing more than one design studio was often made by the TOD experts. Also, attention to preservation of historic building is considered important. In newer TOD areas, experts prefer original and innovative architecture (fig. 3.2.12). A great diversity of buildings and building styles can however also have disadvantages. Since it can disrupt the sense of orientation of pedestrians, it is even more important that the TOD area connects seamlessly with the existing urban network. With regard to high-rise buildings, it is mentioned that additions are possible in the few cities where high-rise buildings are already present. However, in medium and small cities, high-rise buildings are generally seen as inappropriate. Ultimately, the mixed-use aspect is always essential in TOD. However, the development of homes is an aspect that brings along challenges, particularly in terms of noise pollution. Noise barriers are possible solutions, but are not always aesthetically appreciated. That is why building with soundproof glass and other materials is a more modern and innovative solution. In addition, it is mentioned that residents in a TOD area must always be aware that urban noises are part of the living environment.

Connections

Many experts prefer a medium-sized development block, but they also state to understand that developers prefer to develop a larger block. Most important is the design of the block though, regardless of the size of the block. In addition, the TOD area must be permeable and the street pattern must not only be interconnected, but also be connected to the rest of the city. The area must be easy to reach for pedestrians and cyclists, and within the area shortcuts can be a supporting tool for accessibility. Furthermore, the bus and tram network in and around the area must be in good order. Clear signage and routing through the area helps with way-finding. To prevent the presence of 'two sides of the track', it is important to implement well-designed tunnels and bridges in the area (fig. 3.2.13). The last, most essential point of interest is the plaza in front of the station. The plaza helps train travellers who are arriving or departing to orientate. Most Dutch station do have a public space or square in front of the station, but often this space is occupied by bicycle parking, which does not contribute to the spatial quality.

Pedestrian and cyclist orientation

The cycling and pedestrian connectivity to the railway station is crucial, according to many experts (fig. 3.2.16). Although bicycle facilities are generally well organized, the idea prevails that pedestrian facilities are not often taken care of sufficiently. This is probably due to the fact

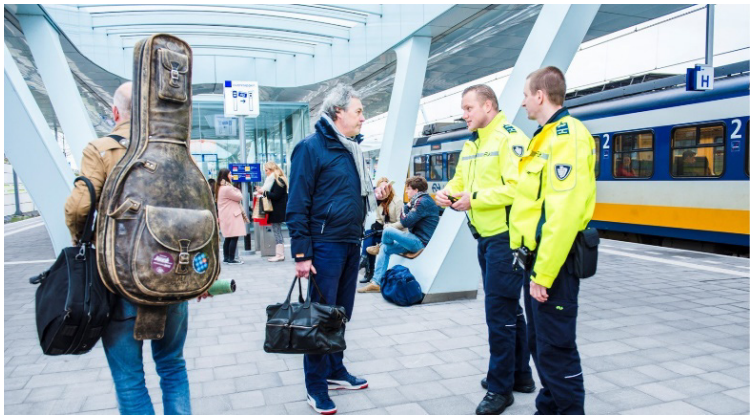


Fig. 3.2.11: Safety at the station location Utrecht Centraal.

Fig. 3.2.12: Variety and complexity at the station location Utrecht Centraal.

Fig. 3.2.13: Connections at the station location Utrecht Centraal.

that most of the urban planners' concerns are for facilities for motorised vehicles. Although sidewalks are often built along cycle paths, this is not always the case.

Transit in the urban pattern

This dimension is of major importance for most of the TOD experts. Most of them agree that the railway station should be a recognisable feature in the urban fabric (fig. 3.2.17). The station does however not always have to be an iconic building, but the design should enable the function of an orientation point in the city. The railway tracks and platforms should ideally be placed in an underground tunnel, to prevent a physical divide in the urban structure. However, this complicates the connection to other transport modes, such as trams and buses. Also, building underground is more expensive. Nevertheless, an increasing number of stations are moving in this direction. Building platforms on elevated viaduct is another possibility, but not preferred by most experts, as this still visually divides the city and results in leftover, empty spaces underneath. Multimodality is seen as a key aspect in TOD. However, a clear hierarchy is necessary to prevent conflicts between different modes of transport. With regard to commercial facilities, the experts mention that the degree of commercial use at a station must be in balance with its environment. Some train stations merely serve as a transfer point, others are complete TOD hubs. In smaller cities, an excessive amount of commercial use might disturb the viability of commercial functions in the city centre. In such places, a clear line of view from the station to the city centre is considered necessary.

Car movement and parking

As traffic calming and parking restrictions are typically implemented in Dutch cities, experts do not consider this a main point of concern. They do state that parking facilities should be placed at exurban transfer points rather than around urban nodes (fig. 3.2.18). If the budget allows it, underground parking is strongly preferred.

Figure 3.2.14 shows the concepts that Pojani & Stead present in their guideline for successful TODs. Figure 3.2.15 shows the application of intermodal- and TOD concepts at the station location Utrecht Centraal.

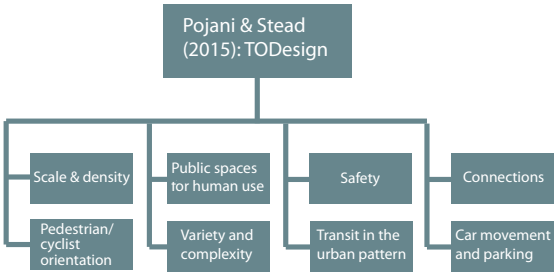


Figure 3.2.14: Transit-oriented design concepts (Pojani & Stead, 2015).

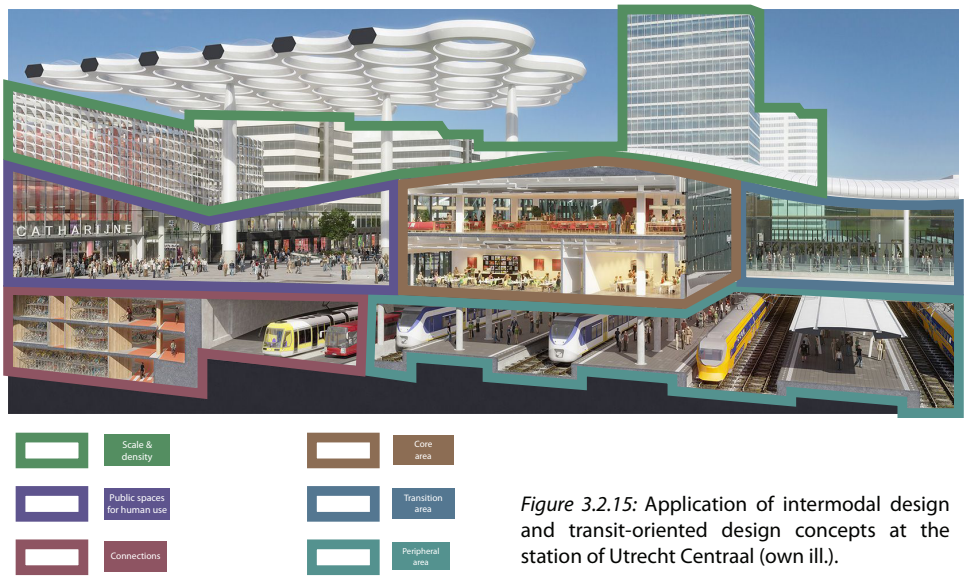


Figure 3.2.15: Application of intermodal design and transit-oriented design concepts at the station of Utrecht Centraal (own ill.).

Fig. 3.2.16: Pedestrian and cyclist orientation at the station location Utrecht Centraal.

Fig. 3.2.17: Transit in the urban pattern at the station location Utrecht Centraal.

Fig. 3.2.18: Car movement and parking connected to the station location Utrecht Centraal (suburban P+R De Uithof).

3.2.4 Station environment: the link

This section describes in more detail the importance of the connection between the station and the city centre, since this is a vital element of the modern station location.

Brouwer (2010) describes that the connection between the train station and the city center in the Netherlands is becoming increasingly important. As mentioned earlier, the train station is often seen as an entrance to the city (Rooij, 2005; Bertolini & Dijst, 2003; NS, 2006; NS Poort, 2009). In addition, more and more cities are promoting their city centers to attract more visitors (Van der Hoeven et al., 2008). This ensures that the connection between station and city is getting busier; it serves more and more people every day. Brouwer emphasizes that the experience for train travelers determines what the first impression of a city is, but that the connection to the city center is often unattractive and lacks vitality. Barriers play an important, disruptive role (fig. 3.2.19). Brouwer also mentions the low quality of the public space and the poor signage.

In order to make improvements to the connection between city and station, Brouwer has drawn up a list of criteria for successful and attractive properties of the connection. The criteria have been drawn up on the basis of successful public spaces. This shows that a connection is successful when attention is paid to:

1. Liveliness
2. Human scale
3. Legibility
4. Safety & comfort

Liveliness refers to the degree of activity on the street. To achieve this, attraction factors must be present. These attract people to ensure that a vital cityscape emerges. Furthermore, the presence of sufficient seating areas is considered to be important. This ensures a degree of social safety. (Jacobs, 1961; Montgomery 1998; Purciel & Marrone, 2006; PPS, n.d.; Ewing & Handy, 2009).

Human scale revolves around the scale of the physical environment in proportion to human size. It must also correspond to the speed at which people move in this environment (Purciel & Marrone 2006). In an inner city situation, the building block should be fine grained to stimulate a walkable city (Jacobs, 1961; PPS, 2009; Ewing & Handy, 2009).

Legibility is important because it helps people to recognize patterns in the built environment (Lynch, 1961). Points of attention in this respect are the possibility of orientation, the presence

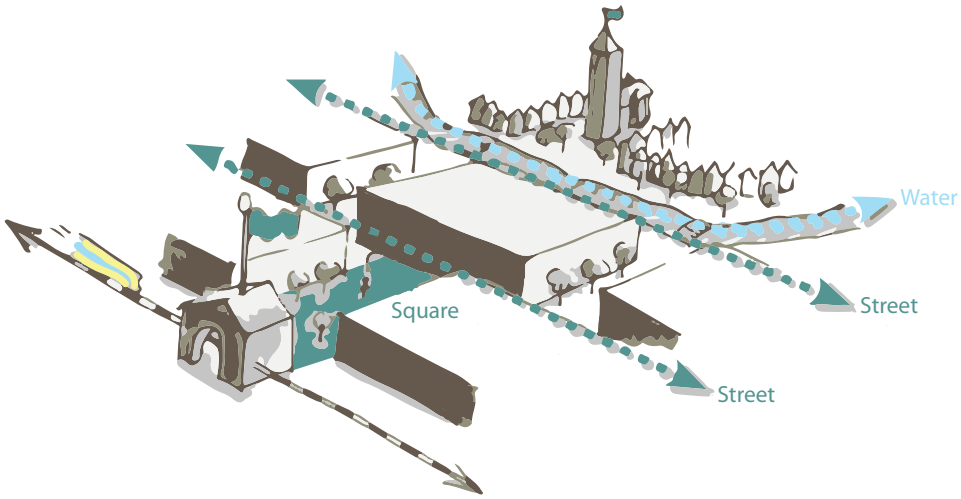


Figure 3.2.19: Barriers between the station and the city center (edited illustration, based on Brouwer, 2010).

and clarity of signing and the linearity of the path. The latter implies that if too many turns have to be made, this leads to a loss of orientation (Lynch, 1961; Montgomery, 1998).

Safety and comfort is about the experience of pedestrians in the public space. As mentioned in the liveliness section, the presence of people on the street is essential to create a vital place. Pedestrian protection can be seen as a condition for achieving this. They are the weakest users of the street and must be given priority over other traffic. In addition, street maintenance and social supervision are essential tools (Brouwer, 2010; PPS, 2009).

Figure 3.2.20 shows the four concepts that are presented by Brouwer regarding the link between the station and the city.

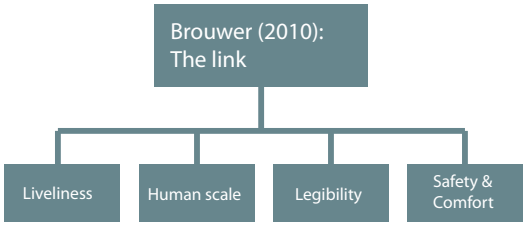


Figure 3.2.20: Concepts for the link between station and city (Brouwer, 2010).

CHAPTER 04
OPERATIONALISATION: STATION LOCATION

CHAPTER 04

The goal of this chapter is to put forward a collection of variables that can be used to assess a station location in a holistic way. All of these variables are derived from theories that are relevant at a station location.

CHAPTER 04 OPERATIONALISATION: STATION LOCATION

The following figures give an overview of the main theories presented so far.

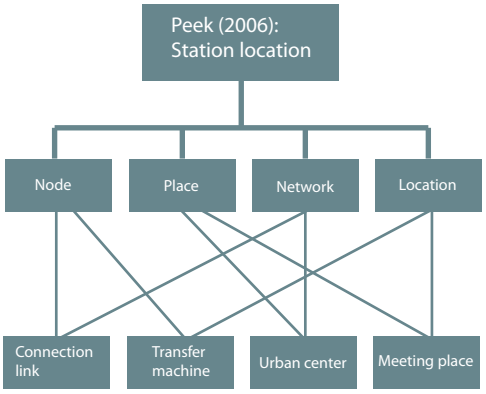


Figure 4.1.1: Station location interrelations (Peek, 2006).

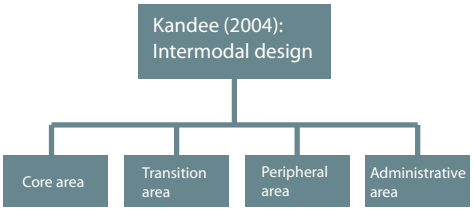


Figure 4.1.2: Main intermodal areas (Kandee, 2004).

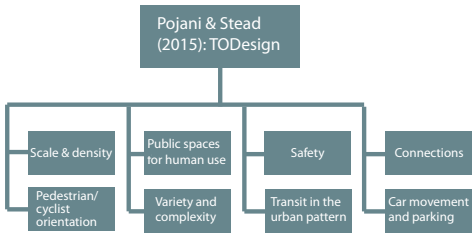


Figure 4.1.3: Transit-oriented design concepts (Pojani & Stead, 2015).

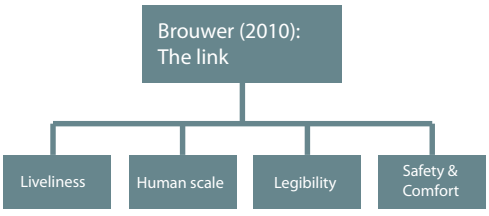


Figure 4.1.4: Concepts for the link between station and city (Brouwer, 2010).

The goal is to determine a set of variables that can be used to assess station locations. This set of variables will have to cover the station location as a whole: both the railway station, including its main characteristics as described by Kandee (2004), and also the station environment, for which Pojani & Stead (2015) and Brouwer (2010) have presented important characteristics.

4.1 Node-place model

As a starting point, the theory of Bertolini (1998) is used to explain the node- and place values (present in the definition of Peek) in greater detail. Bertolini introduced the node-place model in 1998, based on the idea that the interaction potential of station locations for human interaction could be optimised to achieve broader economic and social objectives. The model provides insight into the opportunities for intensifying and / or differentiating activities around transport hubs, it serves as a frame of reference for exploring development potential and has no normative pretensions (Bertolini, 1998).

The basic idea of the model of Bertolini is that improving the accessibility of a station location, which increases the node value, creates favourable conditions for intensifying and diversifying activities there. And vice versa, the intensification and diversification of activities, which increases the place value, leads to an increase in the demand for movements; it thereby creates favourable conditions for the further construction of infrastructural facilities. Bertolini emphasizes the term “conditions”, because whether the development potential is actually realised not only depends on transport and the use of space. Five ideal-typical situations can be distinguished in the model, which is shown in figure 4.1.5.

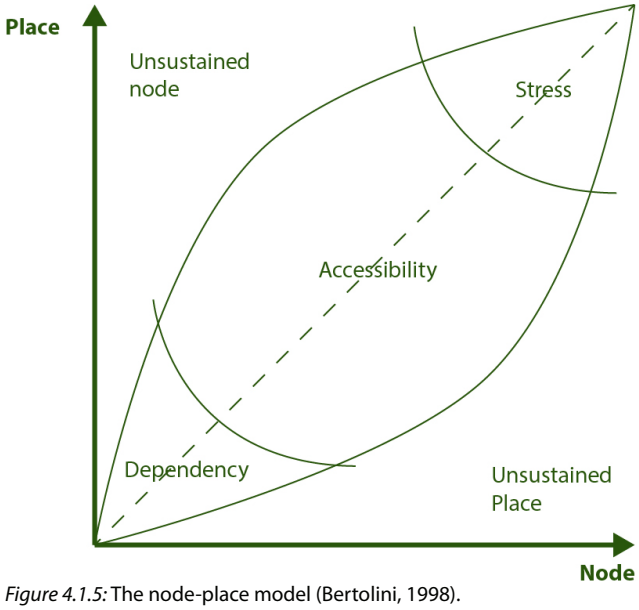


Figure 4.1.5: The node-place model (Bertolini, 1998).

Along the diagonal line, the "balanced" locations can be placed. Here, the node and place values are in balance with each other. At the top of the diagonal, the locations which are "under-stress" are placed. Here, the intensity and diversity of both the mobility flows and the urban activities are maximized. This means that the potential for the development of activities is high (strong node) and that this potential has also been exploited (strong place). The same applies to the potential for the development of transport facilities. At the same time, this concentration of flows and activities can lead to conflicts over the use of space, which complicates further development of the location. At the bottom of the diagonal, the "dependent" locations are placed. There is hardly a struggle for space here. On these locations, the demand for transport facilities for residents, employees and other users is very low. Likewise, the demand of travellers for urban activities is low. As a result, the supply can only be maintained through the interventions other than accessibility, such as subsidies. Finally, there are two "unbalanced" locations. At the top left are the "unsustained nodes", where the supply of transport facilities is large in relation to urban activities. This can be the case for a recently opened station outside the city. Bottom right are the "unsustained places" where the opposite is true. As an example, one can think of a difficult to reach historic city centre. Both "unbalanced" locations are interesting, since there is a strong tendency to expect that they will develop towards a more balanced situation. This can be done in two radically different ways. An "unsustained node" can either grow in place value, for example by attracting new property development, or decrease in node value, for example by reducing the level of transport facilities. An opposite reasoning applies to "unsustained places": either the level of transport facilities will increase or the intensity and diversity of activities will decrease (Peek, Bertolini and De Jonge 2006).

The node-place model has been adapted by many authors through the years (Peek, 2008). He describes that the method of operationalizing node and place value is actor-dependent. The discipline-related discourse in which the actor finds himself determines his perspective on the possible node-place interactions and the underlying mechanisms (Peek, 2006).

4.2 The butterfly model

One operationalisation that gained a lot of attention is the butterfly model (fig. 4.2.1), which was developed by Vereniging Deltametropool (2013) to provide insight into the relationship between node and place. The model provides insight into the different types of transfer points and is based on 6 distinctive variables for node and place value.

For the node value, these are the position in the *slow traffic network*, the *public transport network* and the *roads network* (by which modalities can the station location be reached). For the place value, the variables are *proximity*, *intensity* and *diversity* (to what extent is the station itself an activity centre in its environment). Based on these six characteristics, the butterfly model is constructed, with the left wing providing information about the node value, and the right wing providing information about the place value. The butterfly model should ideally display a balance to reflect a qualitative transfer point. A larger node value enables the possibility of a large place value, and vice versa (Rybels, Lauwers & Van Acker, 2017).

Although the node-value is often operationalised in comparable ways as portrayed in the butterfly model, the operationalisation of the place value varies more. The three traditional variables (proximity, intensity and diversity) mainly provide information about the amount of residents, employees and visitors within the area around the station location. Since this research focuses on traveller experience, it is also essential to acquire information on the possibility for people to meet at a station location, since this is likely to influence the traveller experience (Peek, 2006). The traditional variables do not provide extensive information about the presence of meeting places. Also, the butterfly model gives information on the functioning of a railway station (logistically and about the activities that take place there), but provides little information about the station environment or the connection the city centre, while these aspects are considered to be important for the traveller experience, according to the theoretical framework. Therefore, the butterfly model will be adjusted in order to represent most of the important aspects that have come forward in the theoretical framework.

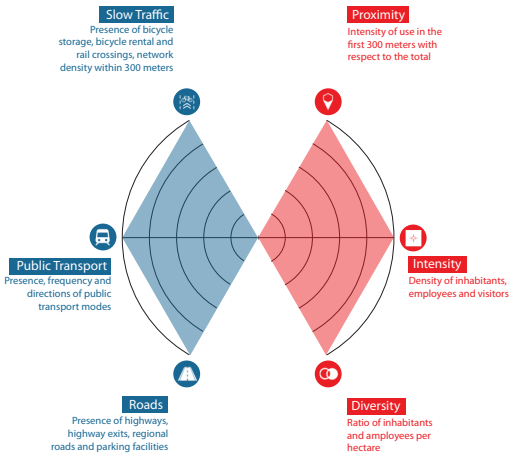


Figure 4.2.1: Butterfly model by Vereniging Deltametropool (2013).

First of all, the operationalisation of the *place value has to be adjusted*, in order to incorporate the dimension of 'meeting place' next to the already present dimension of 'urbanity'. Secondly, the model will be *extended by a third value: the contextual value*. This value will represent the means by which the station location is physically embedded in the city. This value will include variables inspired by transit-oriented design and the connection between station and city.

4.3 Using the node value

The node value, which is determined by slow traffic, public transport and roads, will be applied in the same manner as Vereniging Deltametropool did (fig. 4.3.1). For each of the themes that determine the node value, now the different variables will be presented.

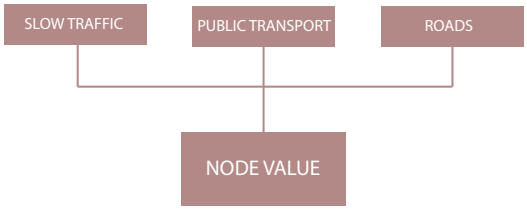


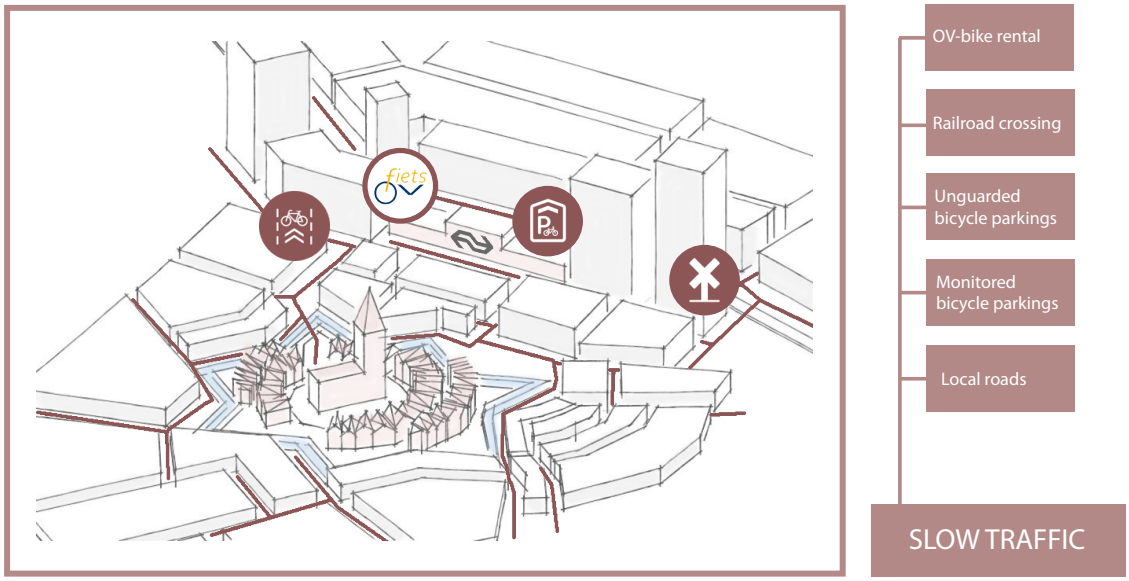
Figure 4.3.1: Node value themes (own ill.).

4.3.1 Slow traffic

Score (OVF + RC + (PB / TR) x 100) + (AMOUNT LR x 1,5)

OVF = Presence OV-bikerental … score:25
RC = Presence railroad crossing … score: 50
(PB / TR) x 100 > 30 … score: 50
(PB / TR) x 100 > 15 … score: 25

PB = amount of parking places for bikes
TR = Amount of travellers
LR = Local roads within 300 meters



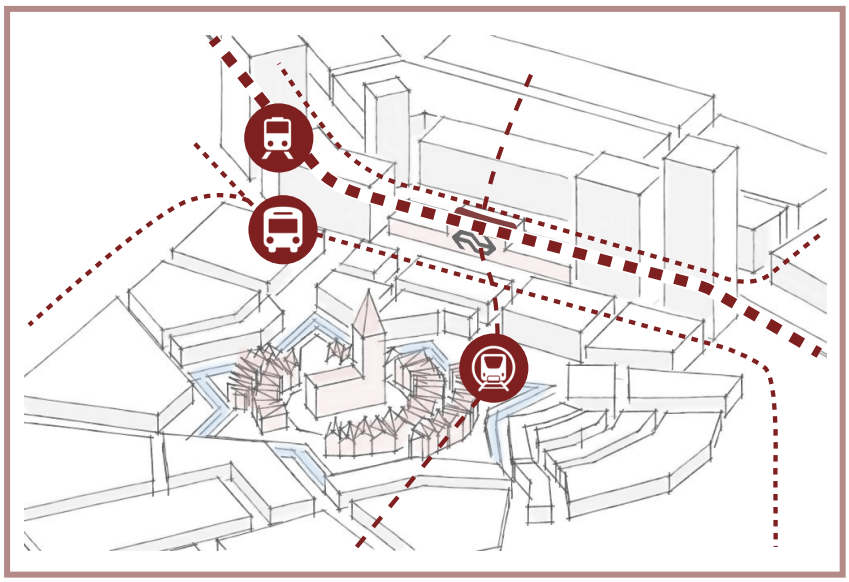
The position of the public transport hub in the slow traffic network is a valuation that was not yet defined before 2013, in particular when it concerns bicycle accessibility (Vereniging Deltametropool, 2013). This position is an indicator for the micro-accessibility of the station. In the Dutch context, the accessibility, especially for bicycles, is essential. More than 40 percent of the travellers use a bicycle to get to the station (Berendschot, 2010). Moreover, the use of OV bicycles has risen sharply in recent years. In 2018, more than three million OV-bike journeys were made, 33 percent more than in the first nine months of 2017, according to the Dutch Railways (2018). Therefore, sufficient parking space and bicycle rental around the stations is of great importance. In this study, the number of bicycle parking facilities relative to the number of travellers is taken as the starting point. The score values the presence of OV bicycle rental, the number of bicycle parking places and the presence of a public railway crossing or tunnel in the immediate vicinity (300 meters) of the station, since these elements are all important for the internal connection value of the node. In addition, the bicycle infrastructure should be coherent and connect to all origins and destinations of cyclists. For this reason, the local network in the immediate vicinity of the station was analysed. The more local roads there are, the finer the network is. A high score can be achieved when the number of bicycle parking places compared to the number of travellers is sufficient and the station is well connected to the local road network, and can therefore be easily reached via a railroad crossing or a tunnel.

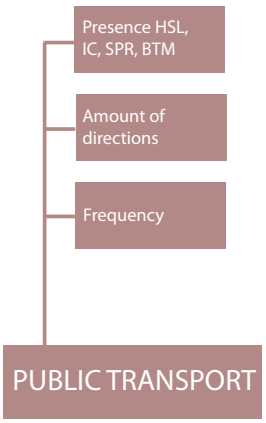
4.3.2 Public transport

Score (HSL + IC + SPR + MR + LO + TC) + Σ(F X D X 0,2 X SCORE)

HSL = presence HSL … score: 125
IC = presence intercity … score: 100
SPR = presence sprinter … score: 75
MR = presence metro end/or R-net … score: 50
LO = presence local bus … score: 50
TC = presence tram and/or city bus … score: 25

F = Frequency
D = Amount of directions





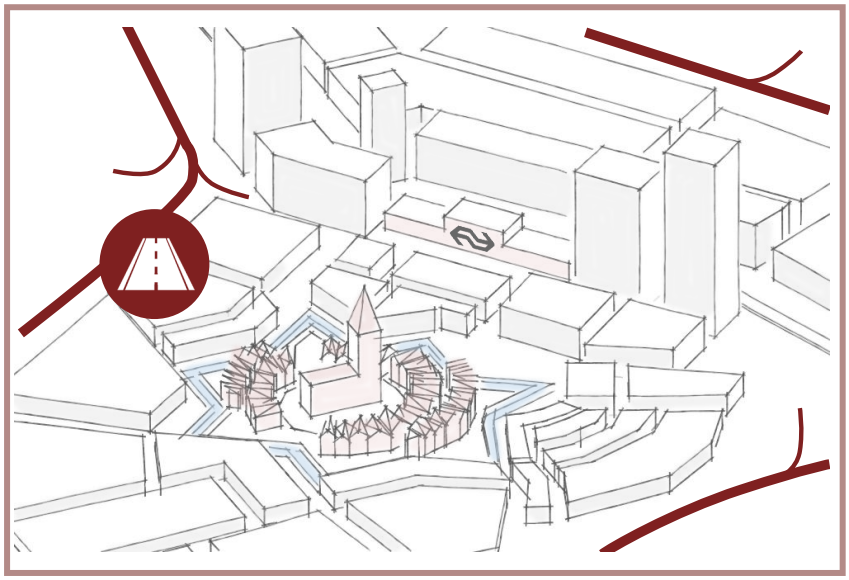
The position in the public transport network indicates to what extent the place is accessible by train and other public transport modes. The valuation was developed for Ruimte en Lijn (2006) by Atelier Zuidvleugel and is derived from earlier studies (Vereniging Deltametropool, 2013). The presence of HSL, intercity and sprinters is appreciated, but also the presence of high-quality secondary public transport (metro, R-net), regional buses, trams and city buses. Faster connections are valued higher. The more modalities are present, the higher the connection value of the node. In addition, the frequency and the number of directions of the various modalities are also included. The higher the frequency and the number of directions, the higher the accessibility value of the node. A high score means that the node can be reached in a high frequency with many different public transport modalities.

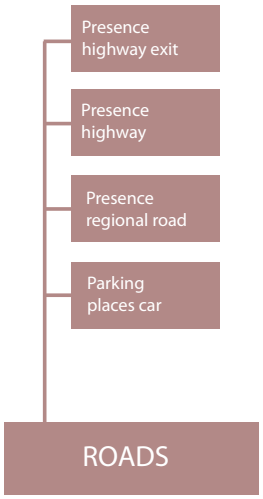
4.3.3 Roads

Score (HE + H + RR1 + RR2 + (PA / TR) x 100) + Σ(D x 0,5 x SCORE)

HE = Presence highway exit 1200m … score: 75
H = Presence highway 3200m … score: 50
RW1 = Presence regional road 1200m … score: 25
RW2 = Presence regional road 3200m … score: 10
(PA / TR) x 100 >5% … score: 50
(PA / TR) x 100 >2,5% … score: 25

PA = Amount of parking places car
TR = Amount of travellers
D = Amount of directions





The position in the road network indicates to what extent the place is accessible by car. Like the position in the public transport network, the rating for this indicator is based on the method in Ruimte en Lijn (Atelier Zuidvleugel, 2006). The score indicates the position of the station in the regional and national road network. The presence of highways, regional roads and highway exits within a certain radius is appreciated. The number of directions from which the station area can be accessed on these roads is also included in the score. In addition, the presence of sufficient parking spaces has now been added to the valuation in Ruimte en Lijn. The higher the score, the better the node can be reached in a multimodal way (Vereniging Deltametropool, 2013).

Figure 4.3.2 shows the three themes out of which the node value is composed. For each theme, the involved variables are listed.

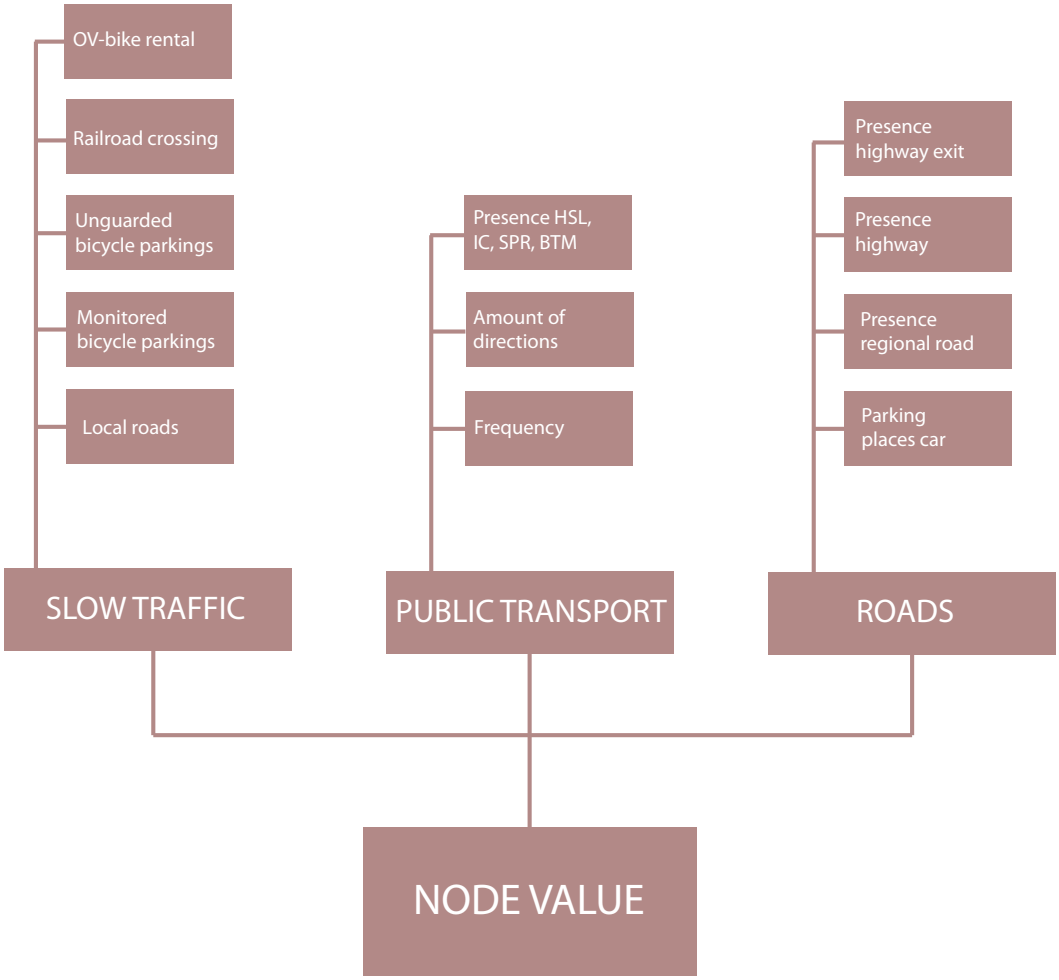


Figure 4.3.2: Node value themes detailed (own ill.).

4.4 Adjusting the place value

According to the operationalisation as applied in the butterfly model, the place value represents to what extent there is an activity centre at the station location. However, this method merely includes amounts of residents, employees and visitors in the area. It does not tell anything about the presence of facilities for travellers. In order to also incorporate the latter, the operationalization of the place value of Peek (2007) and Staps (2015) is followed in this study. This operationalisation views a station location not only as an urban centre, but also as a meeting place.

The theme of urbanity is determined by the amount of residents in a 300 meter radius around the station. Furthermore, an addition is made by including the theme meeting function. This theme is focused on the station itself. The themes that determine the score at the meeting place are 'station facilities' and 'intensity'. The latter is determined by the amount of facilities compared to the amount of travellers.

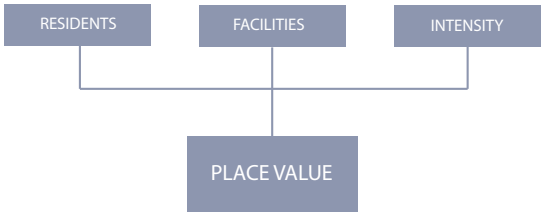
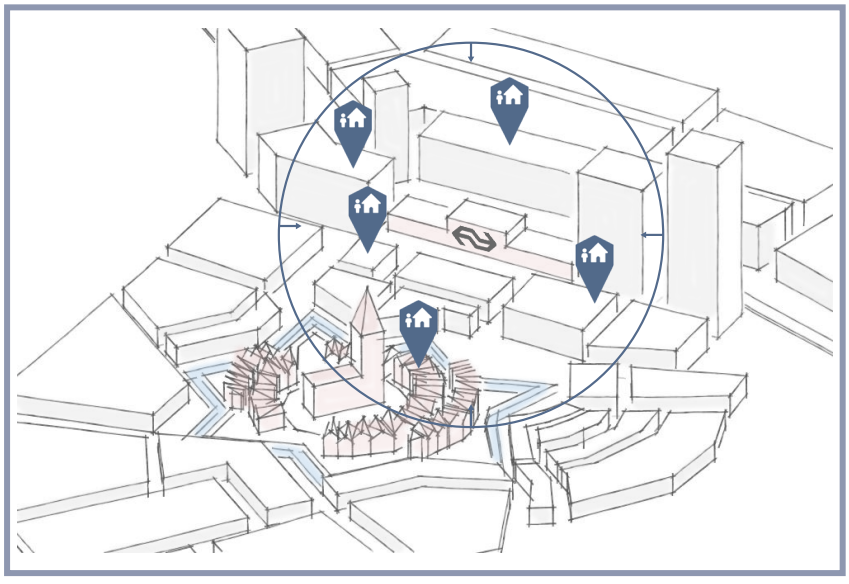


Figure 4.4.1: Place value themes (own ill.).

4.4.1 Residents

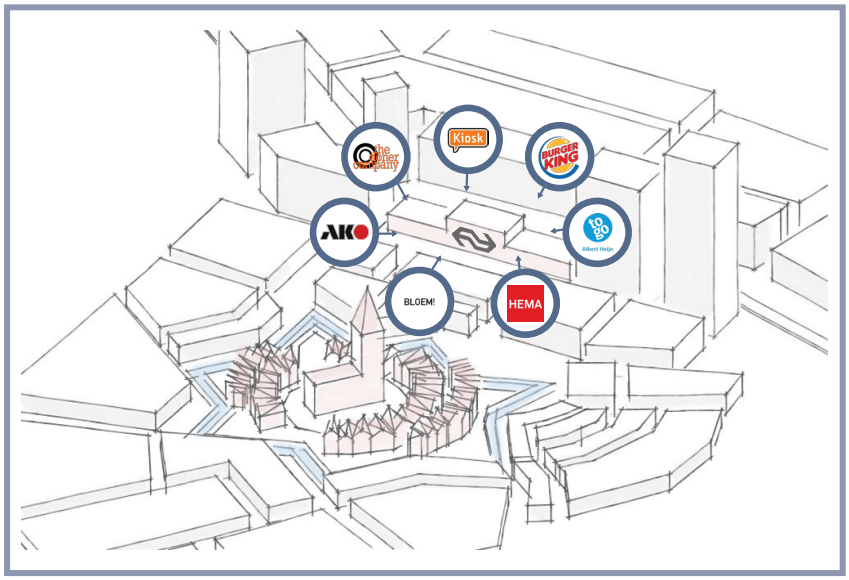
Score = amount of residents within a 300 meter radius around the station location



A station location can become a lively meeting place if it acts as a centre for its surroundings. The number of residents in a radius around the station therefore indicates to what extent there is an activity centre.

4.4.2 Facilities

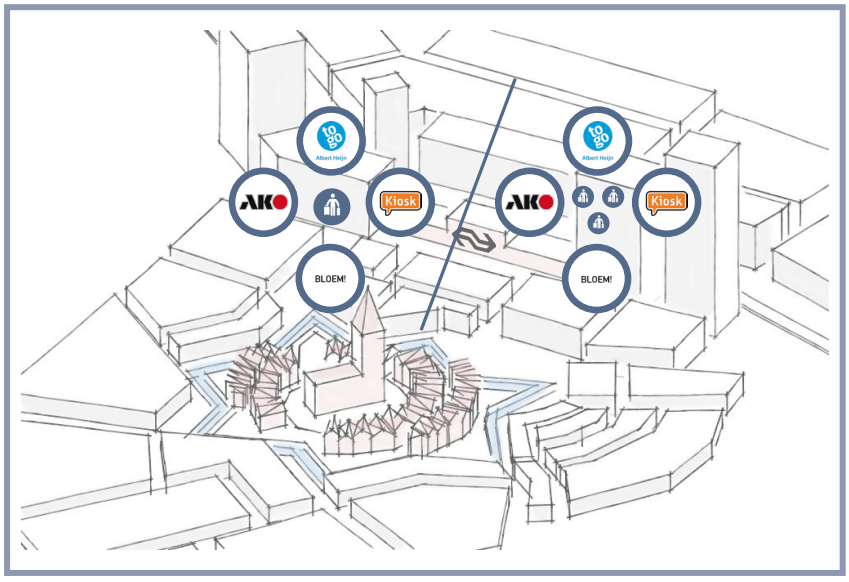
Score = variety of station facilities (retail offer)



To get an idea of the possibility of meeting or spending time at a station location, the variety of facilities at the station location is measured in the variable facilities. This concerns the facilities that are directly connected to the station. A high variety of stores ensures a high score on this variable. If there are multiple stores of the same brand (such as multiple Kiosks) present on a station, this only counts once in the calculation.

4.4.2 Intensity

Score = amount of station facilities (retail offer) / amount of travellers



For the variable intensity, the total number of facilities at a station location is added together and divided by the average daily number of travellers at that station. In the calculation, the total number of facilities is used, regardless of whether there are several stores of the same brand.

Figure 4.4.2 shows the three themes out of which the node value is composed. For each theme, the involved variables are listed.

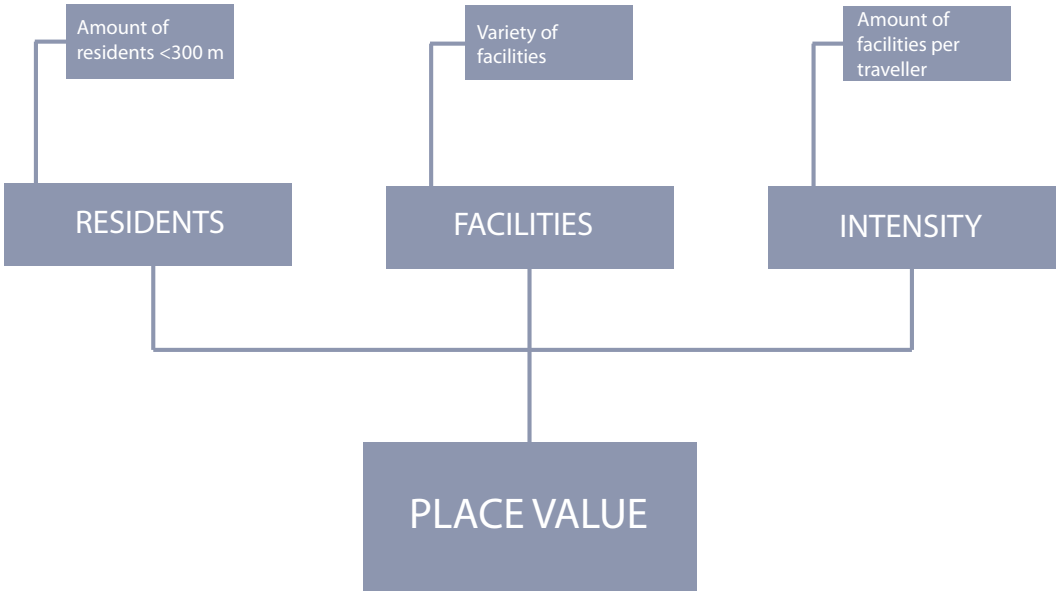


Figure 4.4.2: Place value themes detailed (own ill.).

4.5 Adding the contextual value

The node- and place values emphasize the activities that take place in the station itself. However, as described in the theoretical framework, the station cannot be seen separately from its environment. This contextual layer is considered to be underrepresented in the node- and place value. Therefore, a third value, the contextual value, is now introduced.

In order to come to a suitable operationalisation of the contextual value, the insights of the various theories as discussed in the theoretical framework are consulted. These theories include the ones described by Pojani & Stead (2015) and Brouwer (2010). Both describe various themes which should be considered in a station environment and the corresponding connection to the city (fig. 4.5.1 - 4.5.2).

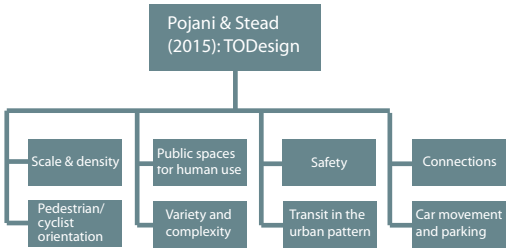


Figure 4.5.1: Transit-oriented design concepts (Pojani & Stead, 2015).

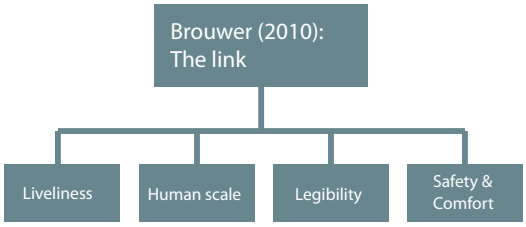


Figure 4.5.2: Concepts for the link between station and city (Brouwer, 2010).

This study wants to assess the newly introduced *contextual value* in a similar manner as the *node- and place values* in the butterfly model are assessed. This means that three overarching subthemes are determined that represent most of the variables that are described in the existing literature. The three subthemes in this study are *quality of life*, *embeddedness* and *urban transition*.

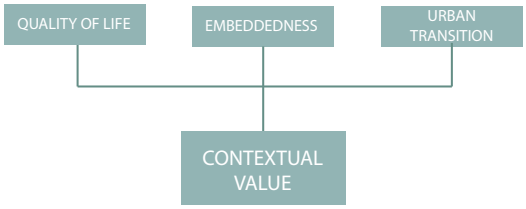
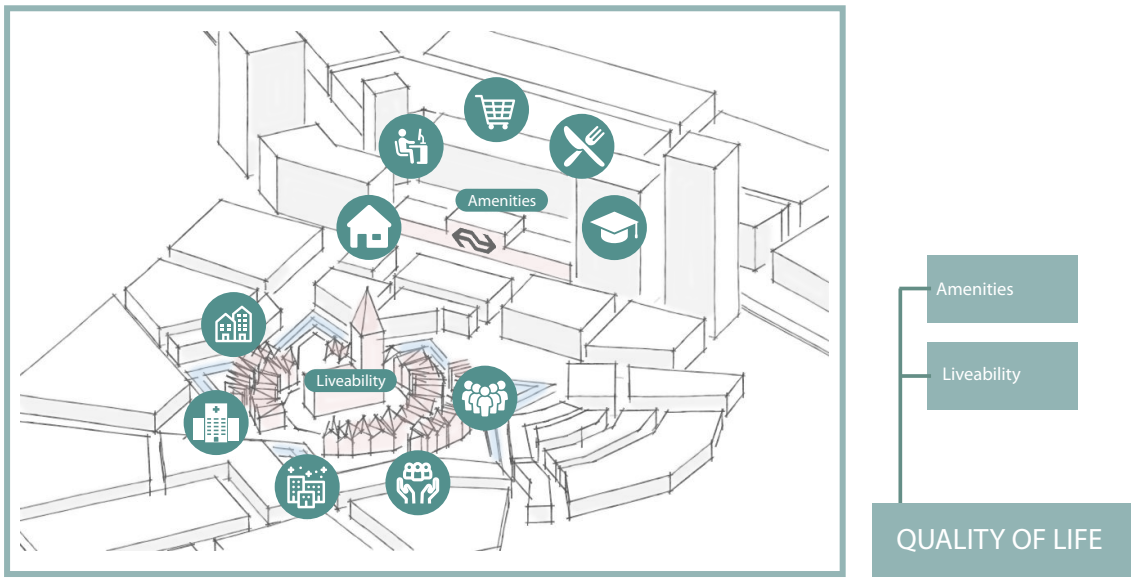


Figure 4.5.3: Contextual value themes (own ill.).

4.5.1 Quality of life

Score = score (liveability) + score (amenities)



The first theme that is covered under contextual value is *quality of life*. Quality of life is determined by two variables: *liveability* and *amenities*. *Liveability* is defined as the extent to which the living environment meets the conditions and needs that are imposed on it by humans. It shows the situation in the neighbourhood, but also developments and backgrounds of the neighbourhood (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, n.d.).

To gain insight into the degree of quality of life in a station area, the Leefbaarometer developed by the Dutch government is used. It provides insight into the quality of life situation per target area. To visualize liveability, 100 indicators are used, subdivided into 5 dimensions. These five dimensions are *dwellings, population, facilities, safety and physical environment* (fig. 4.5.4). Since many of these dimensions are also covered in the theoretical framework, the liveability meter is considered to be a suitable indicator.

These 100 indicators have been included in the *Leefbaarometer* because extensive statistical research has shown that the assessment of viability can best be estimated with these indicators (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, n.d.). This means that the *Leefbaarometer* provides an estimate of the quality of life situation and development based on 100 mainly objective indicators (characteristics of the living environment).

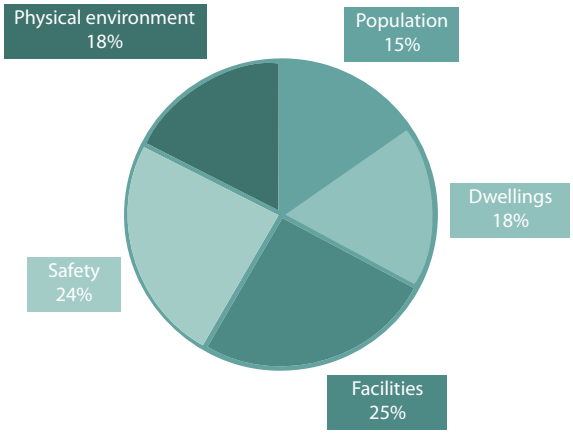


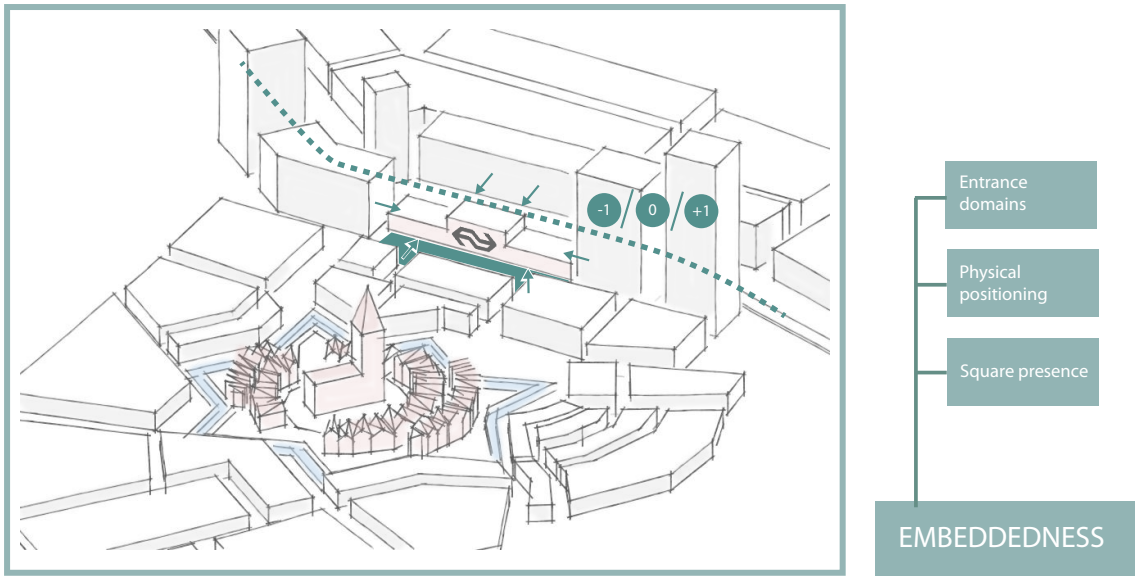
Figure 4.5.4: Leefbaarometer dimensions.

Secondly, the theme quality of life is determined by *amenities*. The station location should offer more than one people attractor. People attractors are offices, residences, shops, places of education, recreation and entertainment. A mix of functions stimulates the activity of the location and creates a lively

and vital scene (Brouwer, 2010). Therefore, for every station location, the presence of a mix of functions in the direct vicinity of the station is investigated. The direct vicinity is defined as the main station square at both sides of the station. Consequently, five different function groups are defines: residences, offices, shops, leisure (restaurants, hotels, cafés) and places of education. For every function, one point can be obtained.

4.5.2 Embeddedness

Score = score (entrance domains) + score (physical positioning) + score (square presence)



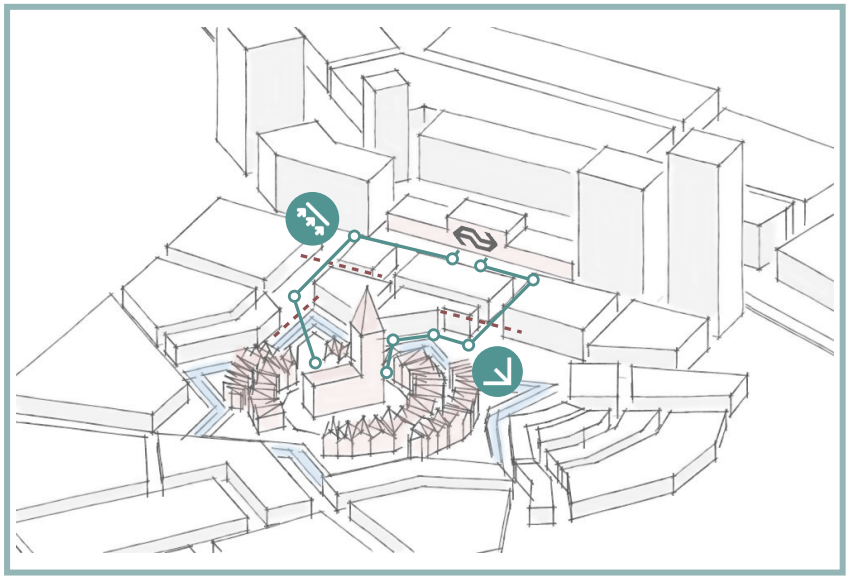
Entrance domains: In order for a station to be accessible and permeable for travellers, there should be enough entrances. However, too many entrances can lead to the opposite: travellers get disoriented. That is why the name 'entrance domain' is introduced. These parts of the station offer services such as ticketing and information desks, but also facilities such as shops and restaurants. Preferably, a traveller crosses this domain, so it can utilise the offered facilities and acquire the information that it needs. Too many entrance domains will not contribute to the quality of the transfer, as the different functions will be less concentrated. Moreover, the concentration of the traveller flow will be lower, which leads to a decrease in safety and monitoring. Multiple entrances that border one entrance domain is not assumed to be problematic. The score for *entrance domains* is determined by the score of 5 minus the amount of entrance domains.

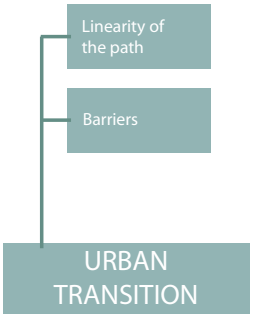
Physical positioning: The railway tracks are often know as barriers that divide the city. In multiple cities, the railway tracks have therefore been elevated or built underground. Both options provide the possibility to cross the railway tracks more easily and enhance the permeability of the station location. Stations with underground railway tracks are values with a score of 5. When the station is served by an elevated track, this score is 3. Ground floor railway tracks are considered to form a barrier in the city the most, and are thus valued with a score of 0.

Square presence: According to the expert panel that draws up guidelines in Pojani & Stead with regard to station embedding, it is stated that a square in front of the station contributes as a desirable element to travellers' orientation leaving the station. An open space for the Dutch station is often present, but can be dominated by bicycle sheds or bus stops. This is generally not considered as spatial quality. For that reason, stations with a square on which there are no barriers are valued with a score of 5.

4.5.2 Urban transition

Score = score (linearity) + score (barriers)





Linearity of the path: The route from the railway station to the city centre should not include too many turns. In other words, the path has to be linear (Van Soest, 2010). This is because a person loses its orientation when it makes too many turns. According to Lynch (1961), people need to orient themselves, especially when it visits a city for the first time. Also, this person has to find its way back to the railway station later on. The value is determined by the amount of turns there are in the route. A turn is made when at a crossing, a different direction other than straight forward has to be taken.

Possible scores:
5: 0 turns
3: 1 turn
1: 2 turns
0: >2 turns

Barriers: Pedestrians that walk from the station to the city centre have to cross several barriers. It is important that pedestrians, the weakest users of the street, always get priority and can easily cross the barriers. A score can be determined by deciding which barriers the pedestrians have to cross along the link to the city centre (fig. 4.5.4). The maximum score is, like the linearity score, 5. If the pedestrian has to cross the ring road, two points are subtracted. Finally, for every road that has to be crossed without priority (zebra without traffic lights) another point is subtracted.

Figure 4.5.5 shows the three themes out of which the node value is composed. For each theme, the involved variables are listed.

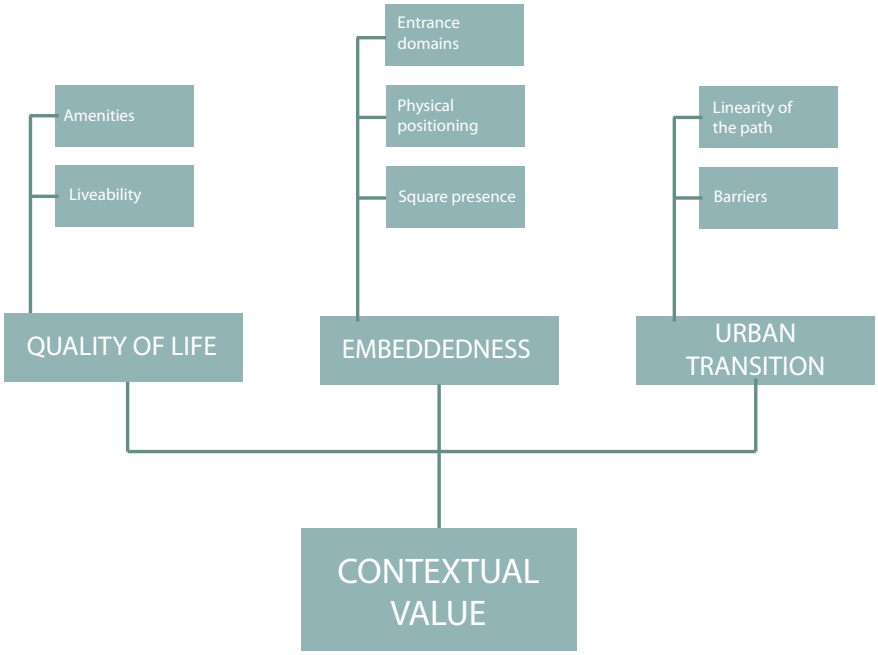


Figure 4.5.5: Contextual value themes detailed (own ill.).

4.6 Introducing the holistic assessment model

The scores on all nine themes will be processed in a holistic assessment model that is inspired by the butterfly model, but also incorporates the contextual value (fig. 4.6.1).

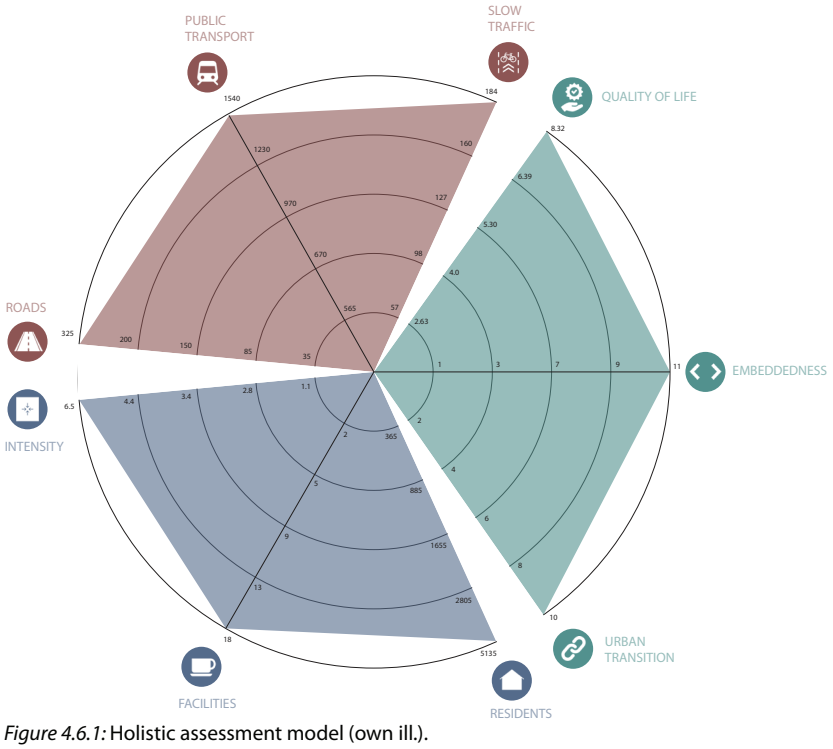


Figure 4.6.1: Holistic assessment model (own ill.).

CHAPTER 05
OPERATIONALISATION: TRAVELLER EXPERIENCE

CHAPTER 05

In the previous chapter, the station location has been operationalised, by the determining a holistic collection of variables. It is necessary to also measure the traveller experience in order to be able to compare it to the station location. This chapter elaborates on the operationalisation of the traveller experience.

CHAPTER 05 OPERATIONALISATION: TRAVELLER EXPERIENCE

Each station location has different characteristics to offer, which in turn relate to the traveller experience. As a result, every station location is perceived differently by the traveller. Apart from their specific corporate goals, the parties that are involved in the development of station location should collectively ensure that the experience is of high quality. Therefore, they try to act on the traveller demands, in order to ensure a good station experience.

To be able to properly tailor each station to the wishes of the travellers and to measure the effect of adjustments (listen-act-learn) it is important to know how the stations are valued and how travellers percept the station. That is the reason that the Dutch Railways (NS), in collaboration with ProRail, has developed a method to consistently measure the rating of travellers about a station. This practical assessment is called the 'stationsbelevingsmonitor' (SBM) (station-experience-monitor). At every Dutch station, surveys are conducted on a regular basis in order to gain information and provide a score for the station. The questions in the SBM-surveys can be clustered into seven important themes. In addition, travellers are asked to give a general opinion about the station as well as an opinion about the area surrounding the station (ca. 300 meter). The seven themes are derived from the customer wish pyramid discussed in paragraph 2.2. All themes in the survey are visualised in figure 5.1.1.

As dissatisfiers, the themes clean, safe and orientation and flow have been distinguished. For the satisfiers, the themes inviting, waiting experience and attractive have been distinguished.

Every theme is represented in a number of statements in the survey, so a separate score can be calculated for each separate theme. For each theme, the statements on the next page are answered by the traveller (fig. 5.1.2)

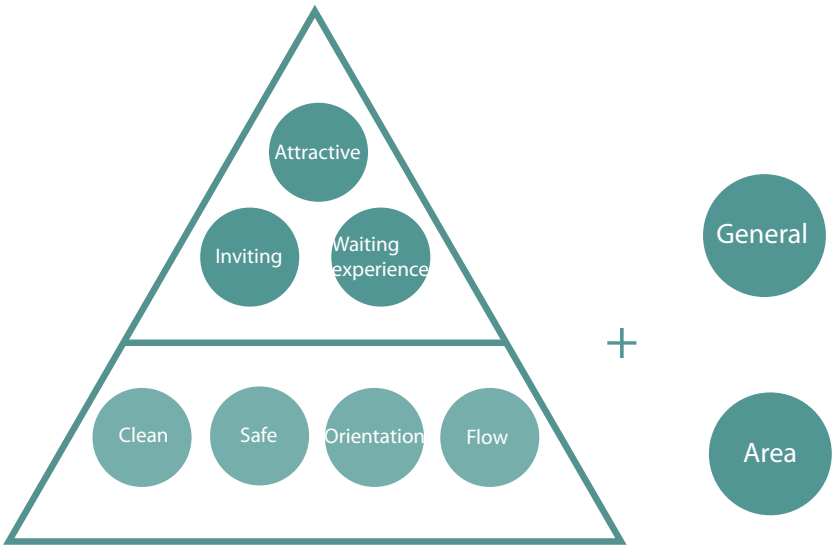


Figure 5.1.1: Themes that are assessed in the SBM (own ill.).

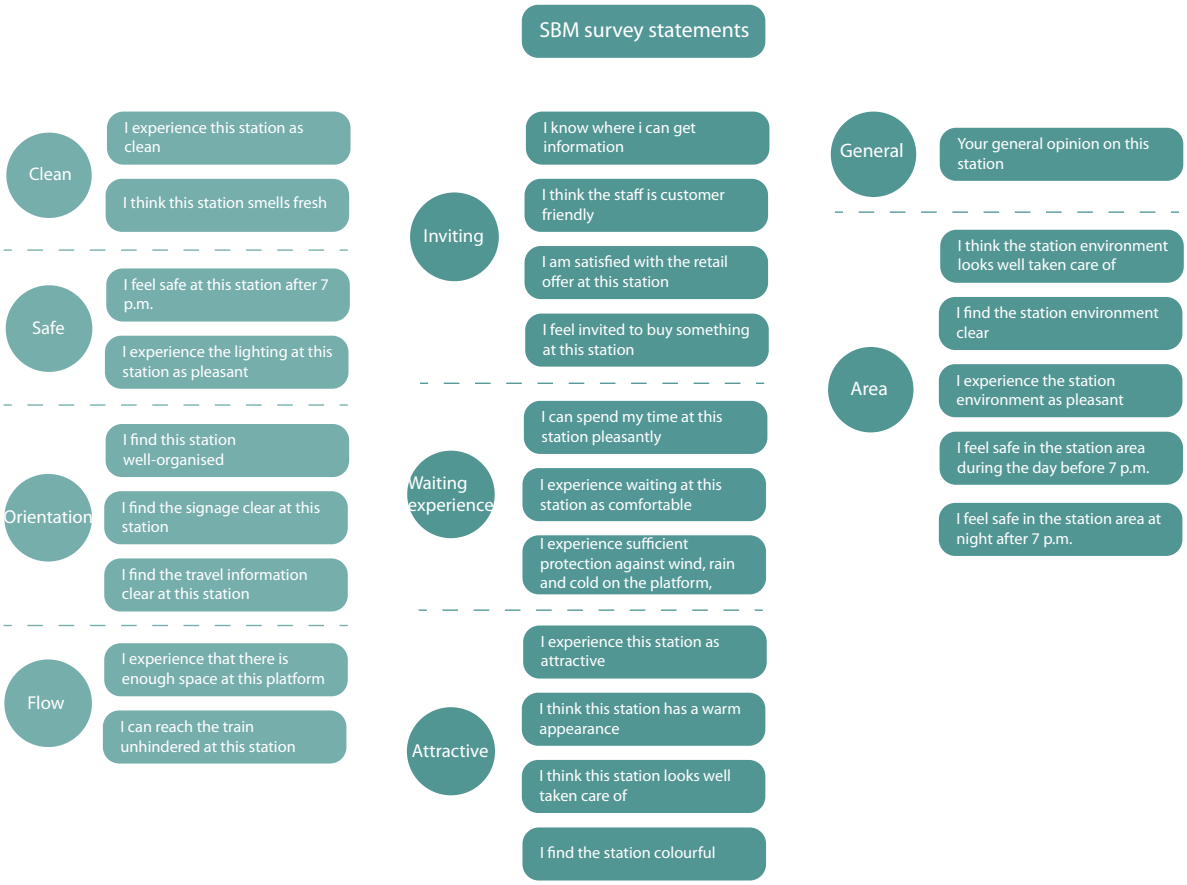


Figure 5.1.2: SBM survey statements per theme (own ill.).

CHAPTER 06
DATA COLLECTION

CHAPTER 06

According to the variables that have been determined in the last chapter, the data collection has been executed. This data collection is specified to a pre-made selection of station locations. This chapter elaborates on this.

CHAPTER 06
DATA COLLECTION

6.1 Station location selection

Station locations can differ considerably from each other. Therefore, the comparison of two station cases that already have many differences in their nature provides no useful information. In order to make a good selection of station locations that are suited for this research, it is necessary to distinguish the station typologies. Holland Railconsult has, in collaboration with NS (chain management and product management), searched for a typology that takes the combination between micro and macro accessibility into account (Van Hagen & De Bruyn, 2002). A classification has emerged that is based on the status of station operation as well as the location of the station in relation to the urban centre. It appears that the use of pre-transport and post-transport is strongly related to the location of the station in its environment. As a result, six station types are distinguished in the Netherlands (Van Hagen & Exel, 2012). In the figures 6.1.1 - 6.1.6, a conceptual visualisation of each station type including a description is presented.

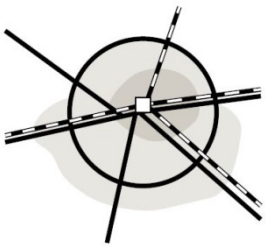


Figure 6.1.1: Type 1: Very large station in the centre of the big city.

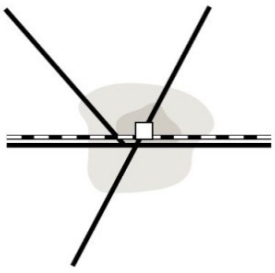


Figure 6.1.2: Type 2: Large station in the centre of a medium-sized city.

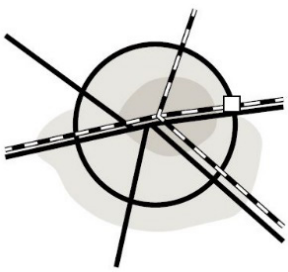


Figure 6.1.3: Type 3: Suburb station with node function.

Figure 6.1.4: Type 4: Station at the centre of a small town / village.

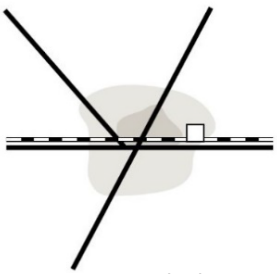


Figure 6.1.5: Type 5: Suburb station without node function.

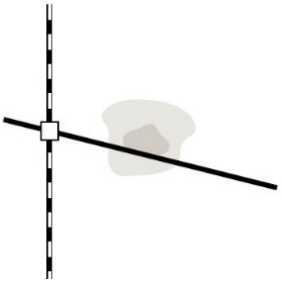


Figure 6.1.6: Type 6: Station in outside area at small town / village.

Since this research partly focuses on the connection between a station location and the city centre, the comparison between station locations can only be made if they are all linked to a city centre. Furthermore, it is relevant to assess station locations that currently receive attention with regard to spatial developments. Therefore, it has been decided that the station type that will be further investigated in this study is *station type 2*. The list in table 6.1.1 shows some key characteristics of type 2 stations.

Examples of station within type 2 are Den Bosch, Delft, Haarlem, Alkmaar, Amersfoort and Zaandam. Within this group of stations, many (re)developments are taking place. Some developments have already been finished, such as Delft, Tilburg and Heerlen, but others are scheduled to be addressed shortly, such as Den Bosch and Almere. These developments show that type 2 stations are currently interesting objects with regard to a change in their environment. The outcome of this research might be useful to support decisions that have to be made.

Figure 6.1.7 shows a map of The Netherlands with type 2 stations pointed out. Figures 6.1.9 - 6.1.14 show examples of type 2 stations.

Figure 6.1.7: Type 2 station in the Netherlands (own ill.).

Spatial characteristics	Transport characteristics
Linked to city centre	Node for local public transport: bus, tram
Regionally oriented	Many travellers, large flows
DIfficult to reach by car and bus	Many inernal transferers (train - train)
Large lack of space	National connections
Double lend use due to major urban development pressure	
Commercial pressure	
16-hour use as a public urban meeting place	

Table 6.1.1: Key characteristics of type-2 stations.

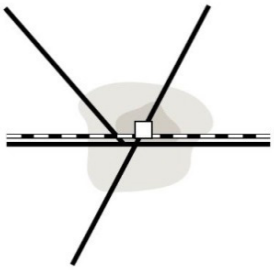


Figure 6.1.8: Type 2: Large station in the centre of a medium-sized city.

Fig. 6.1.9: Station 's-Hertogenbosch.

Fig. 6.1.10: Station Delft.

Fig. 6.1.11: Station Hilversum.

Fig. 6.1.12: Station Almere Centrum.

Fig. 6.1.13: Station Akmaar.

Fig. 6.1.14: Station Zaandam.

6.2 Holistic assessment of type 2 station locations

All 30 type 2 station location have been assessed according to the operationalisation presented in chapter 4. Subsequently, a scorecard design has been set up to provide insight into the findings. In this section, an explanation of this scorecard is provided.

As an example, the station location of Alkmaar is presented here. The map in figure 6.2.1 shows where the station building of Alkmaar is located in the direct environment. The rail track is also clearly pointed out. The facilities that are present in the station are visualised by icons. Besides, the route to the city centre is pointed out. This path is the main connection between the station location and the city centre as pointed out at the signposts. The different barriers that a pedestrian has to cross, and the turns it has to make are pointed out. This information has been incorporated to calculate the score on urban transition. Figure 6.2.2 shows the holistic assessment model, in which the different scores are visualised.

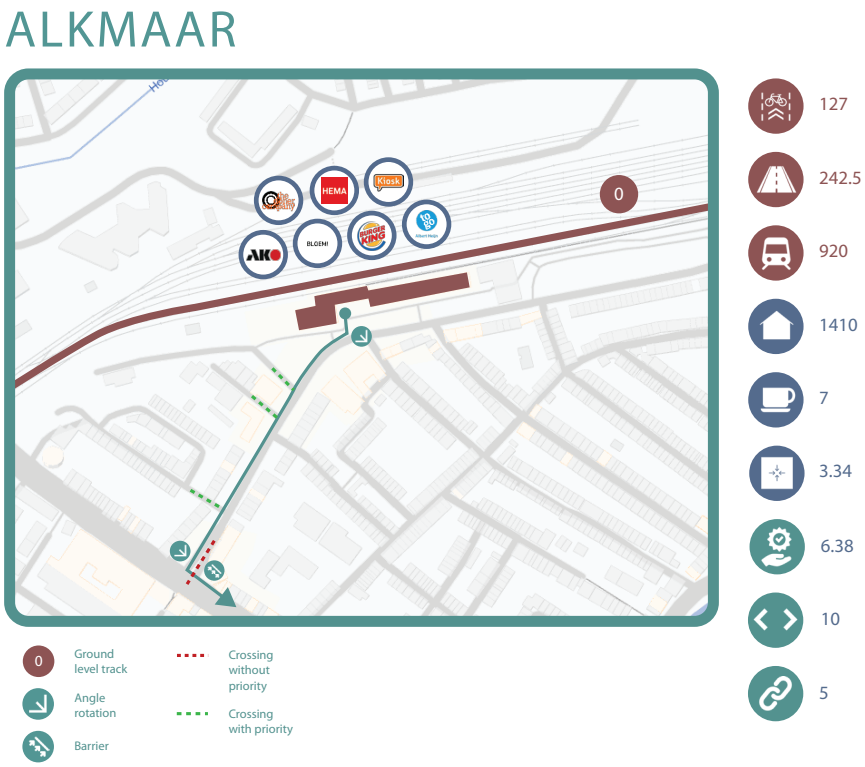


Figure 6.2.1: Assessment map of station location Alkmaar (own ill.).

Figure 6.2.2: Holistic assessment model of station location Alkmaar (own ill.).

In *appendix A*, the assessment of all 30 type 2 station can be found. *Appendix B* shows the worksheets that are used to calculate the different values.

Since this study relies on statistical analysis, it may be doubted whether a sample size of 30 case studies can be used to produce reliable data. Indeed, a quantity of 30 samples is usually seen as a minimum sample size (Van der Houwen, n.d.). However, when performing a statistical analysis, it is also important to consider the total population. In this sense, the total amount of railway stations in The Netherlands currently counts around 400 railway stations, but this includes all types of stations. Since this study wants to compare stations that are located in the centre of medium sized cities, the majority of railway stations are not considered suitable. Of those that are considered suitable, almost the entire population is incorporated in this study. When also other station locations which differ in many respects from the selected station locations would be incorporated, this would lead to a very irregular data distribution. This applies for both station locations that are much larger and for those that are much smaller.

6.3 Traveller experience data

As explained in the previous chapter, the traveller experience is measured by the use of the SBM survey conducted by NS and ProRail. At the large stations, including all type 2 stations, the SBM survey is conducted four times a year, every time in a different season. At least 150 travellers are questioned. An exemplary version of the survey can be found in appendix C. The result of the summer survey of 2019 can be found in appendix D. These results include the score on seven main themes and the general opinion. Scores are based on a scale from 1 to 10.

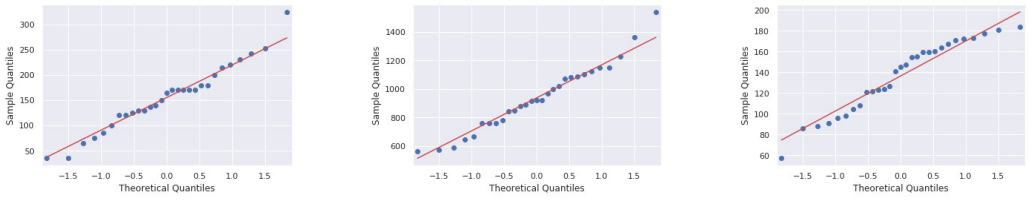
In appendix E, the results of the spring survey are displayed. Here, it concerns the station environment. Travellers were asked to provide their opinion on five statements regarding the station environment. Scores are based on a scale from 1 to 10.

6.4 Test of normality

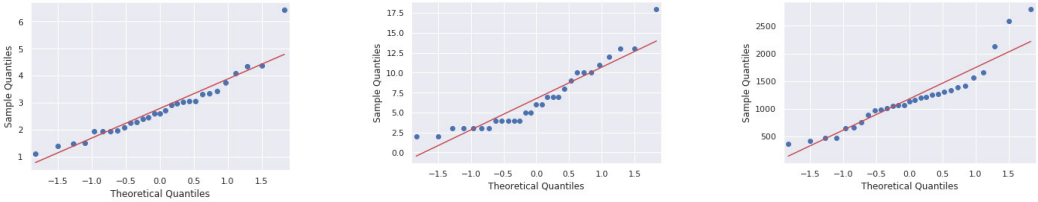
For the dataset of the holistic assessments of station locations, the acquired data is assessed in terms of normality. To do this, a QQ plot is used. A QQ plot calculates the expected value for each observation according to a certain distribution (in this case the normal distribution) and then checks whether the observed data deviate from this. When the different data points are roughly on the line, it can be assumed that the data is normally distributed.

On several themes, one station location turned out to disrupt the normal distribution. Particularly on the theme residents, station Den Haag HS showed a much higher score than all other station location. This is due to the fact that this station location is situated in The Hague, being the third largest city in The Netherlands. Considering the general description of the station types that are being investigated in this study (large station in the centre of a medium-sized city), it can be said that The Hague HS station only partially fits this description. For this reason, and due to various outliers in the datasets, it has been decided to disregard Den Haag HS in this study.

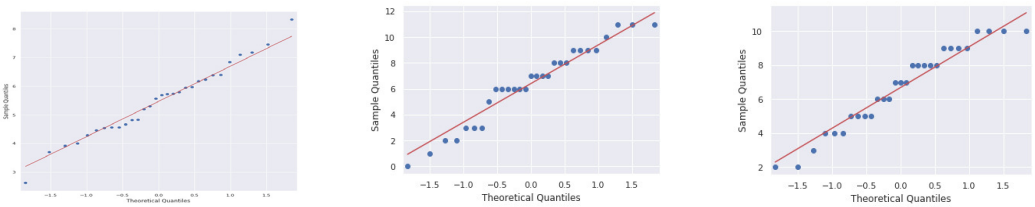
In the following figures 6.4.1 - 6.4.9, the QQ plots of the datasets of both the station location and the traveller experience are shown. Due to the small sample size, the data is never perfectly distributed. However, in this study the distribution is considered normal enough to use for statistical analysis.



Figures 6.4.1 - 6.4.3: QQ plots for the datasets Node Value (FLTR) – slow traffic – public transport – roads.



Figures 6.4.4 - 6.4.6: QQ plots for the datasets Place Value (FLTR) – intensity – facilities – residents.



Figures 6.2.7 - 6.4.9: QQ plots for the datasets Contextual Value (FLTR) – quality of life – embeddedness – urban transition

CHAPTER 07
EMPIRICAL ANALYSIS

CHAPTER 07

In the previous chapter, data about both the station location and the traveller experience has been collected. The aim of this chapter is to analyse these datasets and compare them, in order to determine whether station location characteristics show a connection with the traveller experience. The empirical analysis is performed in a twofold way: firstly, a quantitative *correlation analysis* based on the datasets is performed in order to discover relations between station location characteristics and the traveller experience. Secondly, a limited selection of station locations is analysed by means of *reviewing qualitative data* that is collected among the travellers at these stations. This analysis is performed, not only to support the quantitative findings, but also to gain new insights that were not covered by the quantitative analysis.

CHAPTER 07
EMPIRICAL ANALYSIS

7.1 Quantitative analysis

7.1.1 Analysis method

For the quantitative analysis, SPSS software is used to compare the two datasets. The strength of this software lies in the functionality of being able to compare big datasets, and showing which factors show significant correlations. Therefore not only the aggregated scores per theme (such as *slow traffic, facilities, embeddedness*), but also the raw variables that were used to calculate these scores will be analysed. E.g. for slow traffic, the amount of bicycle parking places (unguarded/monitored) is part of the calculation.

Likewise, not only the aggregated scores per theme on the traveller experience (SBM), but also the scores per survey statement are analysed. The goal is to find patterns between station location variables on the one hand and scores on SBM survey statements on the other hand (e.g. the variety of facilities at a station location positively correlates with the SBM statement 'I am satisfied with the retail offer at this station'). This method is visualised in figure 7.1.1.

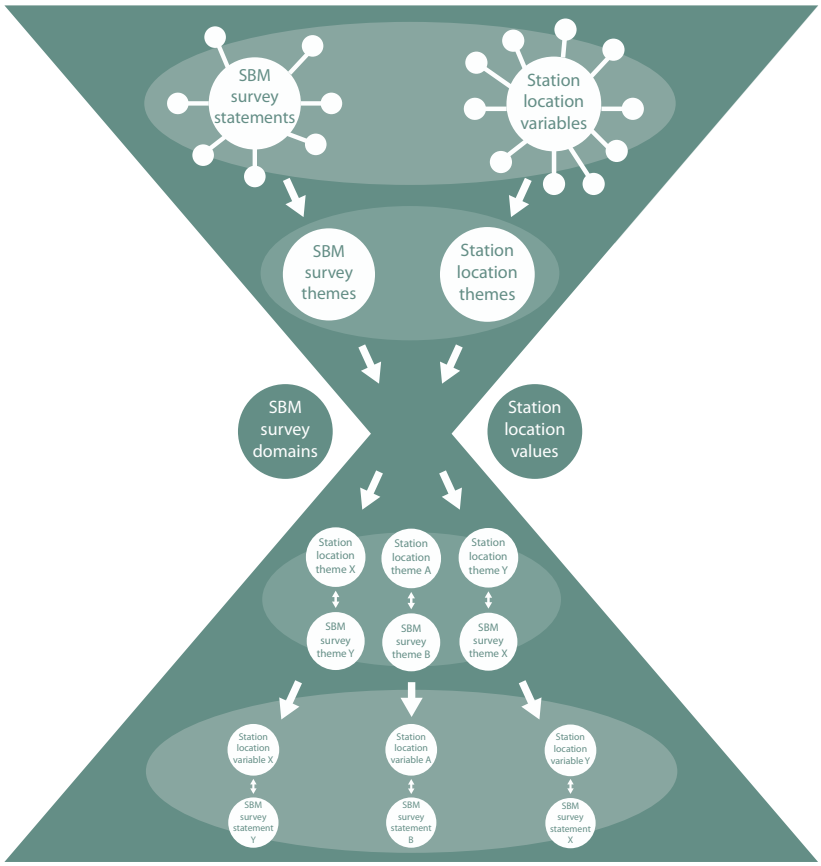


Figure 7.1.1: Visualisation of analysis method (own ill.).

Firstly, a correlation analysis is performed on a aggregated level. In this analysis, the scores on the nine different station location themes are compared to the traveller experience themes that are represented in the SBM. When a significant correlation is found, this hints to a certain dependent relation between a station location variable and SBM survey statement. However, due to its aggregated nature, the initial analysis does not provide information on to which particular variables and statements this correlation applies. Therefore, a second correlation analysis is performed on a more detailed level. This second correlation analysis is performed for each theme that is calculated based on multiple variables. This second analysis will point out which variables have the strongest correlation with the survey statements and are therefore expected to be influential for the traveller experience.

Lastly, the relation between *all survey statements* and the *general opinion statement* is analysed, to determine whether this survey statement can be considered important for the overall traveller experience.

7.1.2 Correlation analysis: aggregated level

This chapter will examine which parts of the data are worth analysing on a deeper level. Therefore, a correlation analysis is performed taking into account the aggregated scores on the different themes in both the station location data and the traveller experience data (fig. 7.1.2). These are the aggregated themes that are represented in both datasets:

Station location themes:

- Node value: slow traffic
- Node value: public transport
- Node value: roads
- Place value: residents
- Place value: facilities
- Place value: intensity
- Contextual value: quality of life
- Contextual value: embeddedness
- Contextual value: urban transition

Traveller experience themes:

- Clean
- Safe
- Orientation
- Flow
- Inviting
- Waiting experience
- Attractive

- General

- Area

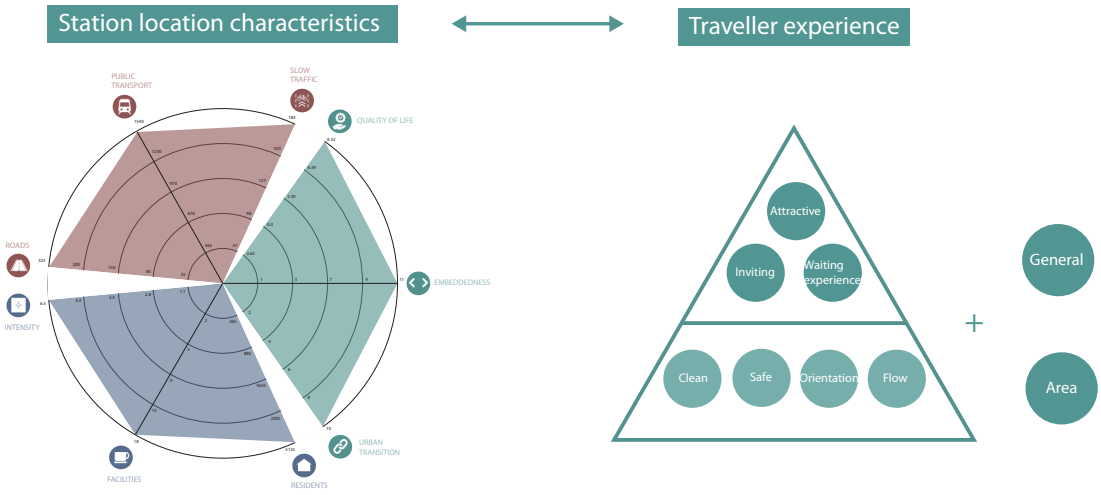


Figure 7.1.2: Visualisation of analysis on the aggregated level (own ill.).

The correlation diagram which takes into account the scores per station location theme and traveller experience theme can be found in appendix F. In this part, the most significant correlations on this aggregated level will be discussed. Within every station location value (node, place, context), one theme is found to show a significant relation with the scores on traveller experience.

First of all, within the node value, the theme *public transport* shows significant correlations with both traveller experience themes *general* and *safe* in particular (fig. 7.1.3). This implies that station location that have a higher score on the theme public transport, are often valued higher by travellers. A high score on the theme public transport implies that the station location is better connected to multiple transport modes.

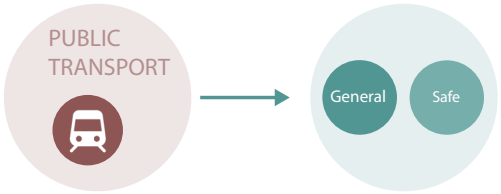


Figure 7.1.3: Relation *public transport - general & safe* (aggregated) (own ill.).

Secondly, within the place value, the theme *facilities* shows significant correlations with *all traveller experience themes*, excluding the theme *clean* (fig. 7.1.4). Here, it concerns the variety of facilities that are directly connected to the station. It must be noted that the correlation is not significant for the theme intensity, which represents the amount of facilities relative to the number of travellers. Consequently, it can be stated that not the amount of facilities, but in particular the variety of facilities positively relates to the traveller experience at stations.

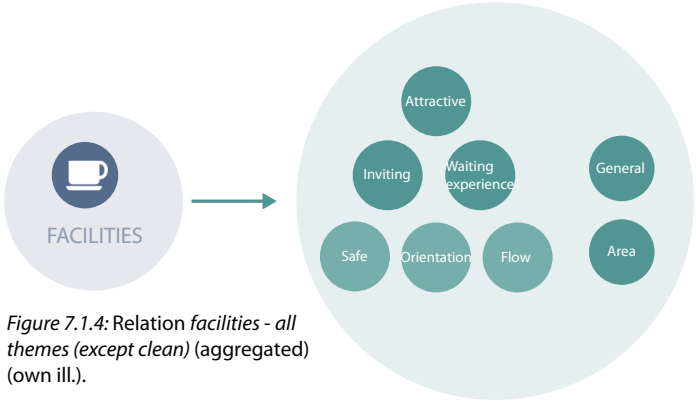


Figure 7.1.4: Relation *facilities - all themes (except clean)* (aggregated) (own ill.).

For the above two found correlations, a side note must be made. For both themes, *public transport* and *facilities,* it generally applies that the score is higher as the station serves more travellers, and can thus be considered as a larger station. Interestingly, both themes positively relate to the traveller experience. For that reason, it can be assumed that within the sample of type 2 station locations, larger stations are generally rated higher by travellers.

As a matter of fact, when the correlation analysis is performed when taking into account solely the *amount of travellers* and the traveller experience, it can be concluded that indeed a higher amount of travellers positively and significantly correlates with *all traveller experience themes*, again excluding the theme *clean*.

The third significant correlation can be found within the contextual value, on the theme *quality of life*. A higher score on this theme most positively relates to the traveller's appreciation of the themes *general* and *safe (fig. 7.1.5)*. The theme quality of life specifically focuses on the station area, which makes it particularly interesting that it positively correlates with the traveller experience themes general and safe, and not necessarily with the theme area. This finding hints to a role of the quality of the area within the overall station experience.

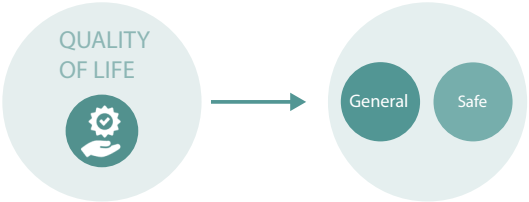


Figure 7.1.5: Relation *facilities - all themes (except clean)* (aggregated) (own ill.).

7.1.3 Correlation analysis: detailed level

Abovementioned correlations are, like stated before, determined on an aggregated level. This is done because of the relevance that correlations on a aggregated level may have: it may show that a combination of various factors within one theme may enhance the traveller experience. However, since it is interesting to also determine whether there are correlations on a more detailed level, taking into account variables and individual survey statements, the next section will discuss these findings. Also for the detailed analysis applies that within every value (node, place and context), one variable is found to have significant relation with one or multiple survey statements.

Node value – slow traffic

The first value-specified correlation analysis elaborates on the slow traffic theme (which is part of the node value). This theme is determined by a couple of variables, which are the presence OV-bike rental, the presence of a railroad crossing, the amount of parking places for bikes and the presence of local roads within 300 meters. Using SPSS, the findings (numbers) on these variables are set against the scores per survey statement of the traveller experience (SBM). Appendix F shows the correlation coefficient and the significance in a cross table, pairing each variable with each SBM survey statement.

Some interesting patterns can be recognised. There is a significant correlation visible between the amount of bicycle parking places and the score on the survey statement 'I experience this station as clean' and 'I can reach the train unhindered at this station' (figure 7.1.6). This means that, on average, stations with more bicycle parking places are rated higher on these statements. This applies in particular to monitored bicycle parking places (fig. 7.1.7 - 7.1.9).

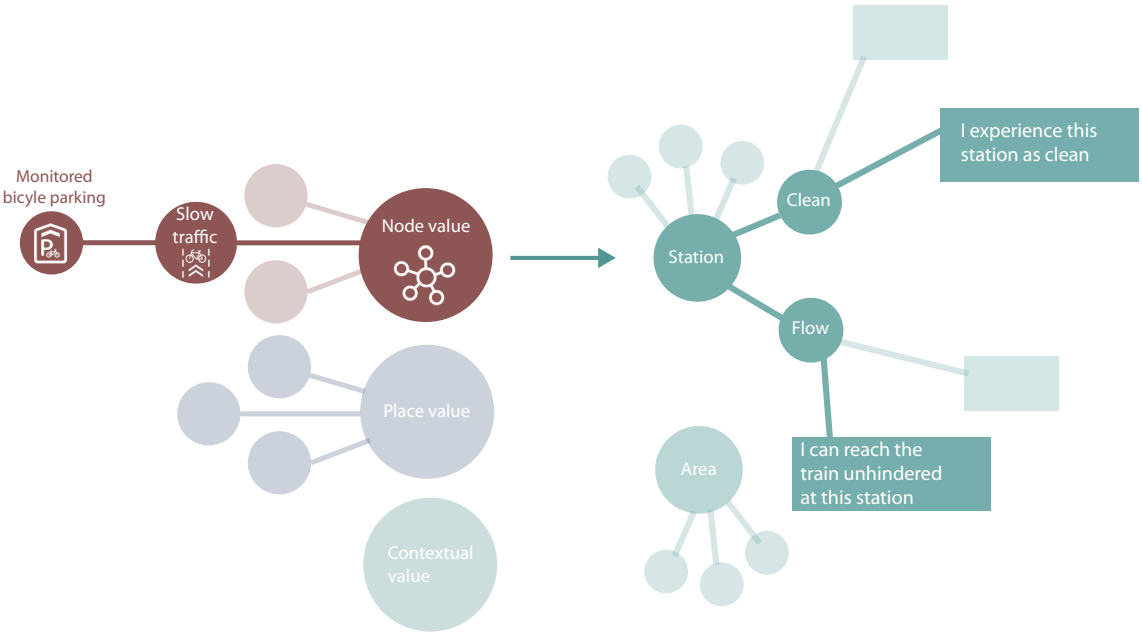


Figure 7.1.6: Detailed correlations: bycicle parking places (own ill.).

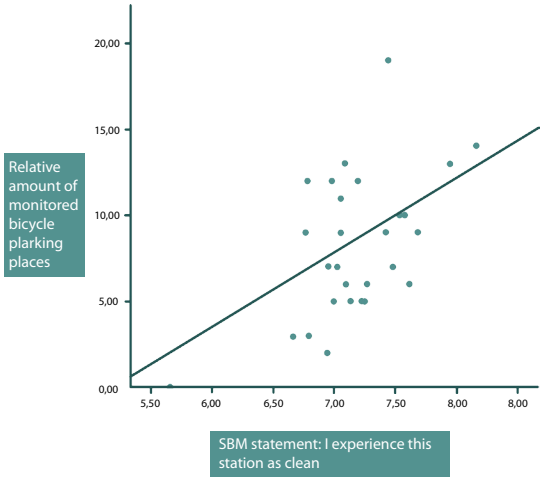


Figure 7.1.7: Scatterplot *bicycle parking places (monitored) - clean #1*

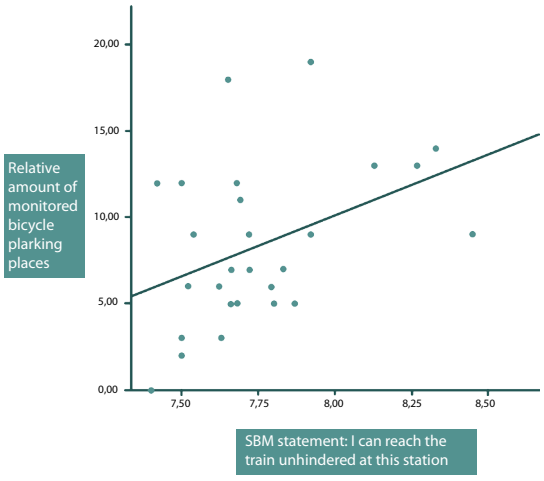


Figure 7.1.8: Scatterplot *bicycle parking places (monitored) - flow #2*

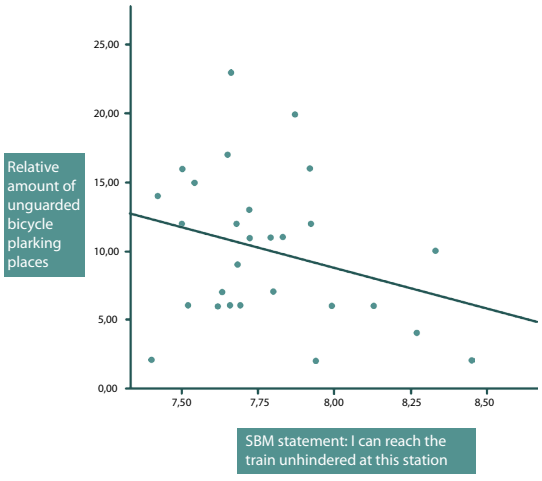


Figure 7.1.9: Scatterplot *bicycle parking places (unguarded) - flow #2*

Like stated in the previous paragraph, it may be the case that stations with more monitored bicycle parking places are on average larger, and that larger stations get rated higher in general. That is the reason that also the amount of parking places relative to the amount of travellers has been incorporated in the analysis. When using these numbers, it shows that the correlation is less significant. However, it also shows that the relative amount of unguarded bicycle parking places negatively correlate with the traveller experience. The absolute difference between either monitored and unguarded parking places is the largest for the statement 'I can reach the train unhindered at this station'. So, the more unguarded bicycle parking places are present at a station location, the more difficulty travellers experience on their way to the train. The reverse applies for monitored bicycle parking places.

In the detailed analysis of the themes 'roads' and 'public transport', no new insights were found. Regarding the three themes within the place value, the theme facilities is analysed in more detail.

Place value – facilities

In the initial analysis, it was stated that the variety of facilities positively correlate with almost every traveller experience theme, excluding *clean*. This section tells with which survey statements the variables *facilities* correlates the strongest.

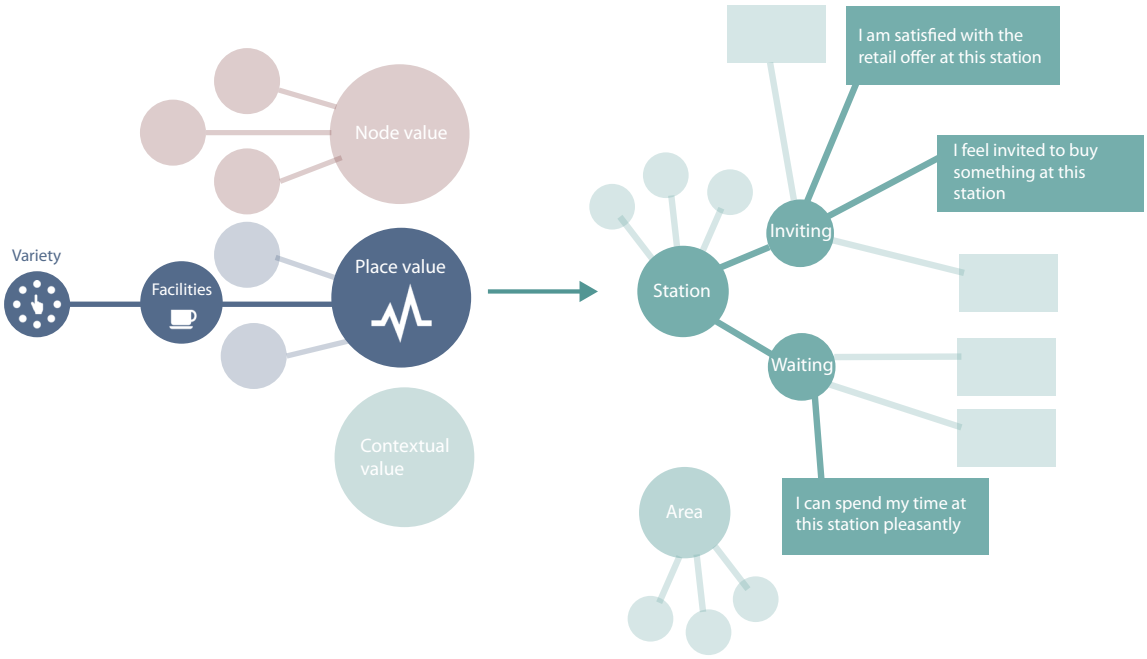


Figure 7.1.10: Detailed correlations: facilities (own ill.).

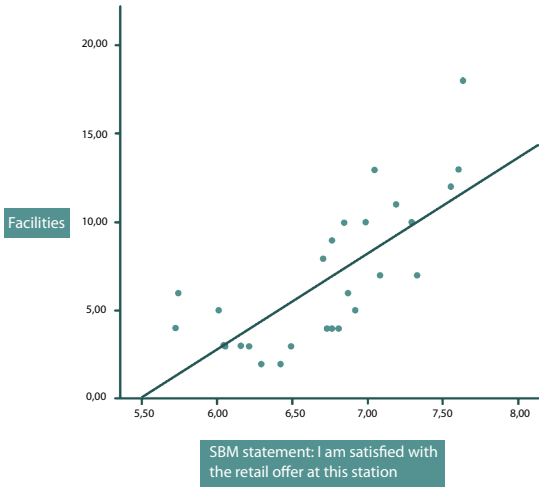


Figure 7.1.11: Scatterplot *facilities (variety) - inviting #3*

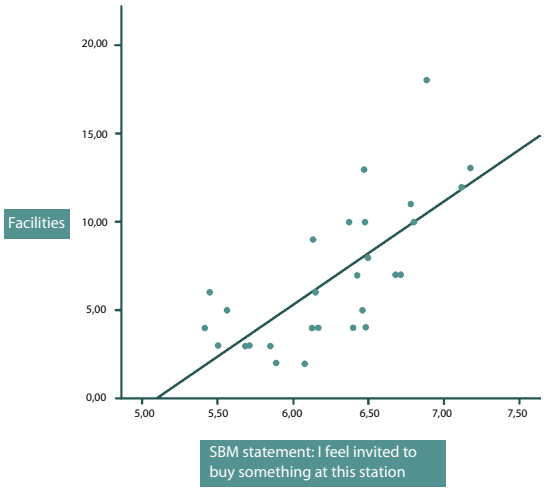


Figure 7.1.12: Scatterplot *facilities (variety) - inviting #4*

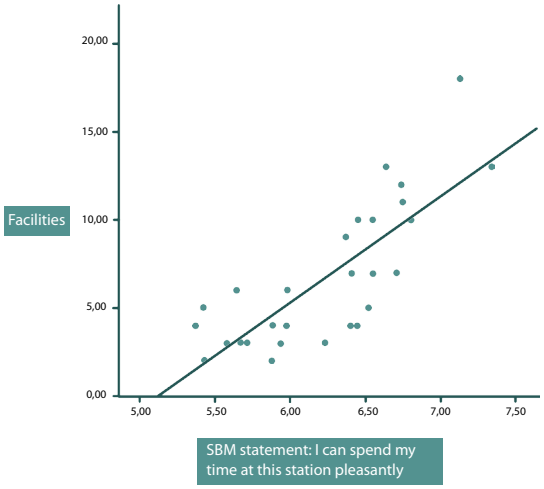


Figure 7.1.13: Scatterplot *facilities (variety) - waiting experience #1*

Within the theme *inviting*, the statements 'I am satisfied with the retail offer at this station' and 'I feel invited to buy something at this station' show a strong correlation with the theme facilities (fig. 7.1.10 - 7.1.13). As expected, a broader variety of facilities relate to the appreciation of the traveller with regard to the retail offer at the station. At least as interesting is the strongest correlation that was found, namely with the statement 'I can spend my time at this station pleasantly'. This implies that a broader variety of facilities generally relates to a higher appreciation of the time spent at a station location.

Contextual value – quality of life

The theme quality of life (which is part of the contextual value) also shows interesting relations with some of the survey statements. Now, the most significant correlations will be discussed.

The score on the theme quality of life is determined according to two variables: liveability and facilities. Striking is that, separately, these two variables only show a weak correlation with the survey statements. However, when the scores on both variables are added together, a strong correlation appears. This applies in particular to the statements that cover safety. The strongest correlation was found with the statement '*I feel safe at this station after 7 p.m.*' (fig. 7.1.14 - 7.1.15). Here, it concerns the safety of the railway station. Although for the station area also a positive correlation is found, it turned out to be weaker.

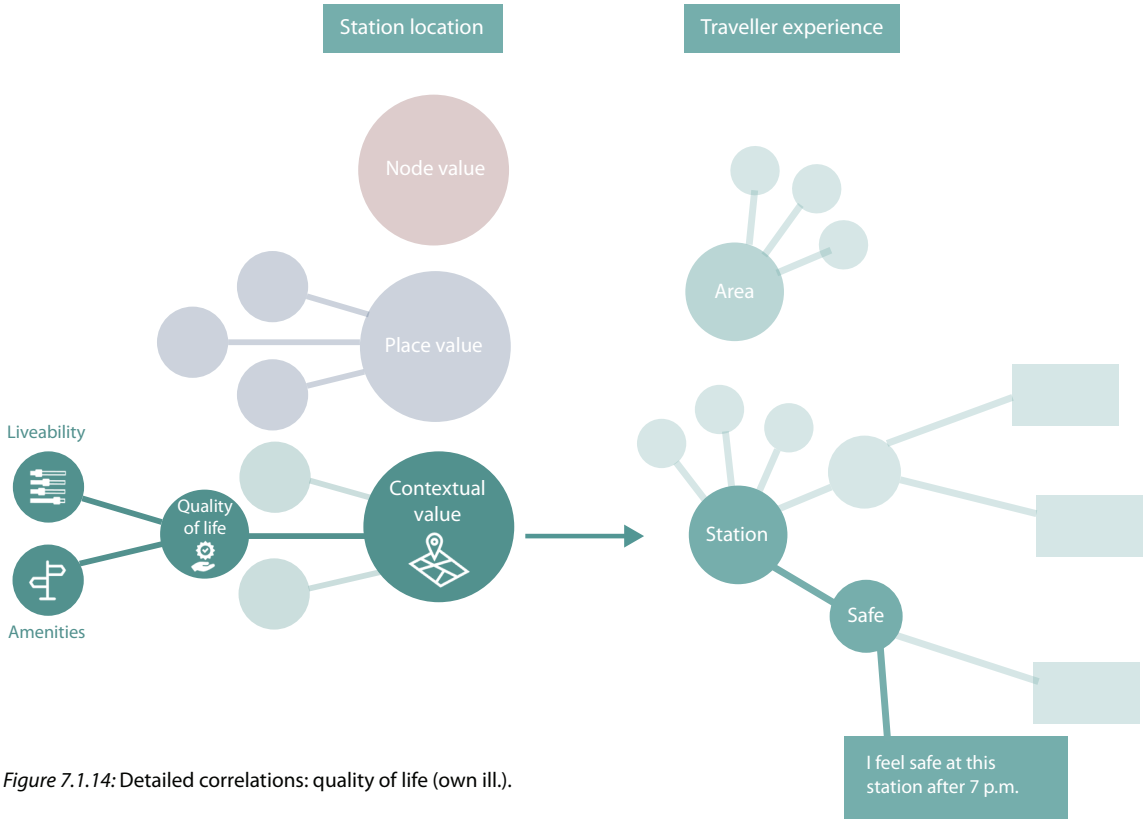


Figure 7.1.14: Detailed correlations: quality of life (own ill.).

This finding hints to a relation between the liveability, the level of amenities in the area and the traveller experience, particularly in terms of safety. When considering a combination of both the liveability and the level of amenities, the correlation with the safety statements can be labelled as strong.

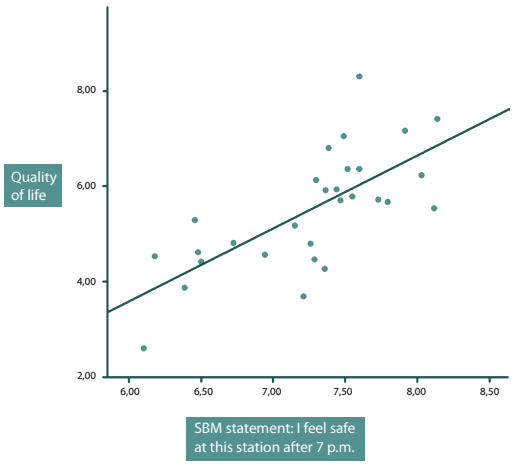


Figure 7.1.15: Scatterplot *quality of life - safe #1*

7.1.4 Correlation analysis: other

This section elaborates on the mutual relationships between the data within the two datasets (station location and traveller experience). Consequently, these correlations do not elaborate on direct relationships between the station location and the traveller experience, but rather on relationships within both datasets.

Station location
Within the data on the station location, one relation turns out to be interesting to mention. Within the contextual value, the variable 'liveability' negatively correlates with the theme 'urban transition' (which is built up from the two variables linearity and barriers) (fig. 7.1.16 - 7.1.17)

In other words, this means that in general, station locations that have a higher score on urban transition, and are thus better connected to the city centre, have a lower score on liveability. This implies that when there is a buffer zone between the city centre and the station, the liveability of the station location is generally higher.

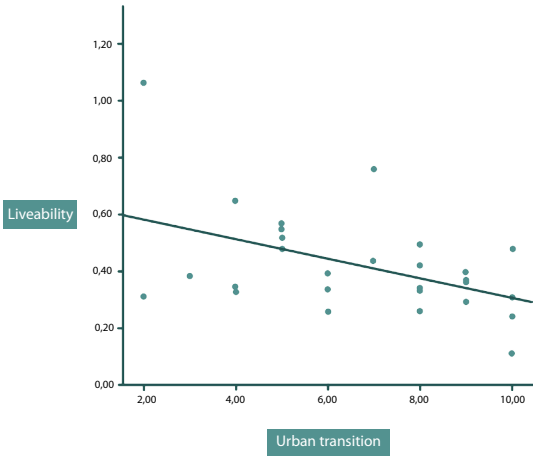


Figure 7.1.16: Detailed correlations: liveability - urban transition own ill.).

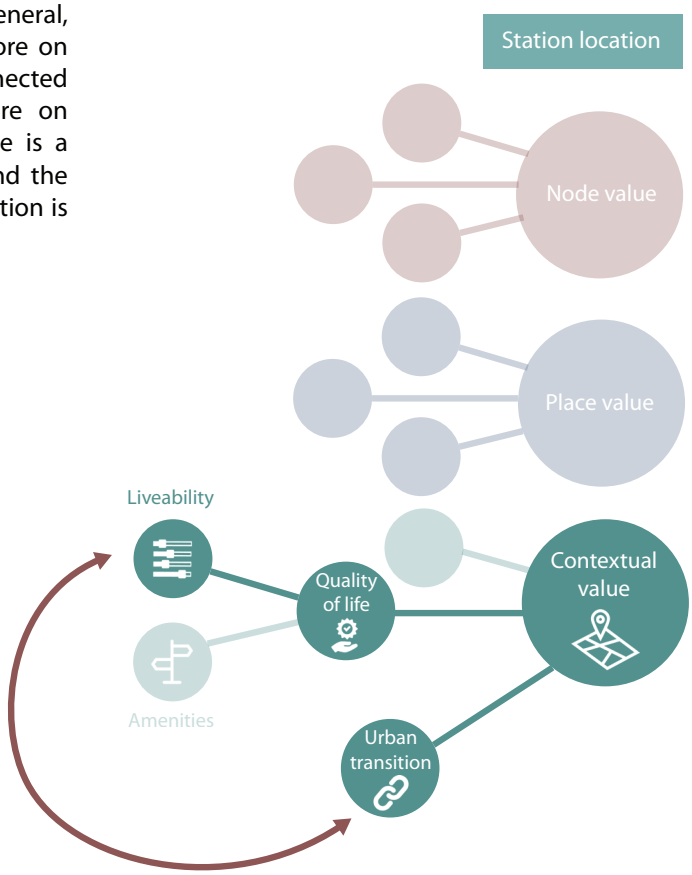


Figure 7.1.17: Detailed correlations: liveability - urban transition (own ill.).

Traveller experience

Within the data on the traveller experience, the relation between the general opinion statement and all the other statements is analysed, to find out which statements most strongly relate to the general station opinion. As expected, all survey statements significantly correlate with the general opinion statement. Therefore, only the most significant ones will be discussed (fig. 7.1.18).

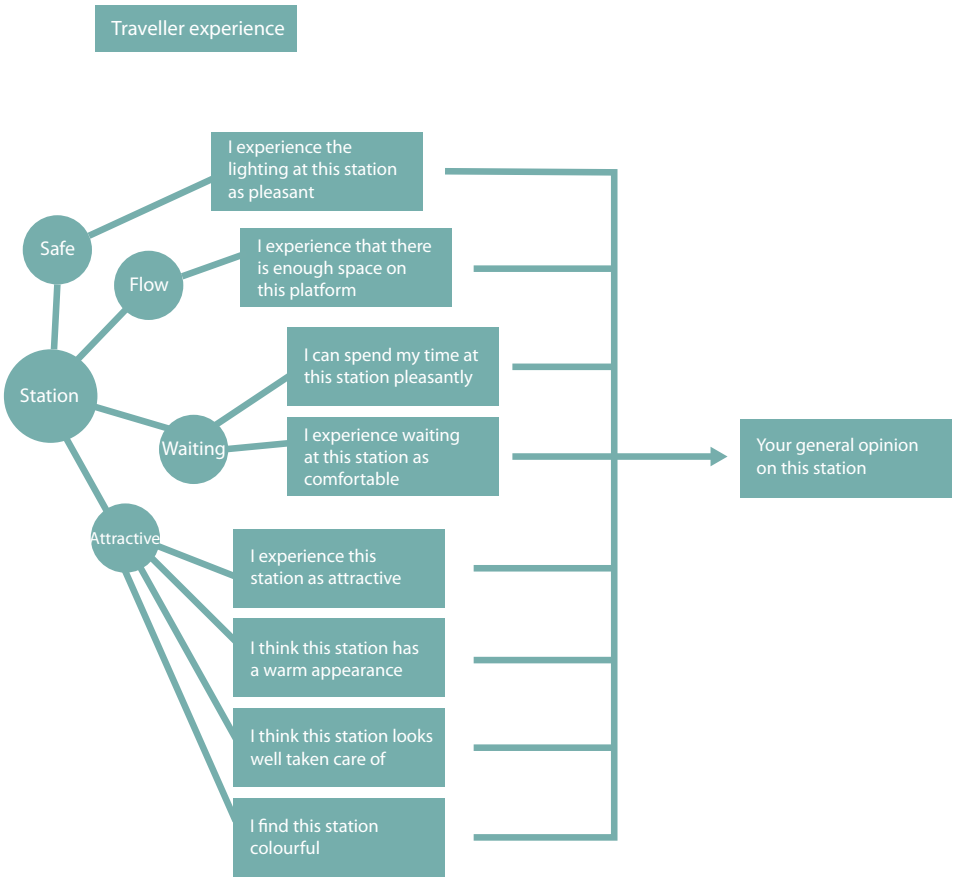


Figure 7.1.18: Detailed correlations: general opinion (own ill.).

Within the theme safe, the statement 'I experience the lighting at this station as pleasant' correlates significantly with the general opinion statement. Within the theme flow, the statement 'I experience that there is enough space on this platform' correlates significantly with the general opinion statement.

Within the theme waiting experience, both statements 'I can spend my time at this station pleasantly' and 'I experience waiting at this station as comfortable' correlate significantly with the general statement.

For the theme attractive, all four statements correlate significantly with the general opinion statement:'I experience this station as attractive', 'I think this station has a warm appearance', 'I think this station looks well taken care of' and 'I find this station colourful'. Consequently, the theme attractive relates most significantly to the general traveller opinion on this station.

These findings will later be used to assess the magnitude of the earlier findings in relation to the general opinion on station locations.

7.2 Qualitative analysis

7.2.1 Analysis method

In the previous chapter, relations between the two datasets of both the station location and the traveller experience have been analysed using a correlation analysis. Aim of this chapter was to discover quantitative patterns (e.g. the amount of monitored bicycle parking places relate to the traveller experience positively). In order to support these quantitative findings, this section will pay attention to the qualitative traveller experience data which is available.

A limited selection of station locations will be analysed by means of reviewing qualitative data that is collected among the travellers at these stations. This analysis is performed, not only to support the quantitative findings, but also to gain new insights that were not covered by the quantitative analysis. Firstly, the selection of stations is determined by performing a cluster analysis. Secondly, the qualitative data that is available of these stations is analysed.

7.2.2 Cluster analysis

Each station location offers its own distinctive characteristics, which distinguish it from other station locations. All 30 station locations are analysed and put into a cluster with station locations that offer comparable characteristics with regard to the node-, place- and contextual value. Within these clusters, station locations are comparable to each other to a certain extent, according to the quantitative assessment. Subsequently, in every cluster, one station location that has the highest general score, and one station location that has the lowest general score on traveller experience are selected to analyse in greater detail. This might provide interesting information, since these station locations offer comparable characteristics as other stations from the same cluster, but show a deviation in the traveller experience score.

For the cluster analysis, SPSS is used to classify all the type 2 station locations into four categories. These categories are based on similarities between the scores that were given to the various station locations according to the holistic assessment model. The scores on one theme (residents, part of the place value) are left out of the analysis, since it restrains the possibility to perform a decent cluster analysis. This is due to the fact that this the data for the theme residents is the least normally distributed. Earlier, this theme was not excluded from the various correlation tests, so as not to have to rule out a possible relation with the traveller experience in advance.

The results of the cluster analysis can be seen in the dendrogram in figure 7.2.1.

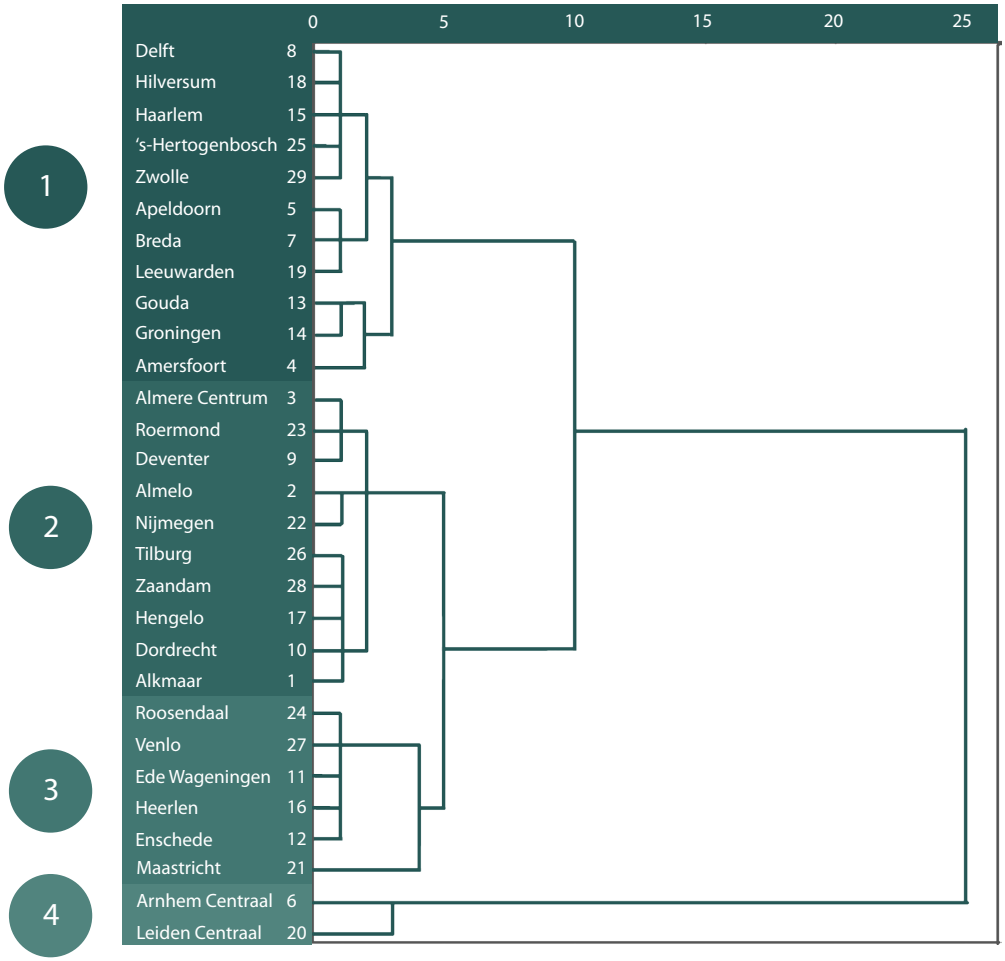


Figure 7.2.1: Cluster analysis dendrogram of type 2 station locations. (own ill.).

As a result, four clusters can be distinguished. Since the station locations that are placed within one cluster offer similar characteristics, the holistic assessment models in which the node-, place and contextual values are reflected also look alike to a certain extent. Furthermore, it is interesting that, apart from their station characteristics, the different station locations within each cluster have a certain similarity with regard to the geographical location in the Netherlands.

Figure 7.2.2: Cluster 1 collection - regional city stations (own ill.).

In figure 7.2.2, the collection of cluster 1 station locations is shown: the *regional city stations*. These station locations are typically characterised by having a high regional significance with regard to their node value. This is accompanied by a relative high place value.

Figure 7.2.3: Cluster 2 collection - peripheral city stations (own ill.).

In figure 7.2.3, the collection of cluster 2 station locations is shown: the *peripheral city stations*. These station location are typically characterised by having a relatively lower score on both the node and place value than the station location in cluster 1. Regional, these station location still have significance, but to a lesser extent.

Figure 7.2.4: Cluster 3 collection – border city stations (own ill.).

In figure 7.2.4, the collection of cluster 3 station locations is shown: the *border city stations*. These stations are typically located in the border regions of the Netherlands. These station locations are typically characterised by having both a low node value and a low place value.

In figure 7.2.5, the collection of cluster 4 station locations is shown: the *central city stations*. These station locations are typically characterised by having both a high node value and place value. For both station locations also applies that the average score on the contextual is relatively high.

Figure 7.2.5: Cluster 4 collection – central city stations (own ill.).

7.2.3 Best – Worst analysis

In the previous part, four clusters have been defined that each contain various station locations that offer similar characteristics according to the holistic assessment. The aim of this chapter is to learn more about those station locations that are appreciated differently by the traveller than the other stations from the same cluster. In other words: within every cluster, the station location with both the highest and the lowest traveller experience score are analysed in greater detail. This means that the qualitative data for the *'best'* and *'worst'* station location of every cluster is researched.

Cluster 1
Accordingly, within cluster 1, two station locations have been selected (fig. 7.2.6). The station with the highest score is the station of Delft. Although the station of Haarlem has an equally high score on the general opinion, Delft has a higher average score when looking at theme-specific scores. The station with the lowest score is the station of Gouda.

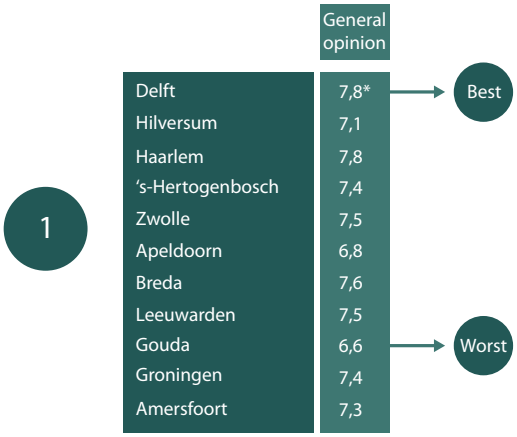


Figure 7.2.6: Best / worst assessment of cluster 1 stations.

In figure 7.2.7, both station locations have been displayed next to each other, including the holistic assessment model and an impression of both stations.

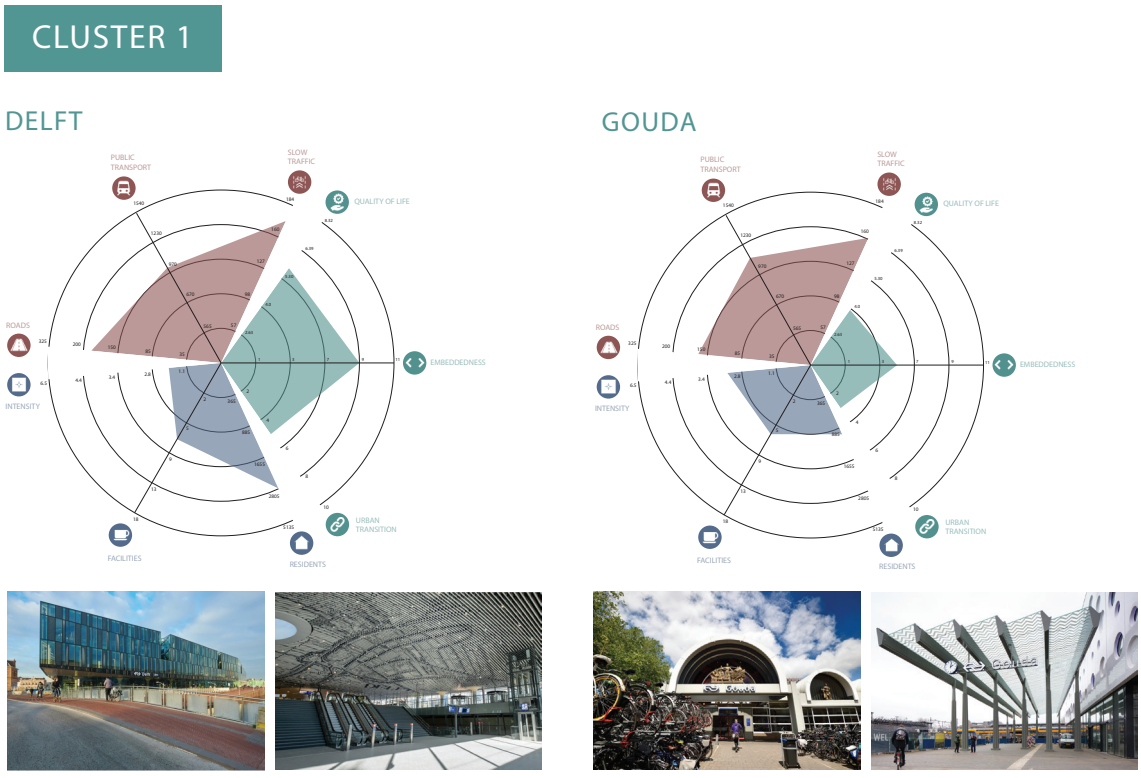
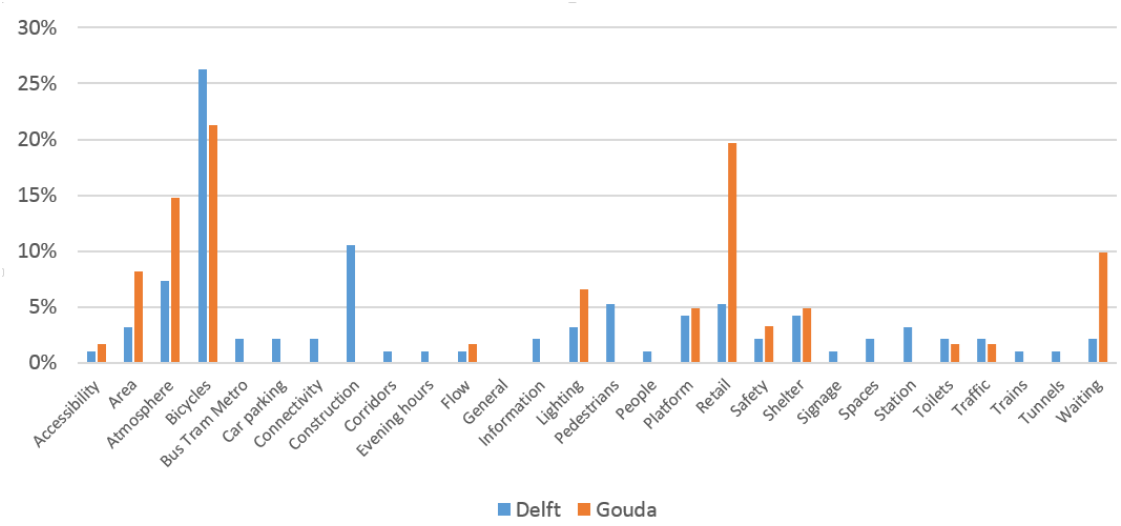


Figure 7.2.7: Best (Delft) / worst (Gouda) comparison in cluster 1.

Based on the holistic assessment models of both stations, a clear difference can be seen at the *contextual value* (green) side of the model. For all three themes within this value (*quality of life, embeddedness and urban transition*), station Delft has a higher score. Particularly regarding the theme *quality of life,* this finding corresponds with the findings of the quantitative analysis, in which a relation between this theme and the enhancement of the traveller experience is identified.

In order to understand better why travellers value the station of Delft so differently than the station of Gouda, the qualitative data collected in the survey of the station experience monitor (SBM) is consulted. In each survey, travellers are asked to provide any recommendations on things that they think should be improved at that station. In this question, no specific direction is requested, which means that travellers can mention every comment they have regarding the station(area).

All answers have been classified to one of the 35 categories that have been defined. In appendix G, the distribution of the answers of both the stations of Delft and Gouda are displayed. It is now interesting to see in which category the most travellers at these station see room for improvement. Graph 7.2.1 shows the percentage of remarks that are given within every category at both the stations of Delft and Gouda.



Graph 7.2.1: Percentage of remarks given in every category at the station of Delft and Gouda.

Although both stations are valued very different by the traveller, graph 7.2.1 shows that at both stations the largest relative share of comments is made in the field of *bicycles*. This supports the finding from the quantitative analysis, in which a strong relation between the amount of *monitored bicycles parking places* and the traveller experience is determined. Furthermore, although the bicycle parking at station Delft is less than five years old and meets modern guidelines, bicycle storage is still a great point of attention for many travellers. Also, many travellers at station Delft mention the inconvenience caused by *construction* works that are still going on, especially in the station area. Overall, the remarks made at station Delft are more widespread than those at station Gouda. Figure 7.2.8 shows some remarks made by travellers at station Delft.

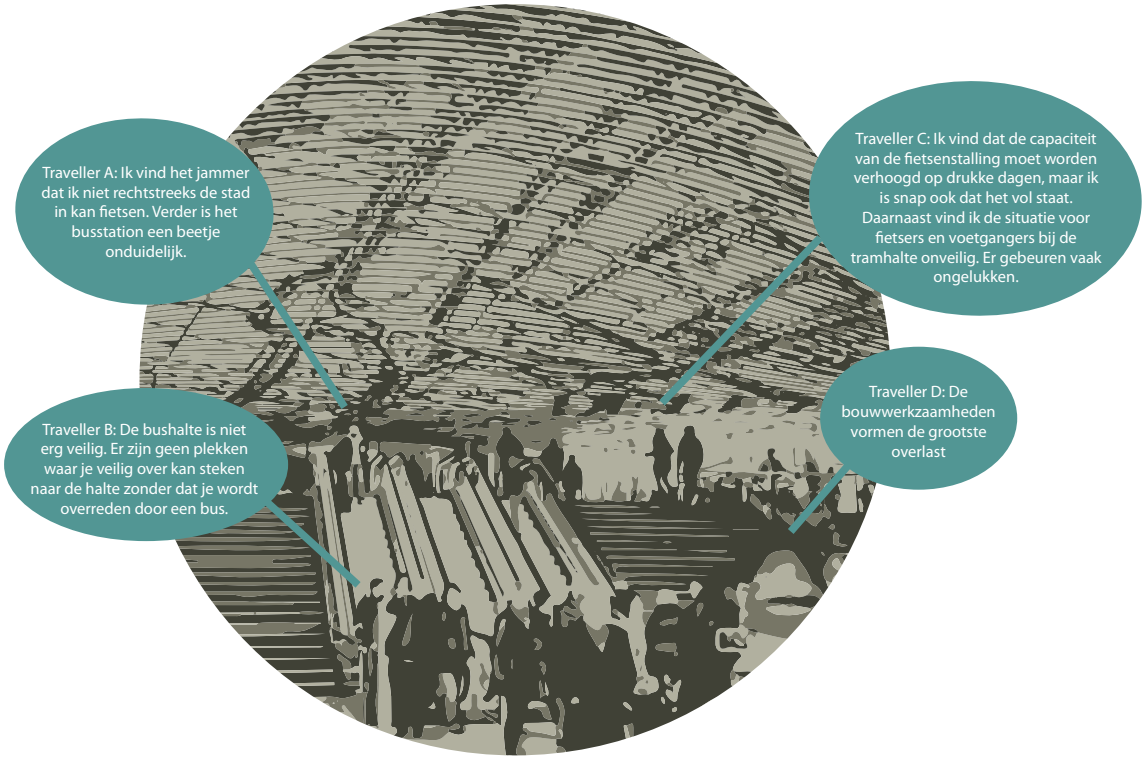


Figure 7.2.8: Traveller remarks made at station Delft (own ill.).

Like stated, also at station Gouda many travellers make remarks in the field of *bicycles*. Here, a large bicycle parking is situated right in front of the station, which causes that the square in front of the station has an unattractive and messy appearance. Also, remarks are made in other categories, like in the field of *retail*. Many travellers would like to see a larger range of shops, which improves the liveliness of the station. This supports the finding from the quantitative analysis, in which a strong relation between the *variety of facilities* (retail offer) relates to a higher traveller experience. At station Gouda, this finding is particularly supported, since the variety of facilities is currently relatively low. When taking findings from both the quantitative and qualitative analysis into consideration, it can be assumed that this is an important causal reason for the low score on traveller experience. Other comments made by travellers at Gouda station mainly focus on the themes of *waiting, atmosphere and area*. The answers are less widespread then at station Delft, which may indicate that there are stronger focus points at station Gouda that attention should be paid to. Figure 7.2.9 shows some remarks made by travellers at station Gouda.

Figure 7.2.9: Traveller remarks made at station Gouda (own ill.).

Cluster 2

Also within cluster 2, two station locations have been selected (fig. 7.2.10). The station with the highest score is the station of Alkmaar. Although the station of Nijmegen has an equally high score on the general opinion, Alkmaar has a higher average score when looking at theme-specific scores. The station with the lowest score is the station of Almere Centrum.

In figure 7.2.11, both station locations have been displayed next to each other, including the holistic assessment model and an impression of both stations.

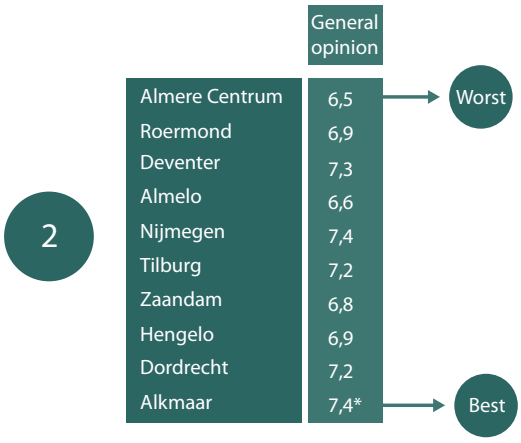


Figure 7.2.10: Best / worst assessment of cluster 2 stations.

CLUSTER 2

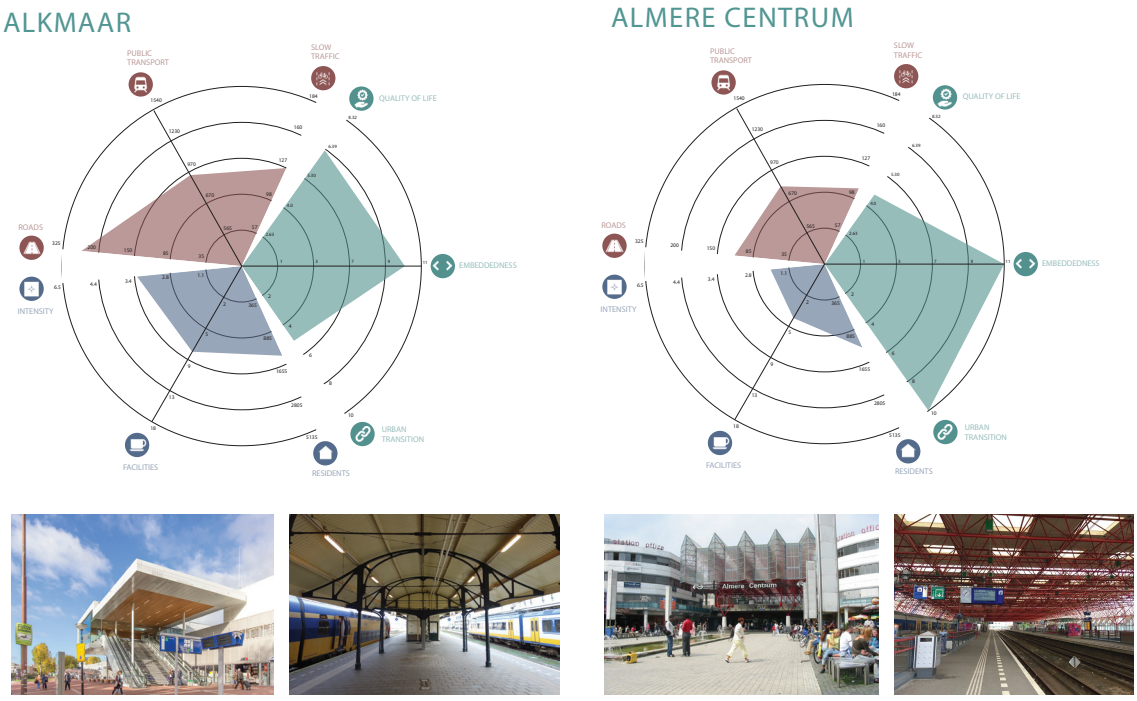
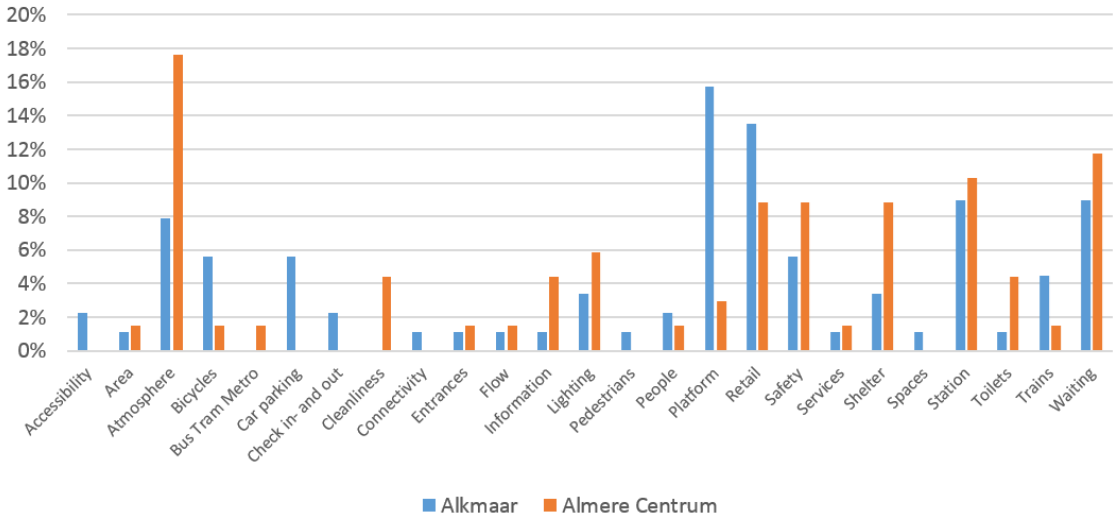


Figure 7.2.11: Best (Alkmaar) / worst (Almere Centrum) comparison in cluster 2.

Similar to the stations from cluster 1, it turns out that the best station has a higher score on the theme *quality of life*. This again supports the quantitative relation that was identified in the previous chapter. In appendix G, the distribution of the answers of both the stations of Alkmaar and Almere Centrum are displayed.

It is now interesting to see in which category the most travellers at these station see room for improvement. Graph 7.2.2 shows the percentage of remarks that are given within every category at both the stations of Alkmaar and Almere Centrum.



Graph 7.2.2: Percentage of remarks given in every category at the station of Alkmaar and Almere Centrum.

One matter that can be noticed right away is that for these stations from cluster 2 compared to the stations from cluster 1, the theme bicycles is a much less mentioned point of attention for travellers. It must be noted that stations in cluster 2 generally serve less travellers than those in cluster 1, which may cause that bicycle storage is more of a challenge at stations in cluster 1.

When considering station Alkmaar, the theme that is most often mentioned is the theme *platform*. Many remarks are made about the lack of good waiting facilities on platform 1, such as seating. Also, the connection to the other platforms seems to be insufficient. Furthermore, travellers give remarks on the retail offer. According to many, more shops should be present at this station and the offer should be less expensive. Figure 7.2.12 shows some remarks made by travellers at station Alkmaar.

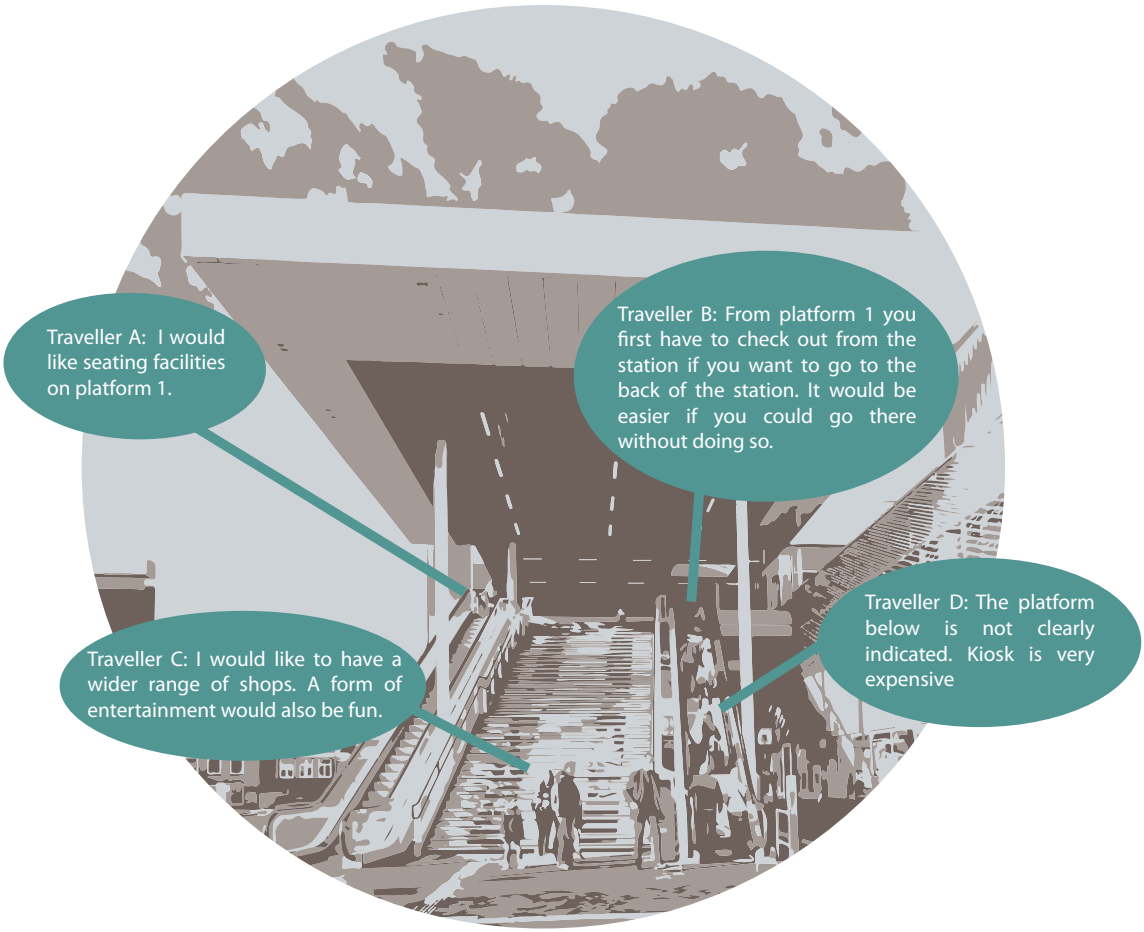


Figure 7.2.12: Traveller remarks made at station Alkmaar (own ill.).

At station Almere Centrum, the theme *atmosphere* is mentioned frequently. Travelers give as a remark that they think that the station should be more cosy and incorporate more green and colour. This is related to the frequently mentioned theme *waiting*. However, within this theme travellers also mention the lack of proper seating facilities. The other themes that are mentioned several times are *retail, safety, shelter and station (general).* Also for cluster 2 applies that the answers for the *best* station are more widespread that the answers for the *worst* station. This may indicate that there are stronger focus points at station Almere Centrum that attention should be paid to. Figure 7.2.13 shows some remarks made by travellers at station Almere Centrum.

Figure 7.2.13: Traveller remarks made at station Almere Centrum (own ill.).

Cluster 3

Also within cluster 3, two station locations have been selected (fig. 7.2.14). The station with the highest score is the station of Maastricht. Although the station of Heerlen has an equally high score on the general opinion, Maastricht has a higher average score when looking at theme-specific scores. The station with the lowest score is the station of Venlo. Although station Ede-Wageningen has an equal score on both the general opinion and the theme specific scores, station Venlo is selected since it rather classifies as a border city station.

In figure 7.2.15, both station locations have been displayed next to each other, including the holistic assessment model and an impression of both stations.

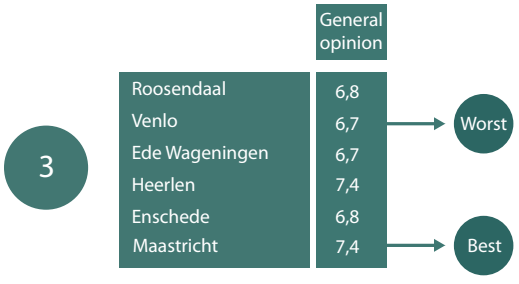
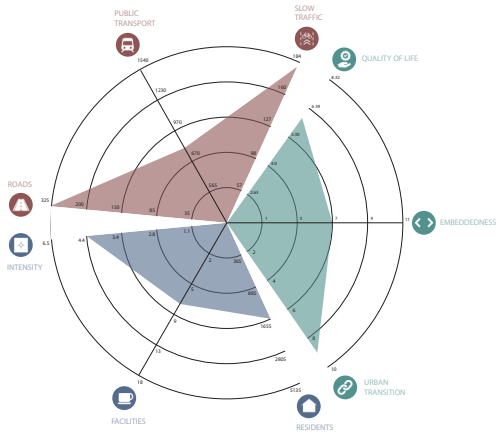


Figure 7.2.14: Best / worst assessment of cluster 3 stations.

CLUSTER 3

MAASTRICHT



VENLO

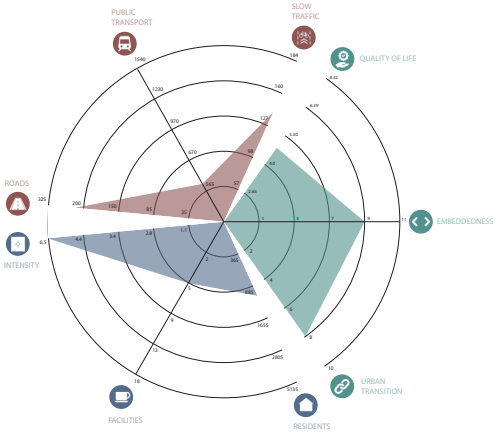
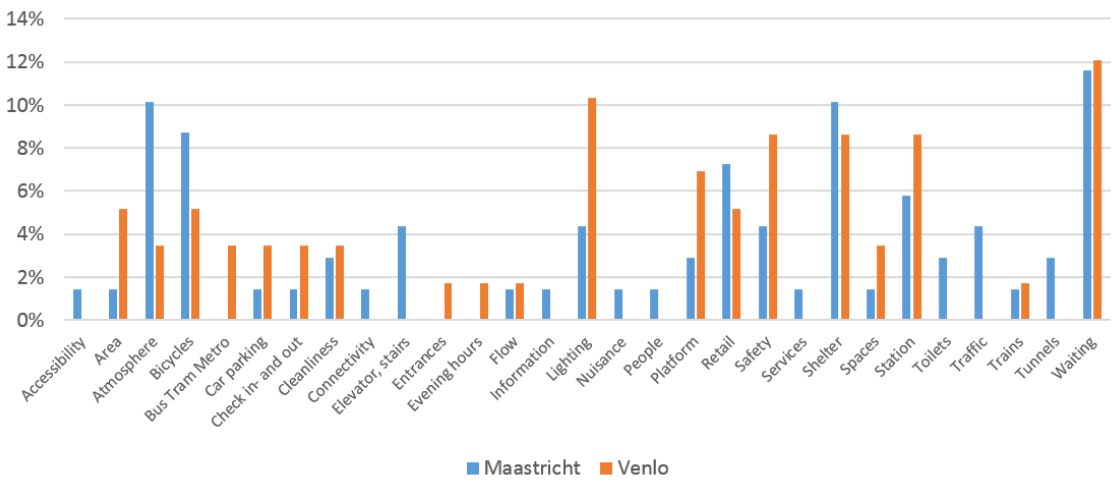


Figure 7.2.15: Best (Maastricht) / worst (Venlo) comparison in cluster 3.

Once more, the score on the theme *quality of life* is higher at station Maastricht, like it is also the case for the *best* stations from cluster 1 and 2. In appendix G, the distribution of the answers of both the stations of Maastricht and Venlo are displayed. It is now interesting to see in which category the most travellers at these station see room for improvement. Graph 7.2.3 shows the percentage of remarks that are given within every category at both the stations of Maastricht and Venlo.



Graph 7.2.3: Percentage of remarks given in every category at the station of Maastricht and Venlo.

For the selected stations from cluster 3, the reactions of travellers are more spread over various themes than for the station from the other clusters. However, there are some interesting results. Overall, for both stations, the theme *waiting* is a frequently mentioned point of attention. The remarks with regard to waiting facilities mainly concern the provision of covered and comfortable waiting places at platforms. This relates to another theme that is often mentioned, namely *shelter*. In this regard, travellers mention that they would like to have more protection from wind and rain at both stations. Furthermore, at station Maastricht, a frequently mentioned theme is *atmosphere*. Travelers would like to see more green and liveliness at this station. Lastly, the within the themes *bicycles* and *retail* there are points of attention according to many travellers. Figure 7.2.16 shows a selection of remarks made by travellers at station Maastricht.

Figure 7.2.16: Traveller remarks made at station Maastricht (own ill.).

At station Venlo, many travellers point out that they think the *lighting* at the station should be improved, particularly the lighting at the square in front of the station and the bicycle lanes. This relates to the theme *safety*, which is also frequently mentioned by travellers at station Venlo. Travelers speak of a feeling of discomfort that is caused, among other things, by the lack of good lighting and cameras. Lastly, travellers point out that in *general*, the station is outdated and ready for a makeover. Figure 7.2.17 shows a selection of remarks made by travellers at station Venlo.

Overall it can be stated that the main points of attention at station Maastricht can be classified within the *satisfier themes (waiting, attractive and inviting)*, whereas at station Venlo most points of attention can be classified within the *dissatisfier themes (clean, safe and functional)*.

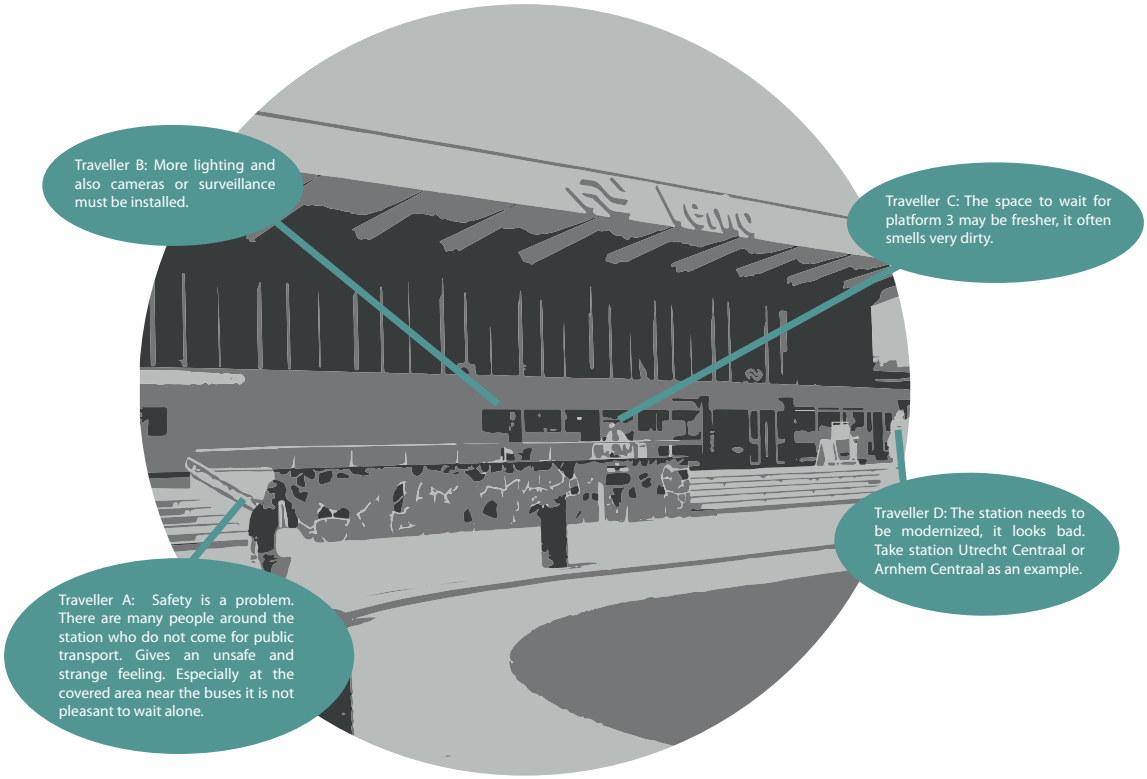


Figure 7.2.17: Traveller remarks made at station Venlo (own ill.).

CHAPTER 08
CONCLUSION

CHAPTER 08

In the previous chapter, the findings have been discussed. It is now time to see how these findings can be interpreted in order to answer the research question of this study. In this chapter, the conclusion will be presented.

CHAPTER 08
CONCLUSION

The aim of this research is to contribute to the field of knowledge concerning the composition of Dutch station locations, and how its elements relate to the enhancement of the traveller experience. Stakeholders that crowd station location developments can use this knowledge in their decision making processes. The main research question was formulated as follows:

Which elements at Dutch station locations can be identified that relate to the enhancement of the traveller experience?

In order to answer this question, both the station location and the traveller experience have been modelled in this research, so they can be compared to one another. Regarding the station location, this has been done by composing a holistic model in which a range of station properties has been made measurable. Regarding the traveller experience, this has been done by using survey results collected among travellers at station locations. The survey was set up, based on traveller experience theories. In a quantitative correlation analysis, patterns between the collected data on both the station location and the traveller experience have been analysed. Besides, a qualitative analysis has been performed in order to support the findings of the quantitative analysis. Below, based on the findings of both analyses and within the scope of this research, critical elements at Dutch station locations that relate to the enhancement of the traveller experience are presented.

The conclusions below are based on correlation analyses, supported by qualitative research. It must be explicitly stated that, although there are relationships between variables, these cannot be called causal relationships. The research framework is so broad and exploratively arranged that a controlled experiment in which dependent variables are tested against each other is not possible within this scope. The identified relationships should be interpreted freely within the framework that has been introduced in this study.

"Whenever a correlation is observed, or a correlation coefficient is computed, let it be remembered first, last and all the time, that it measures nothing, except statistical association between variables, no matter how glamorous or seductive the suggestion of causal relationship may seem." (Pearson, 1857-1936).

Bicycle parking places

It can be concluded that the provision of bicycle parking places at the analysed railway stations moderately relates to the extent to which travellers appreciate the station (fig. 8.1.1). In the holistic assessment model, a distinction was made between monitored and unguarded bicycle parking places. These two variables show opposite results in the quantitative analysis. In general, stations with relatively more *unguarded* bicycle parking facilities are appreciated lower by the traveller, while stations with relatively more *monitored* bicycle parking facilities are rated higher. This applies in particular to the perception of cleanliness and convenience at the station.

These findings are solidly supported by the qualitative analysis, in which travellers' recommendation with regard to the station location are analysed. Especially in Dutch university cities, bicycle parking is often a point of attention, both at stations that are generally rated high and low by the traveller. In particular in the comparison of the station locations at Delft and Gouda, it appears that a significant number of travellers at both stations notice that the bicycle parking facilities are inadequate. However, this only results in a remarkably *low* score in terms of traveller experience at station Gouda. Considering the fact that there are relatively more *unguarded* bicycle parking facilities at station Gouda than at station Delft, this supports the findings of the quantitative analysis.

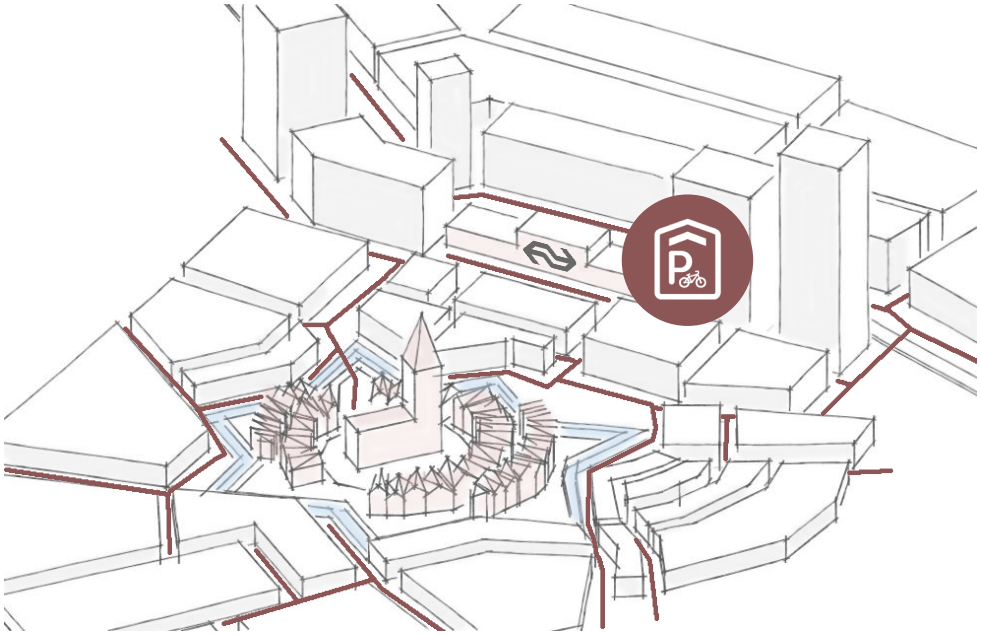


Figure 8.1.1: Bicycle parking places as part of the slow traffic network (own. ill).

Facilities

A second key element that strongly relates to the enhancement of the traveller experience is the variety of facilities offered at a station (fig. 8.1.2). Here, it concerns the retail offer within the station building. The quantitative analysis points out that the broader the variety of the retail offer, the higher the station is rated by travellers. This particularly applies to the themes *inviting* and *waiting time experience*. When regarding the latter, particularly reactions to the survey statement *'I can spend my time pleasantly at this station'* are related to the variety of shops offered at a station.

The qualitative analysis supports this finding. Many travellers notice that there should be more shops at various stations. However, the qualitative analysis shows that remarks about the retail offer are mentioned at both stations that have a high and low score on the traveller experience. This may be due to the fact that the retail offer at the station can be seen as a *satisfier*. This means that when all other 'basic

needs' are in order (safe, clean and functional, also called *dissatisfiers*), travellers will especially notice things like a retail offer. However, this does not immediately have a negative effect on their judgement of the station. At stations that have a low score, travellers will firstly notice one of the basic needs if it is not taken care of, before they will comment on things like the retail offer. In this case, the lack of one or more basic needs negatively influences the judgment (dissatisfaction).

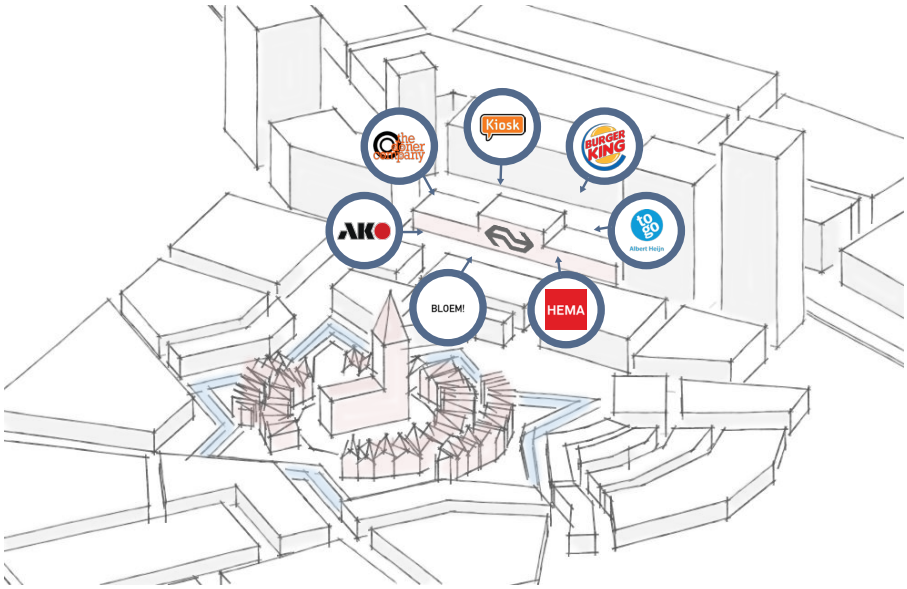


Figure 8.1.2: Variety of facilities at the station (own. ill).

Overall, it can be said that travellers appreciate places at stations where they can buy food and drinks that are not too expensive. Besides, a healthy offer is often requested. Preferably, travellers like to have a possibility to sit down to spend their waiting time comfortably. Since this theme strongly relates to the statement '*I can spend my time pleasantly at this station*', it is assumed to be an important potential enhancer of the passenger experience, when regarding the model in which the valuation of time is displayed (fig. 8.1.3). Besides, this is emphasized because the statement relates significantly to the general station opinion according to findings in section 7.1.4.

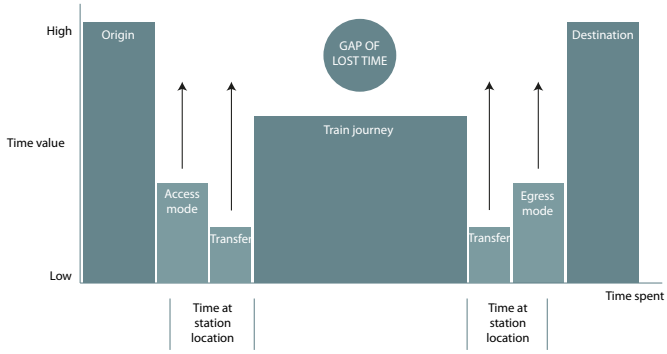


Figure 8.1.3: Appreciation of time in the door-to-door journey (Van Hagen, 2011).

Quality of life

Thirdly, the quality of life in the station area is determined to have a significant relation with the traveller experience. In contrast to the previous two elements (b*icycle parking & facilities*), here it concerns a combination of two elements that is positively related to the traveller experience. These two elements are *liveability* and *amenities* (fig. 8.1.4).

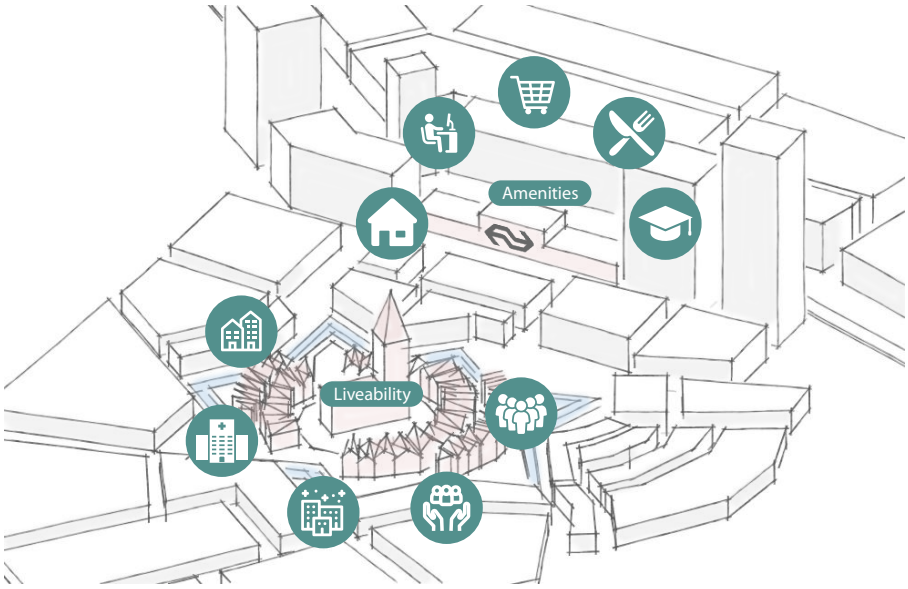


Figure 8.1.4: Aspects involved in the theme *quality of life* (own ill.).

It is particularly interesting that the relation is stronger when considering a combination of both elements. In this regard, and according to the theory of Van Hagen (2011) (fig. 8.1.5), the variable *liveability* could be seen as a as a degree to which the basic elements in the environment are in order. This includes safety and population. In contrast, the variable *amenities* is about the presence of various functions around the station. A wide variety of functions can provide added value. This statement is recognizable in terms of traveller experience. In this way, the *liveability* can be seen as a *dissatisfier*, and the presence of *amenities* as a *satisfier*. The liveability must be of a sufficient level before travellers can appreciate added value in the station environment.

This statement is supported by qualitative findings. At stations that are valued low by travellers, many notice shortcomings in the direct station environment. At both the stations of Almere Centrum and Venlo, travellers mention the safety of the station area as a main problem. Although on other contextual themes these stations have high scores, this is often not reflected in the traveller experience score. Thus, when the quality of life in the direct vicinity is low, the station is often valued low, regardless of whether the station is well embedded or has a good connection to the city centre.

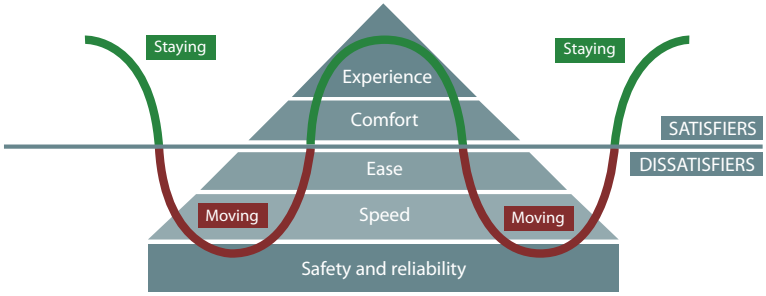


Fig. 8.1.5: Customer demand pyramid for railway stations (Van Hagen, 2011).

Liveability – urban transition

Another interesting relation that was found in the quantitative analysis, is the negative correlation between the liveability of the area and the score on urban transition. This finding implies that stations that are better connected to the city centre, often have a lower score on the theme liveability. A striking example for this is station Almere Centrum, which is also valued lowest within cluster 2. This station has the highest possible score on urban transition, while it has the lowest score on the liveability (when not taking station Den Haag HS in consideration). In other words, travellers can most easily walk from the station to the city centre, but also encounter an area that is underperforming in the field of safety, population, physical environment, etc. If, based on the conclusions in the previous section, it can be assumed that liveability acts as a *dissatisfier,* it is a condition that the liveability around a station meets the standards before a traveller will value the station location higher and appreciate qualities like a good connection to the city centre.

CHAPTER 09
DISCUSSION

CHAPTER 09

In the previous chapter, the conclusion has been presented. It is now time to see how the findings can be interpreted in a broader societal framework. In this chapter, the discussion will be presented.

9.1 Limitations of the research

As a result of the defined scope and applied research methodology, the research knows several limitations which are further explained below.

Scope
In this research, both the station location and the traveller experience are regarded to from a holistic point of view. This entails a very broad perception of both concepts, which has in turn brought along some challenges. In the section below, this will be discussed.

At station locations, travellers encounter many elements. This varies from *material* things (such as a bicycle parking, shops, ticket counters) to much more *immaterial* things (such as the climate, colour, odour). Not all of these things (particularly the immaterial elements) can be measured objectively. Therefore, partly based on existing theories and operationalisations, a collection of elements has been selected to measure. For this limited range of elements, the connection with the traveller experience has been made, in order to identify patterns.

The traveller experience data is based on the survey which has been composed by NS and ProRail. The questions, or statements, which are present in the survey, are based on the traveller experience theories that were also presented in this study. These theories do not correspond one-to-one with the theories that were used to model the station location. As a result, the elements that are measured at the station location cannot always be directly linked to the questions asked in the survey. However, this does not apply to all elements that are part of the holistic assessment. As a consequence, not all elements of the holistic assessment are critically related to the statements from the traveller survey. However, this is also what gives the research an exploratory character.

Thus, in terms of the scope, the broad perception of the station location which entails both the station building and the direct environment, has on the one hand caused difficulties for the operationalisation, but on the other hand has enabled the possibility to identify the most crucial elements in a very broad terrain.

Case selection
Within this research, thirty station locations were analysed according to the holistic assessment models. These station locations were selected according to the classification that was introduced by NS. This was done due to the comparability between these station locations and the possibility of applying the holistic model to these stations. However, the decision to use comparable stations has also caused some limitations. Based on the data about traveller experience, it appears that station locations that belong to a different type more often show a remarkably high or low score.

An example of this are the type 3 stations, also called the suburban stations, such as Amsterdam Lelylaan and Schiedam Centrum. Apart from the fact that these stations are comparable in a different way, they are generally also rated *lower* by the traveller. The opposite can be seen at the type 1 stations (very large station in the centre of a big city), such as Utrecht Central and Rotterdam Central. These stations are generally rated fairly *higher* by the traveller. By also including these stations in the analysis, perhaps more striking results could have been found. However, since the operationalisation of this study is specifically pointed towards type 2 stations, this would require a critical review of the applied method.

Methodology
It has been decided to execute this research in a quantitative manner. This means that the analyses have been carried out, based on data. The prerequisite for this was to collect data on the various elements that compose a station location. Like it has also been mentioned with regard to the scope limitations, the operationalisation has been carried out by such means that only measurable variables have been investigated, while there are several other elements that cannot be measured, but are likely to be related to the degree of a good traveller experience. The absence of these elements in this study is therefore a direct consequence of the choice to conduct a quantitative study in the basics.

In addition, the data about the station location and the traveller experience were compared with each other by carrying out correlation analyses. As mentioned in the chapter with the findings, no causal relationships can be proven based on correlation analyses. The qualitative analysis based on the clusters was carried out to reinforce the quantitative relationships. However, even this addition did not lead to the possibility of making causal connections in this study. It must therefore be explicitly stated that the results presented in this study can be interpreted freely, but within the scope that was set in this study.

9.2 Relevance of the research

In the introduction of this research, it was stated that more insight into elements that relate to the enhancement of the traveller experience is crucial in order to improve station locations as a whole. However, a scientific substantiation on the most contributory factors often seems to be missing. Given the many developments in and around railway stations in the Netherlands, there is relevance for doing scientific and specific research on this subject. *In particular* it is interesting to know more about the role of the station environment in relation to the traveller experience, since it cannot be viewed separately from the railway station itself.

Although the findings of this research cannot be regarded to as causal relationships, they can be used by stakeholders to substantiate their decisions with regard to station location developments. An example may be that stakeholders are encouraged to make sure that first the basic elements of a station environment are taken care of (so the degree of liveability of the area is improved) before they lay their focus on adding value by providing additional functions. However, most important conclusions that are found in this study could be seen as logical or as expected. The added value of this research is therefore mainly in the field of statistical substantiation and not in the field of the discovery of new insights.

Apart from the empirical findings that this research has brought forward, another useful outcome is the introduction of the holistic assessment model for station locations. Since the author aimed to approach the station location from an integral point of view, and thus also considered the direct station environment as relevant, it was necessary to include this aspect in the assessment model that was used to collect data. This model is an adaptation and extension to the existing node-place model by Bertolini (1998). The node-place model particularly focuses on the extent to which the station location is as a node connected in various manners and as a place a centre of activity. It does not provide information about various aspects that relate to the station environment, such as the degree of liveability of the area and the quality of the connection to the city centre. Therefore, next to the node and place values, a third value, the contextual value, has been included in the model. This value consists, like the other two values, out of three themes that have been operationalised in this research. As a result, the holistic assessment has been introduced, which not only includes the node and place value, but also the contextual value. By doing so, this research contributes to the collection of theories that exist about station locations and attempts to provide an operationalisation that regards the station location in an integral way.

9.3 Review of findings

Regarding the answer to the research question, several important elements were identified that relate to the enhancement of the traveller experience at station locations. These conclusions were found within the framework and according to the assumption made in this research. The application in practice can show whether the measures that are prescribed in this study are indeed useful or not. For this reason, several findings have been discussed with specialists in station development to test the validity of the results. Firstly, an expert panel from the planning department of the Dutch Railways was consulted to criticize the results that were found in this study. Secondly, the findings of the research were reviewed by the representatives of two municipalities: Almere and Heerlen. For both municipalities, a specified assessment of the station location in that city was presented and discussed.

9.3.1 NS Planning Expert Panel

Bicycles at Dutch station locations

According to experts from NS, the challenges with regard to bicycles are probably one of the most crucial aspects at Dutch station locations (fig. 9.3.1). At many stations in the Netherlands, the main pre-transport mode is the bicycle. The percentage of travellers that get to the station by bike is often around 50% (NS, 2019). In university cities, this percentage is even higher. The provision of adequate bicycle facilities is crucial according to the NS, especially at those cities. This is supported by the fact that the qualitative analysis points out that in multiple university cities, such as Delft and Maastricht, a significant part of the travellers mention the bicycle facilities as a point of attention.

This not only applies to the bicycle parking, but also to the bicycle infrastructure and the provision of OV rental bikes. Among the specialists, it is expected that the general opinion of the traveller may be influenced so heavily by their opinion on bicycle facilities, that it may be useful to also execute this study, but leave out the bicycle aspect in order to identify other crucial elements.

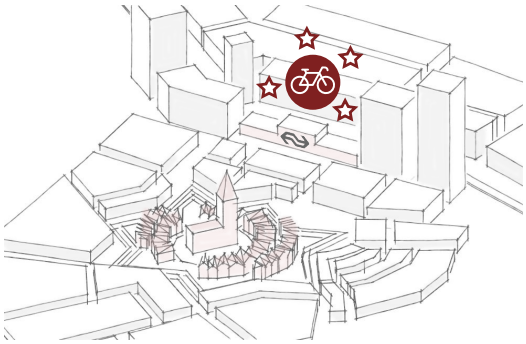


Fig. 9.3.1: Bicycles at Dutch station location (own il.).

Retail offer at station location

The study points out that both the variety of facilities at the railway station and the station area strongly relates to the traveller experience, especially in terms of spending time at the station. Generally, a broader retail offer thus results in a better traveller experience. This statement could easily be conceived as a substantiation on why to add retail facilities in and around the station. However, from an urban-economic perspective, specialists note that this is not always desirable. Particularly in cities that suffer from retail vacancy in the city centre, adding stores around the station can cause the situation in the city centre to deteriorate even further. In such a case, visitors can be pulled away from the city centre to the station area, or no longer have any need to get to the city centre, since the required facilities are already within their reach (fig. 9.3.2).

Although it can be effective to increase the retail offer at stations, especially since many travellers actively request it, this measure must be carefully considered. It can disturb the balance in the city in terms of retail supply, which causes that the effect is ultimately counterproductive and only benefits the station.

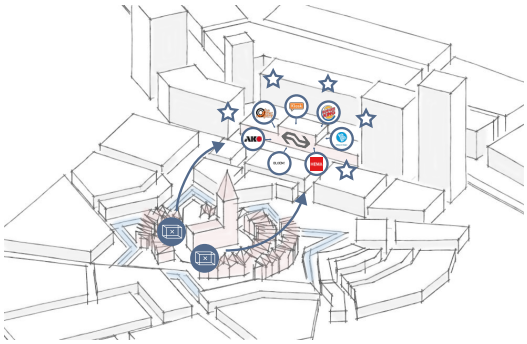


Fig. 9.3.2: Competition between retail facilities in the city centre and at the station location (own il.).

'Underworld' at underground or elevated stations

In the operationalisation of the station location, one of the themes that compose the contextual value is the theme embeddedness. One variable that determines the degree of *embeddedness* is the *physical positioning of the railway tracks*, which entails whether the tracks are placed underground, at ground level, or elevated (fig. 9.3.3). According to the theory by

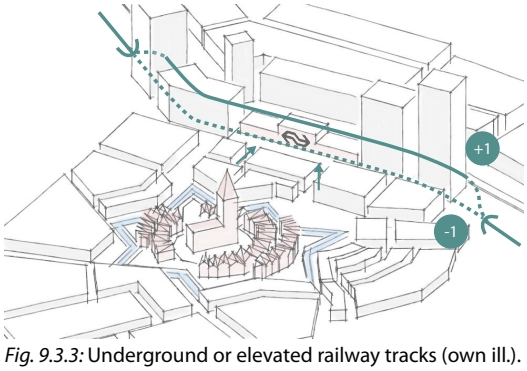


Fig. 9.3.3: Underground or elevated railway tracks (own ill.).

Pojani & Stead, based on which this variable was included in the model, the railway tracks are preferably placed underground or elevated. This is because then the tracks are less of a barrier in the city.

Specialists at NS do not entirely agree with this statement. According to them, from the perspective of the traveller, an underground station has a negative effect on the experience. Travellers find it more difficult to orientate themselves, which leads to confusion on where to go. Also, the underground platform might have an unpleasant atmosphere. This can be experienced at various stations, such as Rijswijk and Rotterdam Blaak (fig. 9.3.4 - 9.3.5). However, it also appears that when designed properly, an unpleasant atmosphere it not necessarily present at an underground station. Here, the example of station Delft can be given.

At stations where the tracks are elevated, the same problem arises. Although the tracks can easily be crossed underneath, this same space underneath is also at the heart of the problem. Specialists speak of an 'underworld' where the environment is often unsafe. In many cases, the lighting is also inadequate. Examples of these stations are Amsterdam Sloterdijk, Amsterdam Muiderpoort and Almere Centrum (fig. 9.3.6 - 9.3.7).

In the holistic model, points were awarded to those stations where the railway tracks are placed underground or elevated, since the consulted theories mention this as desirable. However, when a negative relationship would have been established in the correlation analysis, the opposite would be demonstrated, like the specialists at NS suppose. This does however not appear to be the case. No significant correlation was found for the variable physical positioning whatsoever, which means that neither one of the theories regarding the placement of the railway tracks is supported by this study.

Fig. 9.3.4 - 9.3.5: Underground platforms at stations Rijswijk and Rotterdam Blaak.

Fig. 9.3.6 - 9.3.7: Elevated railway stations and the space underneath at stations Amsterdam Muiderpoort and Almere Centrum.

Attraction / production stations

Lastly, the outcome of the qualitative analysis was noticed by some of the NS specialists, in the sense that within the first three clusters, the stations with the highest traveller experience score can be classified as *attraction stations*. On the other hand, the stations with the lowest scores can be classified as *production stations*. The difference between these stations will now be shortly discussed.

NS keeps track of the amount of travellers that take the train at each station in terms of numbers, but also in terms of time. This means that it is known for every station how many travellers leave in the morning, but also how many travellers arrive there. This gives information on to what extent the station (and thus the city) can be seen as a *people attractor* or as a *people producer*. Often, this corresponds with the image and popularity of the city. Stations in suburbs and residential villages will often have a productive character. Large cities and places with a cultural-historical significance will often have an attractive character. It is conceivable that both station types are perceived differently by travellers. Production station are more often used by commuters and business travellers (must-travellers), whereas attraction stations are also often used by recreational travellers (lust-travellers). According to the traveller experience theories discussed in chapter 2, lust-travellers value their journey slightly higher than must-travellers. This might influence the traveller experience scores that are given at both station types.

In graphs 9.3.1 - 9.3.3, for the *best* and *worst* stations of every cluster is displayed to what extent it is a *productive* or an *attractive* station. This is measured as a percentage, together adding up to 100%. It can indeed by seen that in general, the worst (right) stations always have a lower share regarding attraction, when compared to the best station. Logically, their share regarding production is higher. Only in cluster three, it can be stated that the *best station (Maastricht)* has a significant higher share regarding attraction than the *worst station* from that cluster *(Venlo)*. Overall, the statement made by specialists is not rejected, but also not convincingly supported by these findings.

Graph 9.3.1: Percentages of attraction and production at station Delft and Gouda.

Graph 9.3.2: Percentages of attraction and production at station Alkmaar and Almere Centrum.

Graph 9.3.3: Percentages of attraction and production at station Maastricht and Venlo.

9.3.2 Almere municipality

The municipality of Almere is one of the municipalities that were selected to contact and to present a specified assessment of the station location in their city. In appendix H, all specified assessments, including the one for Almere Centrum, can be found.

Earlier in this study, station Almere Centrum was also mentioned, namely as the lowest scoring station within cluster 2. When looking at the holistic assessment model for Almere Centrum (fig. X), a few remarks can be made. The model shows that both the node and place value are below the national average or the so-called benchmark. This means that the public transport, bicycle and car facilities are relatively limited. The very high score on the themes of embeddedness and urban transition is remarkable. This means that the station is perfectly embedded in the city and has a very comfortable connection with the city centre. The theme of quality of life reflects, among other things, the degree of liveability. With a score of 0.11, the surroundings of station Almere Centrum station have the lowest liveability score of all type-2 stations in the Netherlands.

With regard to the traveller experience, station Almere Centrum scores below all benchmarks. The judgment of the traveller is particularly critical with regard to the themes clean and safe. Remarks from travellers reveal that they want the station to become more atmospheric. In addition, a wider range of shops is required. Many of them think that this requires extensive modernisation of the station.

Abovementioned findings were discussed with Paul Schulten, project manager 'station Almere Centrum' at the municipality of Almere. The following section is based on the personal communication with abovementioned actor on January 10, 2020. Since this section contains confidential information, it can be found in appendix I.

9.3.3 Heerlen municipality

The second study object that was discussed with the involved municipality is the station location of Heerlen. The specified assessment can be found in appendix H. When looking at the holistic assessment model for Heerlen, a few remarks can be made.

The model for the recently renewed station of Heerlen shows that the themes of public transport and facilities are below the national average, or the so-called benchmark. This means that the public transport service and the variety of shops at this station are relatively low. In contrast, the amount of shops compared to the amount of travellers (intensity) is very high. The proximity of regional and highways shows itself in a high score on the roads theme. Station Heerlen scores well on all themes that relate to the station environment. The theme quality of life reflects, among other things, the degree of liveability. With a score of 0.26, station Heerlen does not score significantly high. However, the high scores on themes embeddedness and urban transition indicate a solid embedding in the city.

With regard to traveller experience, the scores most themes are on or above the benchmark at station Heerlen since the opening of the new station. Only on the safety-theme, the station scores relatively low. Remarks from travellers reveal that they want more shelter on the platforms while waiting. In addition, the station environment is experienced as unsafe in the evenings.

Abovementioned findings were discussed with Gerrit Modderkolk (project director 'Maankwartier' at Gemeente Heerlen), Jack Gorgels (director at Stichting Weller Wonen), Ronny Wolfs (policy officer traffic at Gemeente Heerlen) and Ruud Schmeitz (traffic engineering specialist at Gemeente Heerlen). The following section is based on the personal communication with abovementioned actors on January 15, 2020. Since this section contains confidential information, it can be found in appendix I.

8.3 Recommendations

A main take-away from this study is that the way that the study was operationalised has directly influenced the outcomes. This seems logical, but has in this case led to both advantages and disadvantages. The typical broad approach of this study has ensured that possible elements that relate to the traveller experience have been explored in a very broad field. An advantage of this holistic approach is the wide variety of possible influential elements that can be explored. However, the disadvantage is that the outcomes remain to be on a relatively abstract level, with less space for detailed conclusions. There are several ways on how to approach this field of study in a different way, so conclusions become more meaningful.

More specified assessment

One obvious way on how to carry this type of research further, is to execute a more specified assessment on the station location. This entails that instead of the entire station location, only a limited part of it would be investigated in detail. Naturally, it would be logical to perform this analysis based on the elements that prove interesting from this research, such as bicycle facilities, retail at the station location or the quality of life in the area. In a similar way, an assessment model could be constructed, specifically focused on one of these elements, in which all kinds of sub-components can be mapped. The comparison with the traveller experience data could then lead to more meaningful findings.

Historical analysis

Another possible extension of this research could be to incorporate an historical aspect. Since the assessment model is easily executable at any case object, it could also be applied to assess past situations of station locations. In combination with traveller experience data of that moment, the comparison with the current situation could give crucial information about the effects of measures in the meantime. This analysis could be seen as an experiment set-up, in which only a limited amount of aspects change over time, while the other aspects remain the same. When also an alteration in the traveller experience score can be determined in the same timeframe, this could hint to causal relationships between the taken measures and the traveller experience.

CHAPTER 10
REFLECTION

CHAPTER 10

The final chapter of this report contains a reflection on the graduation research. A number of topics will be discussed, starting off with the position of the research within the education. Secondly, a reflection on the scientific and societal relevance is presented. This is followed by a review on the methods used to conduct this research. Lastly, a reflection from a personal point of view will be discussed.

10.1 Position of the research

This research is part of the Real Estate Management graduation laboratory, which is part of the Management in the Built Environment (MBE) department. The Real Estate Management chair investigates the housing of the users of the built environment, while taking into account changing goals in society and organisations, sustainability requirements and feasibility. With this integral approach, key words are design-minded, lifecycle thinking, demand side and user-oriented (TU Delft, n.d.).

The chair of Real Estate Management provides a number of graduation laboratories. This research can be arranged under a combination of two of these: corporates & cities and public real estate. This combination emphasizes the dual nature of a station location as a semi-public piece of real estate. On the one hand, it is used by its owner (NS Stations) to achieve its corporate objectives, also in terms of feasibility. On the other hand, it is a place which is accessible to all and serves the societal and urban needs in terms of transport, activities and many more. In current urban developments, these places in the city are changing rapidly. The concept of transit-oriented development describes the reason why this is happening. Due to the high demand for (mainly) residential space in the city, the quest for available land often leads to places that are both available and well accessible. Station areas are examples of these places. As a result, many developments at station areas take place, often in conjunction with the railway station itself. Therefore, both the railway station and the station area should not be viewed separately, but rather as a coherent entirety: the station location.

Consequently, many new stakeholders are engaged in station location developments, but many rather often follow their own aims and objectives, and substantiate their decisions with own interpretations and assumptions. This leads to uncoordinated collaborations with conflicts of interests. This study wants to clear some of the air in this respect. However, from which perspective should one observe the station location to decide which elements deserve attention? According to many theories that revolve around real estate management, the user has a central position in this regard. Most importantly, their demands should be taken into consideration in order to provide successful real estate. Therefore, this study also positions the user of a station location as a central point of attention. More specifically, the definition of the user has been narrowed down to the traveller which encounters various elements at the station location during their door-to-door journey. This scope has been defined to keep the research executable, and because a significant proportion of the users of a station location are also travellers.

The study is executed by reviewing thirty Dutch station locations and statistically compare them to each other and to the appreciation of travellers at those stations. As a result, critical elements at station locations have been identified that relate to the enhancement of the traveller experience. The fact that these crucial elements have been determined based on traveller experience data, emphasizes the relevance with regard to the user of this type of real estate.

During station location development processes, the output of this research can be used by actors to get a clearer view on the demands by the main user. Stakeholders should always critically review this information and assess whether and to what extent their current real estate supply should be adjusted in order to meet these demands.

10.2 Relevance

In the introduction of this research, an important statement was made, which has had its consequences in the execution of the research. This statement elaborated on how to perceive the station location. It was decided to do this in a holistic way by also explicitly taking into account the station area. Scientifically, this way of considering Dutch station locations has not been extensively applied before. Therefore, this research has attempted to combine various theories to define and operationalise the different elements at a station location.

One important foundation on which the operationalisation of the station location is based, is the node-place model by Bertolini (1998). Many authors have adjusted the model since it was introduced, according to their perspectives and objectives. One example is the application of Meijers (2000) in which the model has been expanded with the meeting function. Another example is the application of Van der Krabben and Van Rooden (2003), in which they adjusted the model to a model for predicting the effect of the improvement of accessibility on the value of real estate. Likewise, the node-place model has been adjusted in this research, in order for it to be applicable within this research scope. In addition to the node and place value, the contextual value has been added as a third component in the model. This adjustment was done in order to more explicitly incorporate the aspect station area. Apart from the results that were found in this study, the introduction of the holistic assessment model for station locations can be seen as a relevant addition in terms of science.

Regarding the results that were found in this study, it has also been stated in the discussion that the relevance is not necessarily in the field of discovery of new insights, but rather in the field of statistical substantiation of some of the most crucial elements from a traveller perspective.

Besides, like stated in the introduction, various theories regarding experience (Pine & Gilmore, 1999; Klingman, 2007; Löfgren, 2014) describe that research in which a combination between the physical environment and experience aspects is made, can be explicitly useful, since the outcomes can be used in design processes to create a physical environment that can indeed enhance the experience.

10.3 Methodology

Literature study

The goal of the literature review was to gain a broader understanding of both the station location and the traveller experience, since these two concepts form the main basis in this research. Both concepts involve many theories outside the field of real estate management. Station locations are often referred to as nodes in various networks. Theories which describe this function are mainly in the field of transport and logistics. This makes it tempting to lose sight of the built environment-aspect. The same applies for theories that refer towards the station location from a cultural-sociological perspective (place). However, the challenge was to retrieve information that discusses the intersection between the built environment and these theories. This was done by researching more applied theories and by actually applying them (in this study at the station location Utrecht Centraal). Prominent theories that were discussed revolved around transit oriented development (and –design), intermodal design and the transition between city centres and railway stations.

Regarding the traveller experience, the focus of the literature review was towards the customer demand pyramid and its application to the train traveller. Also for this subject, many theories are not in the field of the built environment, but they do describe the demands of the user, which is placed central is this study and can therefore be considered as essential. Prominent theories that were discussed revolved around the door-to-door journey and the various themes in the customer demand pyramid for railway stations (including satisfiers and dissatisfiers).

Findings of the literature review were used as input to set up the operational model for this study

Quantitative analysis

Based on the theories analysed in the literature review, the operational model was set up. This model describes the comparison of two main concept: the station location and the traveller experience. In order to compare these two in a quantitative manner, both had to be operationalised in such a manner that data could be acquired in an objective manner. For the station location, this has been done by introducing the holistic assessment model (the adjustment of the node-place model). For the traveller experience, this has been done by consulting the results of the station experience monitor, which is a traveller survey set up by NS and ProRail based on the customer demand pyramid that was also discussed in this research.

Like it was also stated in the discussion, not all elements of the holistic assessment model turned out to be relevant when considering the questions of the traveller survey. Therefore, only some elements were found to show a significant relationship with the survey statement scores. It can be seen as a lesson learned that within an operational model, all elements should be reviewed critically in terms of relevance. Subsequently, some elements could have been replaced by other elements that are expected to relate to the traveller experience.

Regarding the case selection, it was found that its strength is also an pitfall. Thirty type-2 stations were analysed, because they are comparable on many levels (large station in the centre of a medium-sized city). However, it turned out that it is indeed difficult to determine crucial elements based on this case selection, since the differences between the case objects were often too small. However, involving stations of other types would have led to the comparison of apples to oranges, and would have brought along disadvantages of other kinds.

Qualitative analysis

The qualitative analysis has been executed in this research, mainly to research whether the findings could support the findings from the quantitative analysis. This analysis has been performed based on a cluster analysis, in which the 29 case objects were compared to each other. Station locations were placed into four clusters, together with other station locations that have similar characteristics according to

the holistic assessment. Although four cluster were formed indeed, it also turned out that the similarity between the case objects is very high. However, despite the fact that the clusters were not very convincing in terms of their distinctive character, they were nevertheless used to further carry out the analysis. This was done, because the cluster analysis was not primarily important as a finding, but rather provided a framework which has been used to perform the analysis. Within every cluster, the station location with the highest and the lowest traveller experience score was analysed in greater detail, to find out more about the opinion of individual travellers. For this, the 'open answer space' on the traveller survey was used, in which travellers can write down their recommendations regarding the station. Since this data was already available in relative large numbers, the analysis could show reliable information to support the quantitative findings. Another possibility was to personally interview travellers at these station location. This might have led to more detailed findings, by specifically asking about the perception of travellers. However, by doing this, it would not have been possible to collect such a large amount of qualitative data. As a result, the findings would have been less powerful.

All in all, the used method has been appropriate to meet the aim of the research. Since the findings of the quantitative analysis left some questions, it was necessary to provide additional support to these findings. The qualitative analysis has helped to make the findings more tangible and provide a greater level of detail.

10.4 Reflection on research process

This paragraph reflects on the research process of the past year. Therefore, this paragraph has been written from a personal point of view.

Towards the P2

By the end of 2018, I got in touch with NS Stations, who provided me with some relevant information on current topics that could be interesting for my graduation research. At that moment, I formulated a preliminary problem statement and contacted possible graduation mentors at the MBE department. At first, this seemed quite a challenge, but after some conversations I succeeded in finding two suitable mentors who each have affinity with the subject. Their view of the railway station helped me to distance myself and to approach the problem statement from a scientific perspective. At the same time, I also became increasingly clear to me how complex station locations are and how much literature is available. At first, I noticed that I struggled to define the scope of the research, something which is absolutely necessary in these complex environments. In the weeks towards P2, I discussed the topic with researchers at NS, which helped me to focus my ideas and to define a research model that is executable. After some time, I managed to set up a theoretical framework which was built upon some of the most striking concepts concerning station locations and at the same time provided useful input for the empirical research. I found it personally interesting that the input for the empirical research was on the one hand based on the theoretical framework and a newly introduced model, and on the other hand based on existing data from surveys. The newly introduced framework took the ambivalence of a station location into account, something that I find intriguing. The desired balance between the node- and place value is something that everyone understands, yet hardly anybody ever talks about. I noticed that when I explain this to other people, they often find it a very understandable phenomenon. That is also what appeals me to the topic in particular. It could be seen as 'tangible'. Since everyone has some kind of a relation with railway stations, the topic becomes understandable and relatable. This has motivated me to spread my ideas and talk with other people about the proposed challenges.

Towards the P4

After the P2, it turned out that the proposed methodology was far from executable in a scientific and quantifiable manner. The required adjustments that had to be made to the assessment model were hard for me to carry out. It was necessary to perform additional literature research in the summer period in order to operationalise the research plan by using objective variables. Finally, the operationalisation of the node- and place value by Vereniging Deltametropool provided me with some support to perform this job. I tried to incorporate my own insights into this model and thus introduced the holistic assessment model for station locations. By doing this, I included a personally important factor in the model: the station area.

The holistic assessment model finally gave me the idea that it could be possible to 'get a grasp' of station locations, which I previously considered so complex and confusing. It gave me new energy to actually perform the empirical analysis. But first, it was necessary to collect all data. Therefore, I analysed many different station locations, something that I actually really enjoyed. I always find it interesting places in the city, each having its own characteristics and image. In some cities, it is a place that is not necessarily favoured by the people. In other cities, it is the absolute vibrating heart of the area. Besides, I visited some of the case objects in order to also get a 'real feel' of the place. This made me more aware of the fact how different station locations can be perceived. As an example, it showed me how pleasant an entire station experience can be, like at Arnhem Centraal, as opposed to how bad of a first impression a station can be for a city, like at Gouda. Once I collected my data, a next challenge was to statistically analyse this data and compare it to the traveller experience data. This turned out to be possible, but result

in findings that left some questions here and there. As a result, it was necessary to perform an additional qualitative analysis. It took me some time to determine how I would organise this additional analysis, but experts at NS supported me to determine what would be a good approach. The additional analysis helped me to provide more tangible and explicit results.

I have experienced the phase just before and after the P2 as most challenging, since I struggled with creating a usable operationalisation model. This is probably the consequence of the decision to primarily perform a quantitative research, in which the data has to be collected in an objective and understandable manner. The task to 'model' the built environment is a complex one. This is probably one of the reasons that quantitative research in this field of study is not carried out a lot. However, I happily accepted this 'quantitative challenge' and have learned a lot from it.

Towards the P5

Between the P4 and the P5, I attempted to bring the outcomes of this study to a higher level. Initially, the review of findings section in the discussion chapter only included the NS expert panel review. This section has been extended with interviews of the representatives of two municipalities; Almere and Heerlen. In these interviews, two analyses applied to the stations Almere Centrum and Heerlen were discussed. The comparison between these two station locations is particularly interesting, since one is in the initial phase and the other is in the final phase of the development. The interviews provided me with information on the actual operation of station location development processes, and which challenges are faced, not only by private parties, but also by public parties. I tried to find out whether the essence of a qualitative station environment is also agreed by municipalities. This actually turned out to be the case, as the involved municipalities even see the renewal of the station area as a complement to the station design. They want it to become a pleasant place to stay. Overall, the involved municipalities highly appreciated the analysis of their main station and agreed on many aspects. For me, this application and validation of the study has provided me with more in-depth knowledge and insight in the subject and allowed me to complete my journey.

CHAPTER 11
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Fig. 1.1.2: Station Rotterdam Delftsche Poort in 1858.
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Fig. 1.1.3: Station Amsterdam Centraal in 1888.
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Fig. 1.1.6: Railway tracks in Delft as a barrier in the city.
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Fig. 1.1.7: Focus on motorised vehicles at station Heerlen in the 70s.
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Fig. 1.1.8: Station of Heerlen from 1985 to 2013.
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Fig. 1.1.9: Intercity Brussel at station Bruxelles-Midi.
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Fig. 1.1.10: The use of steel structures at station Leiden Centraal.
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Fig. 1.1.13: Station Rotterdam Centraal as a gateway to the modern city.
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Fig. 3.2.5: Conceptual intermodal station with seperate areas.
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Fig. 3.2.6: Intermodality at station Den Haag Centraal.
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Fig. 3.2.7: Transit-oriented development at station Amsterdam Sloterdijk.
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Fig. 3.2.8: Scale & density at the station location Utrecht Centraal.
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Fig. 3.2.9: Public spaces for human use at station location Utrecht Centraal.
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Fig. 3.2.10: Typical Dutch 'gezelligheid' at station location Utrecht Centraal.
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Fig. 3.2.13: Connections at the station location Utrecht Centraal.
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Fig. 3.2.16: Pedestrian and cyclist orientation at the station location Utrecht Centraal.
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Fig. 3.2.18: Car movement and parking connected to the station location Utrecht Centraal (suburban P+R De Uithof).
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Fig. 6.1.9: Station 's-Hertogenbosch.
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Fig. 6.1.10: Station Delft.
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Fig. 6.1.11: Station Hilversum.
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Fig. 6.1.12: Station Almere Centrum.
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Fig. 6.1.13: Station Akmaar.
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Fig. 6.1.14: Station Zaandam.
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Figure 7.2.11: Best (Alkmaar) / worst (Almere Centrum) comparison in cluster 2.

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Figure 7.2.15: Best (Maastricht) / worst (Venlo) comparison in cluster 3.

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Fig. 8.2.4: Underground platform at station Rijswijk

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Fig. 8.2.5: Underground platform at station Rotterdam Blaak.

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Fig. 8.2.6: Elevated railway station and the space underneath at station Amsterdam Muiderpoort

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Fig. 8.2.7: Elevated railway station and the space underneath at station Almere Centrum.

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