Gerald Hoekstra

Push Back The Boundaries

The potential of multimodal concessions
to make the modal boundaries in public transport disappear

"Often people are blamed for not using public transport, but we find people will use public transport if it meets their needs, and unfortunately over the decades we've provided public transport that suits the needs of the authority … not necessarily the commuter"

- Paul Turner

Push Back The Boundaries

Master Thesis

by

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List of Abbreviations

CT	Competitive Tendering
GTT	Generalised Travel Time
IC	Intercity (train)
ITS	Integrated Tariff System
NPM	New Public Management
OD	Origin-Desination
PT	Public Transport
PTA	Public Transport Authority
TC	Traffic Control
TT	Travel Time
WGTT	Weighted Generalised Travel Time
WTT	Weighted Travel Time

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Gerald Hoekstra

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Executive Summary

A Dutch version is available in Appendix A / Een Nederlandse versie is beschikbaar in bijlage A

All across Europe, Competitive Tendering (CT) of Public Transport (PT) concessions has been regulated since the year 2000. In the Netherlands, the Passenger Transport Act 2000 (Wet Personenenvervoer 2000, 2001) directed the reorganisation of the Dutch regional PT system. Although CT of concessions has led to, in most places, more customer focus and more efficient operations (Beck, 2011; Mouwen & Rietveld, 2013), also some externalities are noticed. The push for defragmentation resulted in (more) unwanted boundaries at concession borders, both spatial as well as between modalities (see figure S.1). Those borders are expressed in, for example, tariff variations and poor connections. Borders will always remain in a PT system where many operators are present, but some of them can be taken away or reduced. An often proposed solution to let modal boundaries disappear is CT of multimodal concessions. In such a concession, the operator obtains the right to perform PT by both regional train and bus in a particular area. In theory, the borders between those modalities should, then, be taken away, resulting in an integrated PT system for passengers, while at the same time operations get more efficient, since no competition exists anymore between train and bus. A Public Transport Authority (PTA) only has to deal with one operator, which simplifies the current situation in most cases. However, also some expected drawbacks of multimodal concessions can be mentioned. For example, multimodal concessions are often larger and only larger operators are able to bid on them. Multimodal concessions seem to have potential in theory, but the real benefits and drawbacks are unclear yet. Therefore, the main question of this study is *What are the pros and cons of contracting out regional multimodal public transport concessions for travellers, authorities, and operators instead of regional unimodal concessions?* Thereby, the focus is on regional train and bus operations in a non-urban context.

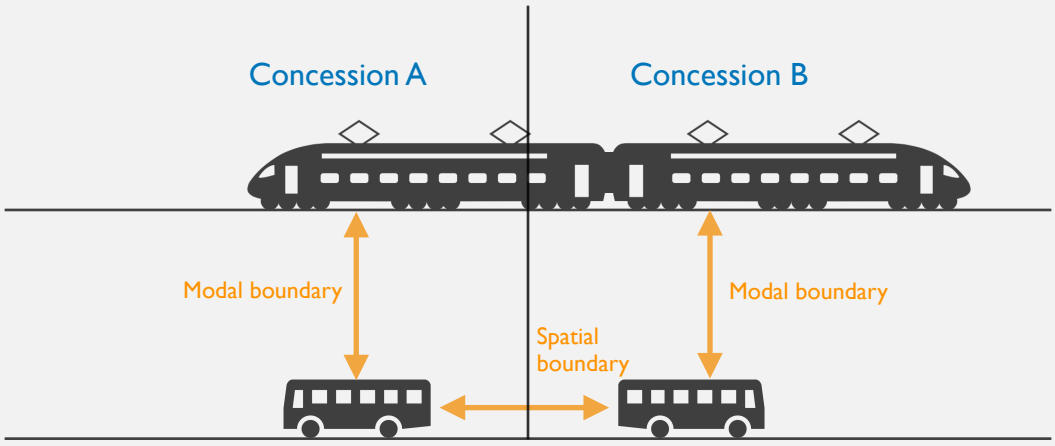


Figure S.1 | Visualisation of spatial (horizontal) and modal (vertical) boundaries in PT concessions.

Literature

The aim, when implementing a multimodal concession, is to create an integrated PT system. However, a multimodal concession is only one way to achieve that. In literature, already some studies are dedicated to the meaning and operationalisation of the concept of (intermodal) integration. "Through intermodal integration, […] passengers perceive the transit system as one, unified, rather than fragmented system, and the offered services as "seamless" journeys with minimum interruption, independently of the number of modes or operators involved" (Saliara, 2014, p536). As depicted in table S.1, intermodal integration can be divided into three levels:

organisational, operational, and physical integration (Saliara, 2014). A real integrated system is integrated on all three levels. Organisational integration is a prerequisite for the other two levels and is about the existence of and arrangements between stakeholders, PTA(s) and operator(s). The actual execution of integrated services is the topic of operational integration. Part of operational integration is a feeder network, a pulse timetable, integrated information provision, integrated fares and tickets, and integrated vehicle management. Also on a physical level, facilities must be designed well to accommodate integrated services. This aspect, however, is outside the scope of this research. In the remainder of this study, the focus is on the different ways of coordinating a multimodal network to achieve operational integration and the passenger benefits of a feeder network. This knowledge is combined and applied in an actual case under 'implementation'.

Table S.1 | Three levels of PT intermodal integration, adapted from Saliara (2014).

Organisational integation	Operational integration	Physical integration
Existence of one or more independent PTA(s) The PTA has the responsibility to regulate PT in a region	**Network layout** Feeder network where buses are branched onto railway lines	**Access to facilities** All users can reach facilities easily
Arrangements between operators Operators consult each other	**Schedule** Pulse timetable with transfer points for regional trains and buses	**Location of facilities** Transfer points at suitable locations in PT network
	Information All PT related information is available at one place	**Design of stations** Take away physical barriers to transfer
	Fares & tickets Fares and tickets are valid in all vehicles in the system	**Control of vehicle movements** No conflicts between pedestrians and vehicle movements
	Vehicle management Interchanges train-bus are guaranteed in case of delay	

Coordination

The interaction between PTA, operator, and passengers determines the way PT is offered and used. For the provision of PT, especially the interaction between PTA and operator is of interest. This can be organised in different ways. Strategic planning mostly is the responsibility of the PTA or a political council. On the lowest (operational) level, the operator is in charge to arrange ticket sales, information, personnel and vehicle management. The differentiation mostly occurs at the tactical level: network layout, schedules, fare and ticket determination, and vehicle type. This interaction also profoundly influences the way in which integration is achieved. Using the three concepts of economic organisation, namely market, hierarchy, and network (Powell, 1990), three possible ways of coordinating a multimodal PT network are defined.

- **Contractual coordination**: coordination is achieved by a contract explicitly stating what the operator has to do, also on the topic of integration. This type of coordination can be used in unimodal concessions where the PTA is revenue responsible. The PTA has a development function and can steer the operators towards integration.
- **Partnership coordination**: consultation is the keyword of partnership coordination. When the operator is revenue responsible, a PTA does not have the absolute power to enforce integration. The way to go is setting up a partnership between the PTA and the operator(s). Integration is reached by informal contact.
- **Internal coordination**: when one operator is responsible for different modalities, it can organise integration internally. There is no role for the PTA in this. Internal coordination can only be used in a multimodal concession where the operator is revenue responsible.

To test to what extent the three forms of coordination function in practice, a case study is used. In this case study, three Dutch regions were selected where a different type of coordination exists. In all cases, regional train operations are decentralised and tendered. Interviews were conducted to get a clear overview of what is going on. The interviewees were asked how network, timetable, information, tickets/fares, and vehicle management are aligned with each other. Also, the plan requirements were consulted for the formal regulations. Note that in the Netherlands tickets (smartcards) and information (travel apps) are already integrated on a national level to a great extent.

- **Groningen** (contractual coordination): the province of Groningen is a case characterised by a separate net-cost rail and gross-cost bus concession. The province itself is PTA for the rail concession, but the bus concession has been delegated to the OV-bureau. This organisation is established primarily for this purpose. The OV-bureau has tendered an integrated bus concession for two provinces (Groningen and Drenthe). Although formally seen the OV-bureau is part of the province of Groningen, it is found that sometimes conflicts of interest arise on the topic of integration. The interest of the OV-bureau to transport as many passengers as possible is not necessarily compatible with train-bus cooperation. Specifically, this organisational structure causes a network that on some places is integrated (probably when there is a financial interest to do that) and fares, information, and vehicle management that are hardly integrated. There is fruitful collaboration from a common interest in schedule integration.
- **Fryslân** (partnership coordination): features of the second case are unimodal concessions for regional train and bus, but the operator is the same. The PTA, the province of Fryslân, coordinates both net-cost concessions. That leads to a situation in which the operator mainly focuses on what is demanded in both contracts separately. Integration is not a key point in that. Two divisions within the operator focus on their part in the PT chain and only some aspects of integration get attention. Timetables are aligned with each other, information partly, but network layout, regional fares and tickets, and vehicle management hardly.
- **Limburg** (internal coordination): a full multimodal concession is applied in the province of Limburg. The operator operates both regional trains and buses, restricted by a net-cost contract of the province. Network and timetable are designed simultaneously for train and bus. Also, information and fares are integrated. Integrated vehicle management, however, is not arranged.

The interviews revealed several causes for non-integrated aspects in the cases. Sometimes, feeder networks are not applied, according to the interviewees, because of unsuitable geographical structures, passenger flows to one major destination where short-circuits are preferred, or already overcrowded trains. The extent to which fares are integrated depends on existing business cases and arrangements (hard to change in case of income loss for the operator), no perceived added value for passengers (depends on distance and transfers), and uncertainty around a possible operator change at the end of the concession. An important finding is the fact that an integrated network and fare structure mostly are dependent on each other. For information integration, a shared vision on marketing by the train and bus operator is required. Vehicle management was hardly aligned in all cases. That mainly has to do with a too complicated procedure where Traffic Control train needs to call Traffic Control bus proactively. It is a topic that probably will get attention in the near future.

(Financial) Interests were found to play a significant role in the search for integration. Conflicting interests between PTAs (Groningen) and the operator's pressure to win tenders (strong focus on separate contract demands, Fryslân) inhibit operational integration. Therefore, it seems that only two organisational structures are really suitable for an integrated system. In a multimodal concession (internal coordination), there is an incentive for the operator itself to arrange integration. The operator can control the whole PT chain, has all possible data, and will integrate the system. The other option is a Verkehrsverbund model (contractual coordination). In this, the PTA has the integration function. By tendering gross-cost contracts, the operators only perform the services.

Network analysis

Besides the supply side, the demand side is also affected by the introduction of an integrated PT system. It is often assumed that a feeder network, a pulse timetable, and fare integration are beneficial for passengers. In a case study (a part of Limburg), this hypothesis is assessed. Both networks (before and after) were compared to each other using smartcard data and timetables. The demand was modelled using smartcard data. Current smartcard data was applied to both the former network and current network, which made comparison easier, but does not account for changes in travel patterns. Specific TT aspects (access time, in-vehicle time, transfer time, and transfer resistance) were weighted up to model the valuation of different trip components by passengers. The specific case is Roermond-Sittard, where until a few years ago a national railway operator and a regional bus operator were active. Currently, a multimodal concession is contracted. The network has changed into a feeder network with a pulse timetable and integrated fares. From the analysis, it follows that average Travel Time (TT), ungeneralised and generalised, have decreased in a range of -0.3% to -12.2% (see table S.2). This is the case for both all OD pairs as well as actual demand (based on smartcard data). The number of multimodal passengers is, however, small. Therefore, the improved train-bus and bus-bus interchanges have more influence on these outcomes than the network change itself. The main disadvantage of this feeder network is the disappearance of some direct bus lines. The passengers used to take these bus lines are most disadvantaged by the new network. However, also some new direct lines are offered now.

Table S.2 | Average passenger TT in minutes for the different PT networks on working days.

	Objective TT			Perceived TT		
	NS / Veolia	Arriva	Δ	NS / Veolia	Arriva	Δ
All OD pairs	36.8	34.1	-2.7 -7.3%	74.0	66.9	-4.1 -9.6%
Actual demand	23.7	23.4	-0.3 -1.3%	39.2	38.2	-1.0 -2.6%

By using the integrated (paying boarding rate only once) and unintegrated tariffs, a financial comparison was also made. As expected, on average passengers are paying a lower non-discounted fare then before. There are, however, two exceptions. First of all, the new train tariff structure is cheaper on trips <7 kilometres, but more expensive above that limit. This is a political choice of the PTA, but can negatively influence on-going train passengers. Next, some passengers have changed from a unimodal to a multimodal trip. Although the trip duration might be shorter, some of them travel a longer distance and pay more. However, this is a tiny group of passengers. All in all, it can be concluded that on average passengers benefit of the new situation, both regarding TT and price. That is striking, since more efficient operations are also part of the multimodal concession.

Implementation

A lot of strengths and weaknesses of multimodal concessions itself are already mentioned. In order to get insight into the external factors that play a role in the implementation, a suitable case from the current political debate was chosen for further investigation. The regional train services Leeuwarden-Meppel(-Zwolle) and Groningen-Zwolle are designated for decentralisation by the Dutch cabinet (Bureau woordvoering kabinetsformatie, 2017). Already in 2011, Federatie Mobiliteitsbedrijven Nederland (2011) proposed a plan to add these railway lines in a multimodal concession. This plan was reviewed by Janse de Jonge (2012), including a number of network improvements. An update of this document shows that on the current bus network a €3,000,000 save per year can be achieved by scratching some parallel bus lines. The opening of four new stations can help to serve the disadvantaged passengers and may attract new passengers to the PT system as well.

The question, then, is how this integration can be achieved from a coordination point of view. Five alternatives are proposed and assessed, ranging from no organisational change at all to a full multimodal concession in three provinces (Groningen, Fryslân, and Drenthe). The opinion and arguments of all relevant stakeholders on the new railway plan of FMN were obtained to gain more insight into the external factors and make a better assessment. It seems that existing interests at operators of directly awarded contracts and labour unions play an important role. Other factors found are limited public attention, size and duration of current on-going concession boundaries, and complex coordination structures. After weighing all arguments, the most promising alternatives seems to be in-between the extremes. Firstly, two multimodal concessions around both railway lines could be implemented. Alternatively, the services could be added to the current regional train contract in the north. Bus concession will then remain the same, but more focus on integration is needed. The first option will almost certainly lead to a better-integrated system, but requires a lot of organisational effort to reach and is only viable when current concessions are finished. Contrary, the second alternative is viable to arrange at the moment, but requires a lot of attention from the PTA during the concessions. The PTA has to take more control on integration topics. An extended northern rail contract seems to be the best coordination system at the moment, when looking at integration.

Conclusion

It is concluded that an integrated PT system has many advantages for passengers, such as a better network, fares, and one source of information. A multimodal concession can arrange this. In a multimodal concession, the operator can control the whole PT chain and compensate financially between train and bus, which is a definite advantage. The advantages for the PTA are somewhat less clear, but an easier way of coordination and financial benefits are main aspects. Some disadvantages can also be mentioned, such as more interchanges in a feeder network and cases in which a feeder network is not suitable. Also, a coordination question between IC and regional trains arises. However, usually the pros outweigh the cons for most passengers. However, that does not mean that everywhere multimodal concessions must be implemented. An organisation in which the PTA takes more lead can also help to establish an integrated network. Sometimes implementation is retained.

That could have to do with current interests, a lack of public attention, current concessions, and possible organisation issues. All aspects are summarised into a SWOT analysis, as depicted in figure S.2.

The policy recommendations concern the focus on integration. Both multimodal concessions and a 'Verkehrsverbund' like model seem to be able to improve integration, but the second requires are a debatable position of the PTA. Not in all cases it is possible to implement one of these systems directly, but on a short-term improvements can also be done, when they are in the interest of all stakeholders. The second policy recommendation concerns the smartcard data availability, that actually should be provided to all stakeholders. It may give a better overview of what is going on and how integration can be achieved. A specific recommendation for the province of Fryslân concerns the focus on integration in the new bus concession starting in 2022. From a scientific point of view, physical integration, implementation of a Verkehrsverbund in a Dutch context, and a more in-depth feeder network data analysis are mentioned as a recommendation.

Figure S.2 | SWOT analysis of a multimodal concession

	Positive	Negative
Internal	**Strengths** • Feeder network (shorter TTs and better interchanges) • Integrated network and timetable design • Integrated tickets and fares • One source of information • A clear point of contact for almost all PT • Operator has control and oversees the whole PT chain • Financial compensation train-bus	**Weaknesses** • Feeder network causes more interchanges • Feeder network not always suitable • High investment risks / less potential operators • More coordination between ICs and regional trains needed
External	**Opportunities** • Political attention • Pressurised PT budgets • Directly competing train and bus operators • Subsidiarity • Several potential areas in the Netherlands	**Threats** • Complex organisational structures • Limited public attention • Current interest (e.g. operators of directly awarded contracts and labour unions) • Duration on-going concessions • Operator change on the track takes much time • Cumbersome process infrastructural changes

Chapter 1

Introduction

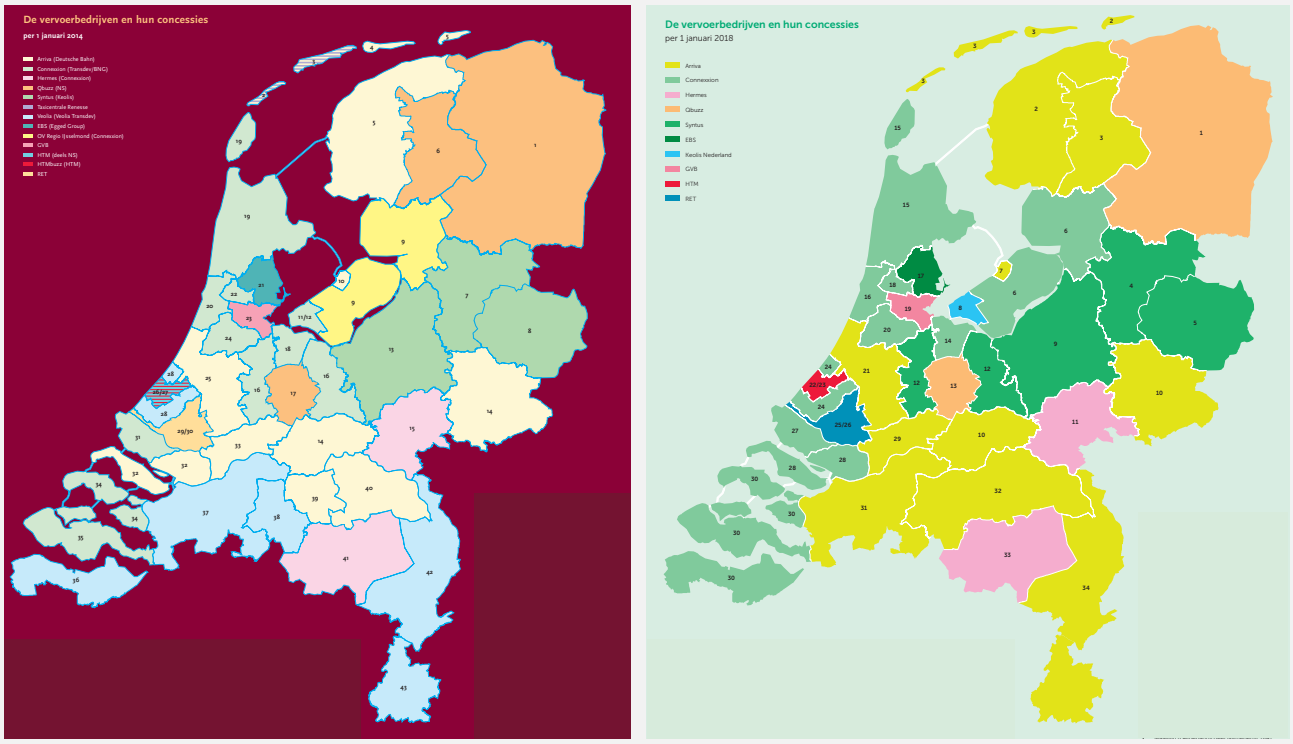
1. Introduction

1.1 Problem analysis

Various forms of Public Transport (PT) should be better connected to each other, to better match the traveller's needs. That was one of the statements recently done by Dutch State Secretary for Infrastructure and Water Management Stientje van Veldhoven on the occasion of 'Prince's Day' at the opening of the parliamentary season (Ministerie van Infrastructuur en Waterstaat, 2018). Although this statement can be interpreted broadly, it gives an indication of the importance of alignment between different modalities, which is the topic of this research. More specifically, the alignment between regional train and bus is the main focus. In this chapter, the focus is on the research structure. The problem is made clear in this section by a problem description and thereafter summarised into the problem statement. Finally, the research goal that follows from the problem description and statement is mentioned.

1.1.1 Problem description

In the Netherlands, the Passenger Transport Act 2000 regulated the introduction of Competitive Tendering (CT) as the standard for the provision of PT services (Wet Personenvervoer 2000, 2018). After the introduction, most bus services were decentralised, except for some urban regions (Veeneman & Van de Velde, 2014). Over the years, some unprofitable railway lines became the responsibility of provinces as well (Van Setten, 2016). In both situations, newly formed regional PT Authorities (PTAs) were charged with the coordination of PT in their region by contracting operators using CT of concessions (Veeneman & Van de Velde, 2014). A concession is the right to perform PT in a certain area during a certain period of time, with the exclusion of others (Wet Personenvervoer 2000, 2001).



▶ **Figure 1.1** | PT concessions in the Netherlands in 2014 (left, 43) and 2018 (right, 34) (CROW, 2013; CROW, 2017).

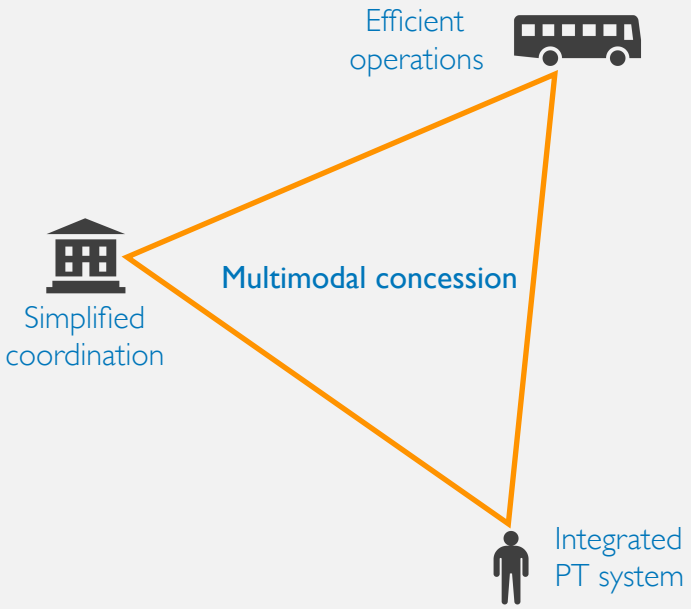


Figure 1.2 | Often mentioned benefits of a multimodal concession for PTA, operator, and passenger.

The decentralisation provided PTAs a lot of freedom to shape the concession contract with the operator (Veeneman & Van de Velde, 2014). Consequently, PT concessions differ in terms of size, number of modalities, and freedom for the operator to introduce (innovative) improvements to the system. After the introduction of the Passenger Transport Act 2000, most concessions were relatively small (Veeneman & Van de Velde, 2014). Initially, the national government pushed for modal, regional, and organisational defragmentation to simplify the various layers of government and increase efficiency. However, this resulted in many undesirable boundaries in the PT system: different identities, fares, and no smooth transfers (Veeneman, 2016).

The externalities of the boundaries in the system were noticed by the PTAs. As a solution, the PTAs took measures: regional cooperation became stronger, smaller PTAs merged, and integrated or multimodal concessions were tendered out (Veeneman, 2016). As can be seen in figure 1.1, the total number of concessions decreased from 61 in 2011 to 34 in 2018 (CROW, 2013; Veeneman & Van de Velde, 2014. In a multimodal concession, the contracted operator is responsible for different modalities in a region, often train and bus. Regional train services and bus lines are integrated in this way. Sometimes demand responsive systems are included as well (Veeneman, 2016).

In the PT sector, a lot of expected advantages of multimodal concessions over unimodal concessions go around (see figure 1.2). Since train and bus operations are provided by one operator, competition between these companies is not possible anymore. This should result in more efficient operations, better passenger service and an improvement in the cost coverage ratio. Besides that, the interaction with only one operator should simplify the coordination task for the PTA. An expected benefit for travellers is a better integrated PT system, which translates among others in tariff integration. A regional integrated PT system focuses more on regional passengers instead of through travellers. Transfers from bus to regional train are promoted and improved. Since the average passenger travel distance by train in the Netherlands is 28.9 kilometre (UITP, 2016), probably more travellers are served better in their daily urban system. Also, network design is seen as an advantage, because different networks in a region can be better aligned with each other. Network design in a lot of regional concessions has hardly changed for decades: most buses simply traverse all villages passing by on their way to the city. A feeder network, in which buses feed a regional railway line, can be a way to decrease Travel Time (TT) for travellers and increase efficiency (Kuah & Perl, 1989).

Just like the expected advantages, some drawbacks of multimodal concessions are often mentioned in the sector. TT is redistributed when a feeder network is applied. For passengers who used to take a direct bus to their destination, TT might increases when such a system is applied and a lot of passengers could be faced with extra transfers from bus to train. A second possible downside of multimodal concessions, in general, may be that only a few larger operators are able to bid on these large and often complex concessions. This might lead to reduced competition in the PT sector. Next, train and bus operations are different specialisations and are often separated within companies. In a multimodal concession, however, these different departments must work together. For example, traffic control of train and bus should be tuned to ensure interchanges in the system. This requires a different way of working. Finally, the focus on regional PT can be at the expense of integration between trains of different operators.

The organisation of concessions is a topical issue. According to the recently published coalition agreement of the Dutch Cabinet, in the near future again four regional train services will be taken from national railway operator NS and tendered (Bureau woordvoering kabinetsformatie, 2017). Three of these lines were mentioned before in the new railway plan of Federatie Mobiliteitsbedrijven Nederland (2011), a cooperation of some regional operators in the Netherlands. In that proposal, the regional railway network outside the Randstad is split up into four parts. These four networks would be tendered and integrated with the regional bus network into multimodal concessions. The proposed plan was assessed at the request of the minister by Janse de Jonge (2012). In this assessment, amongst others, the regional trains Groningen-Zwolle, Leeuwarden-Zwolle, and Apeldoorn-Enschede came along. All three lines were indicated as promising in this report. Allowing market forces on these lines in combination with the regional bus network might help to increase efficiency. However, it can be questioned whether the benefits of tendering out these lines in a multimodal concession outweighs the disadvantages. Besides that, it can be wondered how the optimal regional network design looks like for travellers, PTAs, and operators and if such a configuration can be coordinated best using a multimodal concession. Generally speaking, in what cases can multimodal public transport concessions best be applied for travellers, authorities, and operators?

1.1.2 Problem statement

PT should be operated as one system with smooth transitions at concession boundaries. The push of the national government for defragmentation in the Dutch regional PT system, however, resulted in the existence of new boundaries in the system, such as different fares and no smooth transfers between different modes of transport. **A multimodal concession takes away the modal segregation by accommodating several modalities in a region at one operator but creates new coordination issues at other system boundaries.** The difficulty is in which cases the advantages of multimodal concessions outweigh the drawbacks.

1.1.3 Research goal

The aim of this research is to get insight into the (potential) pros and cons of a regional multimodal PT networks that is coordinated using a multimodal concession from the perspective of travellers, PTAs, and operators. This knowledge can be used to determine the favourable conditions for applying multimodal concessions.

1.2 Research design

Following on the research problem, the research design can be explained. This section describes how the research is to take places and which research methods are used. First of all, the research questions are presented, after which the main question is made clearer by defining the scope. Finally, the methodology is discussed.

1.2.1 Research questions

What are the pros and cons of contracting out regional multimodal public transport concessions for travellers, public transport authorities, and operators instead of regional unimodal concessions?

1. What is the difference between a multimodal and a unimodal public transport concession?
2. How can the different planning and control tasks in regional multimodal public transport networks be coordinated?
3. To what extent are the different forms of coordination functioning well in practice?
4. How can a regional multimodal public transport network be improved in a multimodal concession?
5. What factors influence the implementation of an integrated public transport system?

1.2.2 Scope

As already mentioned, the focus of this research is on multimodal regional PT concessions. A PT concession can be defined as the right to perform public transport in a certain area during a certain period of time, with the exclusion of others (Wet Personenvervoer 2000, 2018). When only one mode of transport is contracted in a concession, the concession can be classified as unimodal. However, the main focus will be on multimodal concessions: concessions where two or more modalities are contracted simultaneously to one operator.

Regional PT can be defined as transit outside urban and suburban regions. The scope, thus, mainly is on rural regions. Multimodal concessions in these regions are the main focus of this research. Most of this research is focused on the Netherlands. For that country, it means that the Randstad region is excluded. Besides that, first and last mile solutions are outside the scope of this research, which means that in most cases the focus is on regional trains and buses solely.

1.2.3 Methodology

In order to answer the aformentioned research questions, different research methods are selected. A schematic overview of the methodology and structure of this study is depicted in figure 1.3. The first question is about the characteristics of multimodal concessions and mainly theoretical in nature. It is answered using literature. Relevant literature is searched in online databases such as Google Scholar. Besides that, snowballing from relevant systematic literature is used to obtain more information. The goal of this chapter is to get explicit what the aim of implementing a multimodal concession, integration, is and what is written about it in the literature yet.

PT networks can be coordinated in many ways. In order to examine the possible organisational structures, firstly the actors involved in the organisation of PT are defined using literature and inductive reasoning. After that, all the planning and control tasks needed for providing PT on a strategic, tactical, and operational level are investigated. Since the focus is on different modalities, also the tasks needed for the alignment between regional train and bus are described. For example, how to deal with train-bus transfers when a train is delayed. The next step is to link the tasks to the actors. The result is visualised and shows which actors are responsible for which tasks. Van de Velde (1999) has made a visual approach for showing the main features of an organisational approach (an

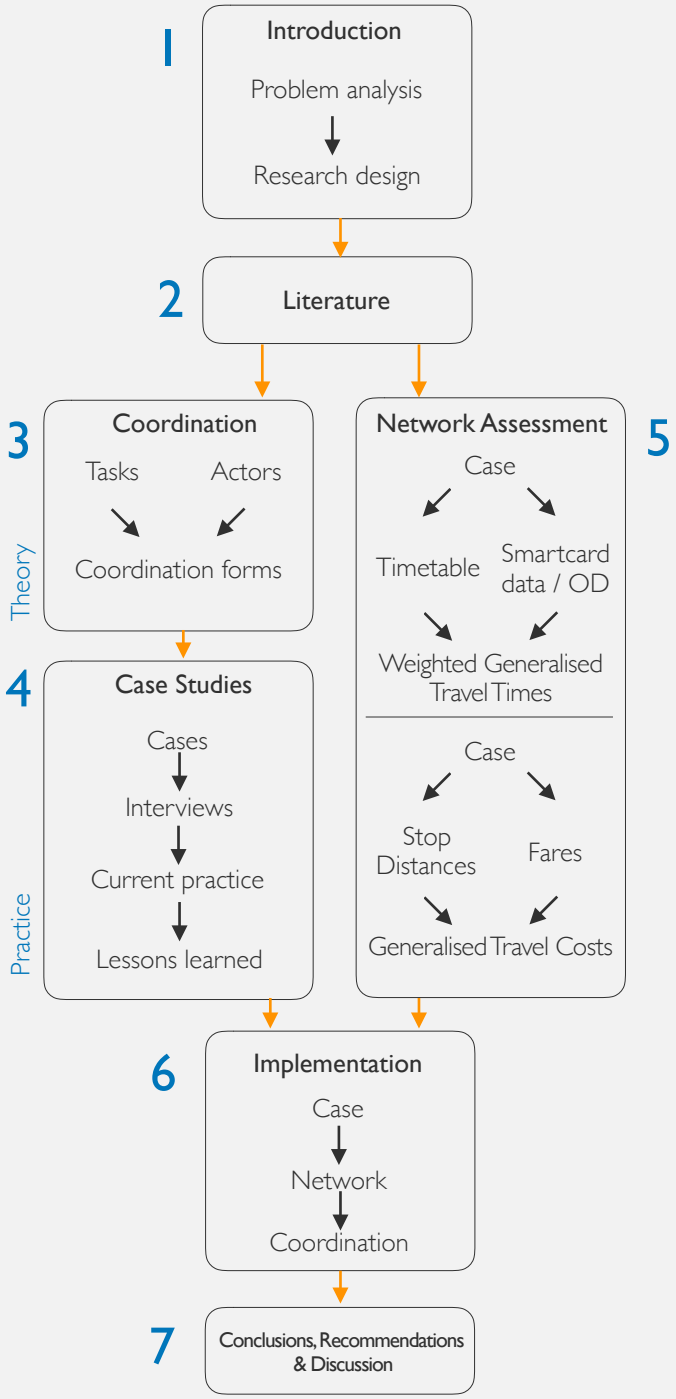
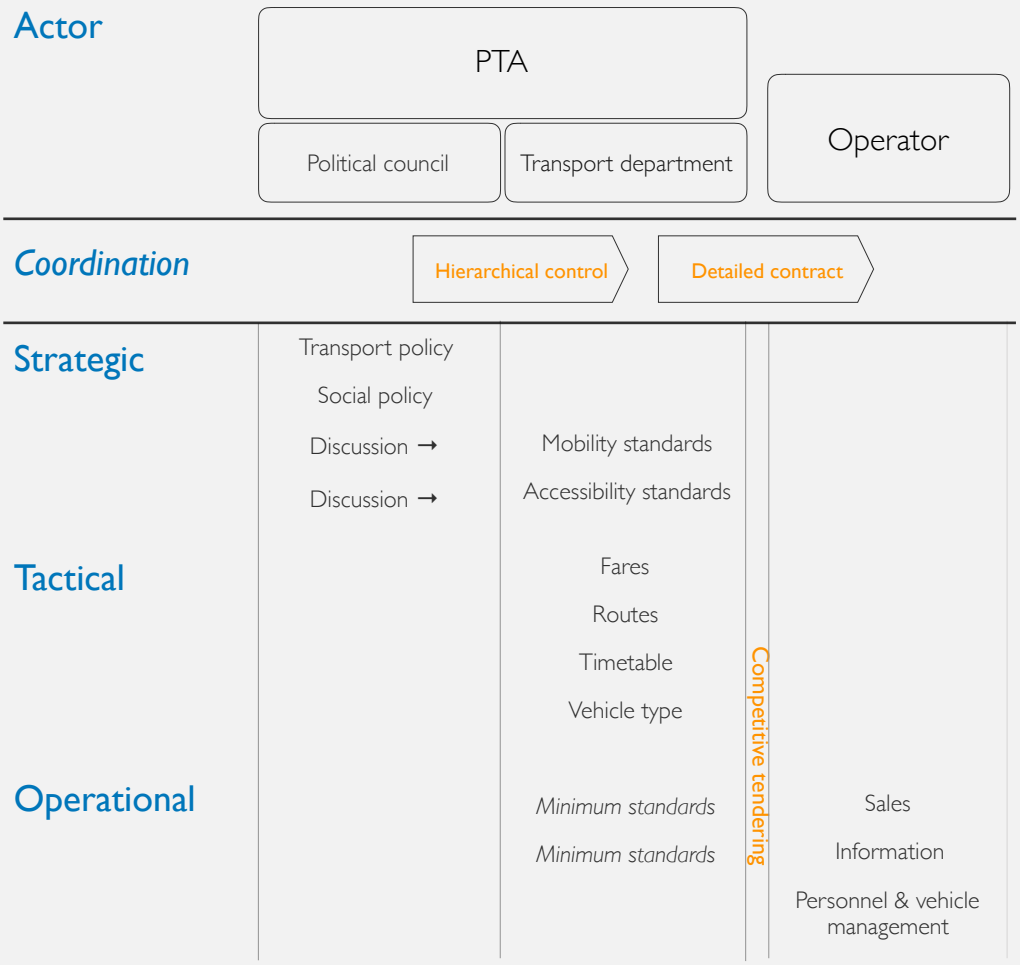


Figure 1.3 | Report structure.

example is depicted in figure 1.4, explained in Chapter 3). This scheme is extended and applied to the case of multimodal PT networks. Using general literature about coordination, a few ways of coordinating a multimodal PT network are defined. These forms differ in responsible actors for the different planning and control tasks and the interaction between them. Therefore, these coordination forms are visualised using the aforementioned approach of Van de Velde (1999).

Thereafter, it is investigated how the coordination structures perform in practice using some three studies. The first case selected is Limburg. This province has one multimodal PT concession. This case is compared to the concessions in Groningen (unimodal bus and train concession, different operators) and Fryslân (unimodal, but the same operator). Subsequently, interviews with relevant stakeholders in those concessions are arranged and conducted. Relevant actors are for example policy makers at PTAs and experts at Arriva working in the particular concessions. The interviewees is asked how is dealt with train-bus coordination on different levels (structure obtained in Chapter 2) and what the pros and cons of the organisational structure are on these topics. The result shows how all tasks in PT are coordinated and what the performance of the concession is. The result is a list of lessons learned from the three cases and conditions in which a multimodal concession is best applicable.

The passenger benefits of an integrated network is the topic of Chapter 5. Here, the network design of a multimodal concession is researched using a data analysis in a specific case study. The particular case is a part of Limburg. Limburg has the largest multimodal concession in the Netherlands. The network has changed to a great extent when Arriva obtained the concession in 2016. A part of the network where the network has changed into a feeder network is used as a case (between the cities of Roermond and Sittard). In order to gain insight into the functioning of the network, timetable information of the selected region is used. From this information, the TTs



▶ **Figure 1.4** | Graphical approach for the comparison of different organisation structures, based on Van de Velde (1999).

from stop to stop are distracted. Except for the town of Echt, only one stop per town is taken into account. Subsequently, the shortest TTs from stop to stop are calculated all TTs from stop to stop within the demarcated area. Also, the perceived TT of passengers is modelled by are attaching coefficients to the different TT components. The corresponding values are found in the literature and represent the different (negative) valuations of waiting time, in-vehicle time, and transfer time by passengers. Using these coefficients, the same analysis as before is done to compare the before and after situation. To represent the real passenger flows, PT smartcard (OV-chipkaart) data of the particular region is obtained. Smartcard data gives anonymised information about travel patterns of passengers. Origin-Destination (OD) matrices of the regional train and bus lines are merged into one big OD matrix for working days and one for Sundays. Although the OD matrices per line were available, combining the data sources requires a complicated combination of data sources to get insight into the passengers that transfer from train to bus. The resulting OD matrices are multiplied with the ungeneralised and generalised (with coefficients) TTs. The results, now, represent the weighted TT gains or losses. Assuming that the passenger flows remained the same over the years, the current OD data is used for both situations. At the end of the analyses, the balance is drawn up for different passenger groups.

In the same chapter, a tariff comparison for passengers is also carried out for the same case. This is done to see the effects of fare integration. Only the full fare is taken into account, because special tickets are different in both situations and therefore difficult to compare. Data representing the distance from stop to stop is obtained. Besides, the NS and Arriva tariffs from 2017 are taken. Using this data in combination with the fastest routes calculated in the TT analysis, the fare per OD pair is

calculated. This analysis again is done for working days and Sundays. The results are average travel costs and weighted travel costs (using the aforementioned smartcard data). At the end of this part, an evaluation is done to indicate to what passengers benefit from the new tariff structure.

To gain more insight in the factors that play a role in implementation and to apply the knowledge gained before, an actual case from the political debate is analysed. The corresponding case is a combination of two of the four regional train services that will be decentralised according to the coalition agreement (described in section 1.1.1). These are the regional train services Leeuwarden-Meppel(-Zwolle) and Groningen-Zwolle. A network analysis is done to see whether optimisations can be achieved in the network and what the consequences for passengers are. However, network improvements can only be achieved with a proper and supporting organisational structure. Therefore, the knowledge from the coordination part is used to recommend on the organisation of the concession(s). Finally, the opinions and interests of the stakeholders are analysed to see which external factors play a role in the decision-making process.

In the conclusion, all parts are merged together and the pros and cons of multimodal PT networks are structured in a SWOT analysis. SWOT means strengths, weaknesses, opportunities, and threats and is a means to determine the potential and possible pitfalls in a systematic way. The output shows the plusses and minuses for both internal and external factors. Some recommendations and a discussion part are available in this part as well.

1.3 Outline

The rest of this report is outlined as follows. Chapter 2 discusses the differences between unimodal and multimodal concessions and mainly is about the concept of integration. After that, the ways to coordinate an integrated PT network are described in Chapter 3. These configurations are compared to each other in Chapter 4 with some real cases. The network effects of a multimodal concession are mentioned in Chapter 5. Chapter 6 is about implementation. Finally, the report ends with conclusions, recommendations, and discussion in Chapter 7.

Chapter 2

Literature

2. Literature

2.1 Introduction

All over the western world, PT was, generally speaking, a profitable business until the 1950s. However, during the 1960s and 1970s ridership got into a decline, mainly caused by increased car usage (Mouwen & Van Ommeren, 2016). This decline led to the first large deficits of PT operators and subsidy from the government was needed to cover the costs. Over the years, the losses became more significant and structural subsidy was needed to prevent a whole deterioration of the PT system. Therefore, regulatory reforms were introduced to increase efficiency and to cut down subsidies in the 90s (Mouwen & Van Ommeren, 2016). In the EU, Directive 1191/69/EU presented CT of exclusive services as preferential direction for efficiently organised PT. In that way, subsidies would be used most effectively (Mouwen & Van Ommeren, 2016). Expectations were an increase in ridership and better service against the same or lower costs.

Initially, unimodal concessions were tendered out. Over the years, however, also multimodal concessions were contracted. This chapter is about the main characteristics of such multimodal PT concessions. Before embarking on the coordination of multimodal PT networks, it is useful to start with a description of multimodal concessions. Literature study provides the basis for this description. The sub-question is: *What is the difference between a unimodal and a multimodal public transport concession?* Section 2.2 is about CT in general. The main characteristics of integration are discussed in section 2.3. Finally, a conclusion is drawn in section 2.4.

2.2 Competitive Tendering

Over the last 25 years, the New Public Management (NPM) movement has got more and more attention, also in the transport sector (Sørensen & Longva, 2016). The reforms in the PT sector since the 90s were driven by this movement. Keywords of these reforms are unbundling, competition, measures of performance, output controls, and private sector styles of management. In the European Union, it resulted, amongst others, in the introduction of market forces in PT in the form of CT. The obligation to tender PT within the European Union led to the foundation of regional PT Authorities (PTAs). They were charged with the coordination of PT in their region. Part of that was the task to contract an operator per concession using CT. A PT concession can be defined as the right to perform PT in a particular area during a specified period, with the exclusion of others (Wet Personenvervoer 2000, 2018). When only one mode of transport is contracted in a concession, the concession can be classified as unimodal, while concessions where two or more modalities are contracted simultaneously to one operator are multimodal.

In a lot of European countries, CT was introduced in a highly regulated PT market, where PT was carried out by a public company (Van Egmond et al., 2003). These public companies got a historical entitlement for providing PT in a region and were protected against other operators. The introduction of CT changed this situation, by giving more responsibility to the operators. The most important differences between a highly regulated market and a least regulated market are mentioned in table 2.1.

▶ **Table 2.1** | Explanation of some key market characteristics in PT under different degrees of regulation (Nielsen, 2005).

	Market environment	
Characteristic	**Highly Regulated**	**Least Regulated**
Type of ownership	**Public** State/local authority ownership of vehicles and infrastructure. Some sub-contracting to private operators	**Private** Private ownership of vehicles. Infrastructure likely to be publicly owned.
Quality licensing	**Similar standards** on for example safety regulations in all market environments	
Fares regulation	**Restrictive** Detailed regulations designed to protect passenger interests	**Limited** Little fares regulation, e.g. no regulation or prescribed maxima only.
Access by Operator to market	**Protection** Size and location of routes are protected from other operators.	**Open Access** Free entry with no limit to the number of operators per route.
Level of planning	**Planned** Routes are allocated by government.	**Unplanned** Routes are determined by the operator, to be confirmed / acknowledged by the relevant public authority.
Regulatory Mechanism	**Fixed group of routes** Fixed collection of spatially connected routes, run by one operator.	**Single route** Routes are licensed individually. Operator may run several routes as a package.
Entitlement	**Fixed entitlement** Operators have a legal / historical entitlement to route(s).	**Renewable tender** Operating contract is subject to regular renewal (time scale will vary between coutnries), usually by the process of competitive tender.
Subsidies	**Flexible** Amount of subsidy is flexible, being paid by deficit funding.	**Fixed** Subsidies are determined when routes are allocated, usually by competitive tender.

A highly and least regulated market are, however, only polar extremes (Nielsen, 2005). PTAs have a lot of freedom to adapt contracts to their wishes. A typical example of this is the remuneration form used. Four remuneration forms are possible, mentioned in table 2.2. In a gross-cost contract, the PTA determines the supplied services in the concession region and covers all expected production costs of the operator in a lump-sum payment (Van de Velde et al., 2008). A second contract type is called a net-cost contract. In such an agreement, fare-box revenues are for the operator, combined with a lump-sum subsidy payment from the PTA. Thirdly, the operator revenues can be entirely dependent on ridership. However, since in most European countries ridership is not large enough to justify the costs, fare-box revenues can be heightened by the PTA. This is called suppletion or a

super-incentive contract. The multiplication factor can be obtained in the tendering process. Generally speaking, there is a trend toward incentive-based contracts (Mouwen & Rietveld, 2013).

Table 2.2 | Characteristics of different remuneration types, based on Van de Velde et al. (2008).

Remuneration type	Lump-sum subsidy	Fare-box revenues to
Gross-cost	Covers expected production costs	PTA
Net-cost	Covers part of the production costs	Operator
Suppletion	-	Operator (multiplied by PTA)
Passenger revenue	-	Operator

A primary advantage of gross-cost contracts is the allowance for flexible planning (Van de Velde et al., 2008). After all, the PTA can relatively easy decide to change services. A disadvantage is that the power of operators, operating a PT network efficiently, is not fully used. Besides that, clear incentives on the topic of ridership or quality need to be defined to challenge the operator to perform better. These incentives are naturally included in a net-cost contract. However, in a net-cost contract, the challenge is to remain flexible in operations and let operators offer services that are not cost-efficient, for example by subsidising them. Suppletion is an even more extreme case. PTAs can hardly intervene in the services. However, there is a powerful incentive for operators to perform well. So, PTAs need to make a trade-off between flexibility and incentives for the operators which may lead to a better cost coverage ratio.

CT is an incentive for operators to get more customer focus in PT (Mouwen & Rietveld, 2013). The main objective is to improve cost efficiency (Hensher & Wallis, 2005). The question is in which cases CT is useful. Amongst others, Van Egmond et al. (2003), ECMT (2007), Beck (2011), Mouwen & Rietveld (2013), Veeneman & Van de Velde (2014), Mouwen & Van Ommeren (2016) show their experiences with CT in Western Europe. Most of them analysed different cases and found efficiency improvements, a better level of quality and customer satisfaction at lower costs when (some form of) competition is introduced (Van Egmond et al., 2003; Beck, 2011; Mouwen & Rietveld, 2013). Also, the critical role of the PTA is mentioned. However, downsides of CT are found as well. Negative results may occur for smaller operators and employees (Beck, 2011). Besides that, also in non-tendered regions, an increase in passenger satisfaction can be observed, due to the pressure in a competitive market on all operators to increase quality (Mouwen & Rietveld, 2013).

2.3 Intermodal integration

While the NPM reforms focused on efficiency and competition, recently more and more awareness can be observed on the topic of integration. That has to do with the occurrence of boundaries in the PT system. In the Netherlands, the introduction of CT was accompanied with a push for modal, regional, and organisational defragmentation by the national government (Veeneman, 2016). Consequently, mostly unimodal concessions were tendered. Another development was, due to the introduction of CT, more focus of the operators on serving the contract. These two developments led to the negative externality of an increase in boundaries. Boundaries are inconvenient for travellers when changing from operator to operator or mode to mode. Examples of these externalities are different fares and no smooth transfers (Veeneman, 2016). The boundaries can be classified into two forms: spatial and modal (see figure 2.1). Spatial boundaries can be observed between two regional (bus) concessions and modal boundaries occur in the interaction between train and bus.

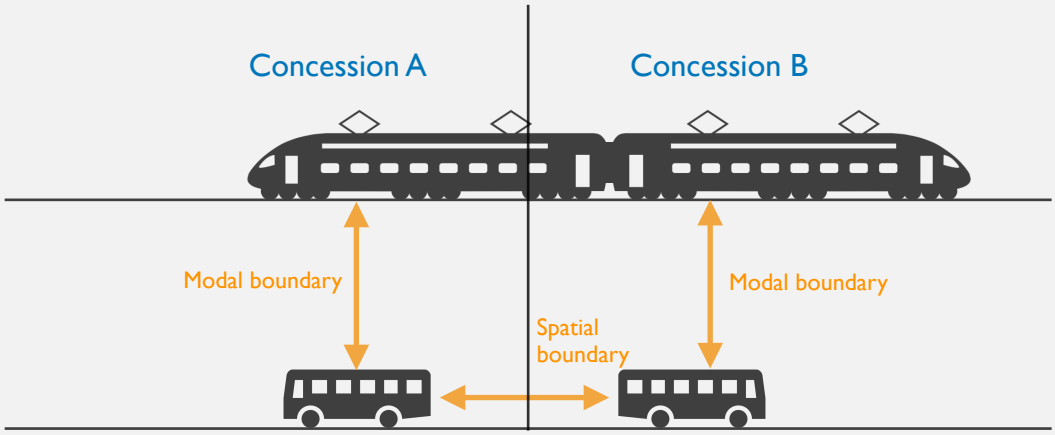


Figure 2.1 | Visualisation of spatial (horizontal) and modal (vertical) boundaries in PT concessions.

Unfortunately, spatial and / or modal boundaries will always remain in the system. After all, it is impossible to run a full PT system by one operator. Though, there are ways to reduce the number of boundaries: e.g. enlarge concessions or create integrated concessions. Enlarging concessions leads to an increase in the number of services that are operated by one operator. The responsibility of the particular operator grows. It helps to overcome spatial boundaries. Contrary, an integrated concession aims to stimulate the integration of different modes by laying the responsibility of (in this case) both train and bus by one operator. Both ways are examples of integration. Integration is needed for the quality of the PT system and to be able to compete with private car (NEA et al., 2003).

"Through intermodal integration, […] passengers perceive the transit system as one, unified, rather than fragmented system, and the offered services as "seamless" journeys with minimum interruption, independently of the number of modes or operators involved" (Saliara, 2014, p536). Integration is used when the coexistence of more than one mode or operator leads to cooperation issues (Saliara, 2014). The goal is to create a unified system of PT, which is clear to (potential) users. Intermodal integration can be divided into three levels: organisational, operational, and physical integration (Saliara, 2014). All levels consist of different elements (see table 2.3) and are necessary for the development of a well-integrated PT system where boundaries are not observed by the traveller. The three levels are partly dependent on each other. Organisational integration is the most basic version of integration. A PTA that coordinates PT in a region and arrangements between the PTA and operator(s) are prerequisite for operational and physical integration.

Table 2.3 | Three levels of PT intermodal integration, adapted from Saliara (2014).

Organisational integation	Operational integration	Physical integration
Existence of one or more independent PTA(s)	Network layout	Access to facilities
Arrangements between operators	Schedule	Location of facilities
	Information	Design of stations
	Fares & tickets	Control of vehicle movements
	Vehicle management	

Applying some form of intermodal integration can be done in all types of concessions. In the case of unimodal concessions, the focus then mainly is on cooperation between operators and the steering role of the PTA. Multimodal concessions already have some form of intermodal integration built-in, because regional train and bus are operated by one company. That means that all levels of integration should be easier achievable in that case. In the rest of this section, the three levels of integration will be explained further and applied to the case of regional multimodal PT concessions.

2.3.1 Organisational integration

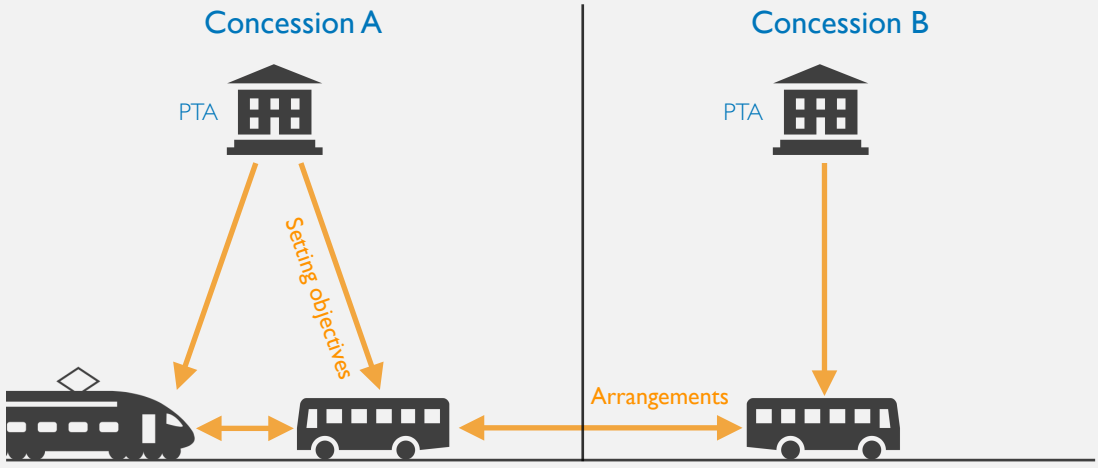
The first level of intermodal integration is organisational integration. It "describes the special arrangements and contracts between the stakeholders ensuring their interest and commitment to the system's performance" (Saliara, 2014, p537). The existence of one or more independent PTA(s) to coordinate functions and operators and the arrangements between operators are part of organisational integration (see figure 2.2). Organisational integration is needed before operational and physical integration can take place at all. Different ways of organising intermodal integration are further described in Chapter 3.

Public Transport Authority

In order to organise PT in a private environment, an autonomous umbrella PTA is needed. This PTA is responsible for PT in a region and ensures that different functions, responsibilities, and jurisdictions of all involved operators are unified (Saliara, 2014). It sets objectives for the intermodal PT system and balances commercial and passenger interests (Rivasplata, 2008; Saliara, 2014). The PTA coordinates the regional PT operator(s). In some cases, there may be several PTAs coordinating different modes of transport in a region. Arrangements between those authorities are needed then as well.

When referring to PTAs, often the concept of the 'Verkehrsverbund' is mentioned (Saliara, 2014; Pucher & Kurth, 1995). This concept originates in the mid-1960s in the region of Hamburg in Germany (Saliara, 2014). In that time, PT was highly uncoordinated, resulting in annoying, time-consuming, and expensive transfers (Pucher & Kurth, 1995). The role of the Verkehrsverbund became to stimulate both operational and physical integration of the services offered by the operator (Saliara, 2014). It got the mandate to fully coordinate the PT in the region, while

Figure 2.2 | Visualisation of organisational integration.



preserving the already operating companies (Pucher & Kurth, 1995). Timetables, fares, and stops were all aligned to smooth transfers from one mode to another. Furthermore, marketing and planning was the full responsibility of the PTA. The operators were responsible for executing the services by providing the vehicles, staff, work schedules, and maintenance (see table 2.4). The establishment of the Verkehrsverbund in Hamburg caused an increase in ridership and was consecutively conceived as successful. More extensive, higher quality, and better-integrated services were the main reasons for that (Pucher & Kurth, 1995). Because of the success in Hamburg, the general concept was imitated in other German cities and later also in countries like Switzerland and Austria. Also there, most regions saw an increase in ridership.

Table 2.4 | Division of responsibilities among the PTA and operator in the Hamburger Verkehrsverbund, based on Pucher & Kurth (1995).

PTA	Operator
Network layout	Vehicle type
Frequencies	Personnel
Timetable	Work schedules
Fare structure	Maintenance
Revenue distribution	
Marketing	

An example of a current Verkehrsverbund is the Züricher Verkehrsverbund (ZVV) in Switzerland. It started in 1988 when the regional train network was decentralised. Since then, strong service standards were defined. These standards still form the basis of the regional PT planning (Petersen, 2009). In these standards, amongst others the times of operation, minimum headways, and geographic coverage are defined. Strategic planning is the responsibility of the ZVV. Tactical planning is (partly) delegated to the eight largest operators in the region.

Arrangements between operators

Although PTAs have the right to set service standards and minimum requirements, sometimes it can be desirable to let operators make mutual agreements. These agreements can enlighten the task of the PTA. Another argument is that the formulation and execution of regional transport planning are not done continuously in a privatised environment, which allows operators to operate without (e.g. fare or timetable) coordination (Rivasplata, 2008). Therefore, PTAs can oblige operators to regulate specific topics themselves. Operators themselves can also make arrangements together on a voluntary basis. Sørensen & Longva (2010) call this partnership coordination. A characteristic is that the regulation is not enforceable directly. In the UK, for example, partnership coordination is used between bus operators to improve service quality on certain corridors (Sørensen & Longva, 2010). Arrangements between operators are always needed, not only in unimodal concessions. An example is the coordination between a bus operator and the national train operator.

2.3.2 Operational integration

Organisational integration can be used to achieve operational integration. Operational integration refers to the planning of the PT system with minimum interruption (Saliara, 2014). It relates directly to the supply of PT services for passengers. When operational integration is achieved, passengers experience a smooth PT system. Network layout, schedules, transfers, information, fares & tickets, and vehicle management (guaranteed transfers) should be synchronised over the whole network. Below, the different aspects of operational integration are described. In the rest of the

coordination part of this report (Chapter 3 and 4), the focus is on the organisational side of operational integration. That means, the ways of organisation to achieve operational integration as described hereafter. The effect on passengers is described in Chapter 5.

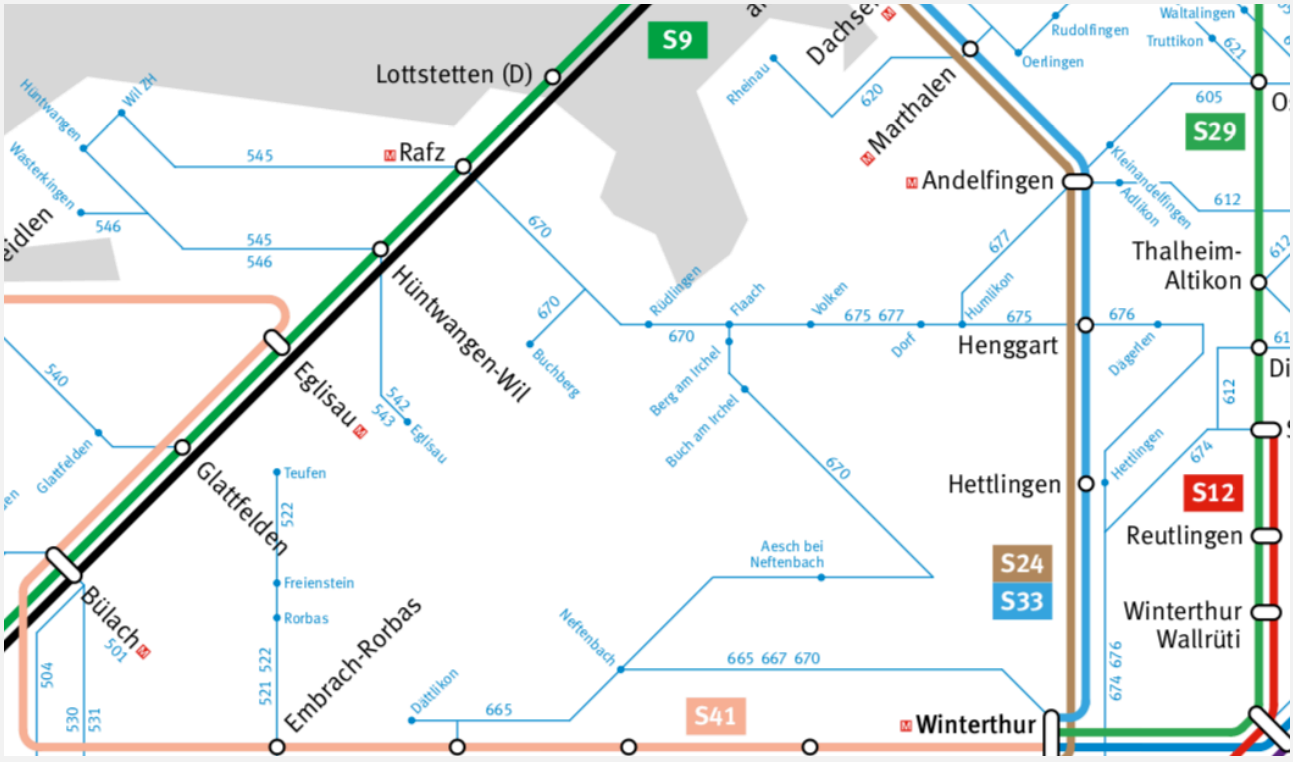
Network layout

Network integration is aimed to reduce wasteful duplication of services and improves the utilisation of transport resources (Ibrahim, 2003). From a passengers perspective, travellers can reach more destinations when PT routes are connected (Chowdhury & Ceder, 2013). This increases the attractiveness of each service itself (NEA et al., 2003).

Switzerland is an international example of an integrated PT system, historically due to the integration of train and bus services (Buehler et al., 2013). The integration is mainly established by the different PTAs (Verkehrsverbünder). Petersen (2009) explores the case of the Weinland PT network in the north of Switzerland, which can be classified as a 'feeder network'. In 1988, when the Verkehrverbund was established, most of the current existing lines have been designed (Petersen, 2009). The basis of the network there is the railway network. The bus network design is based on that. Bus lines aim to feed the train network. Most bus lines start at a railway station, pick-up train passengers and travel outward of that railway line (see figure 2.3). On the route back, the bus gives a connection to the next regional train. The bus lines mostly use main roads to connect towns and sometimes ends at another railway station. Bus lines parallel to the railway lines are prevented. Extra stations on the railway line can be opened to serve the towns located there.

Several advantages and disadvantages of feeder networks can be mentioned (Bracun, 2012). According to him, most passengers will notice a TT reduction. For the operator, a feeder network is an efficient network to operate. Economies of scale can namely be achieved. Generally speaking, in a multimodal concession the financial coverage of less occupied lines is paid by busy lines. In a feeder network, the smaller (bus) lines are shortened, while the already profitable railway line can

Figure 2.3 | Part of the current feeder network in the Weinland region (Züricher Verkehrsverbund, 2017).



take over the passengers on a part in the network. This increase the cost-coverage of such a network. For the PTA, it takes away the need of allocation of subsidy over the lines. Some downsides of a feeder network are an increase in transfers for some passengers. Also, the investment and revenue risks for the operator become larger.

Schedule

A challenge in regional PT, which usually has a low demand compared to an urban region, is to provide high-frequency services that can compete with private car (Nielsen, 2005). As an alternative to high-frequent services, the schedules of different operators can be aligned with each other by synchronising them. Synchronising timetables is mainly about "coordination and synchronization of arrival and departure times of the involved lines and modes in order to reduce waiting, dwell, transfer and total traveling times" (Saliara, 2014, p538). Passengers are offered a better PT system when synchronised timetable has been applied (Nielsen & Lange, 2008).

An often used principle in synchronised timetables is a pulse timetable. It can be described as a network operation in which arrivals and departures are synchronised at important stops or stations (Nielsen, 2005). It may, for example, be the case that in a small town all buses arrive at the station right before the regional train comes in and depart when the train has left. This pattern can repeat itself every 30, 60 or 120 minutes. It allows passengers to transfer from train to bus or vice versa, but also changing from bus to bus is possible. A pulse timetable is even more efficient when 'crossing points' serve as pulse point. These are stations where opposite trains meet each other (Petersen, 2009).

Pulse timetables are for example applied in Switzerland. In 1982, the Swiss Federal Railways (SBB) introduced pulse points in the railway system (Petersen, 2009). These are usually larger stations at which all trains arrive and depart at almost the same time every 30 or 60 minutes. This timetable repeats itself over the day, from 6 a.m. to midnight. The Taktfahrplan concept was extended to several regions, including the Weinland region. In the Weinland region, crossing points serve as a basis for the timetable. These are locations where trains from the opposite direction meet each other and where buses are also departing and leaving at that time. These stations operate as pulse stations on a smaller scale (Petersen, 2009).

Improving transfers is the central goal of a pulse timetable. Interchanges are an essential quality aspect for passengers since it has a significant impact on the reliability of the PT system (Lee et al., 2017). However, operators not always have an incentive to provide good interchanges. It can even make sense for them to offer bad interchanges (Potter, 2010), for example in cases where a bus operator wants to attract train passengers in the same region. Though, when the design boundary is changed on a whole journey, the passenger's perspective, interchanges become important for operators as well and might help to generate passenger growth (Potter, 2010). For operators, a pulse timetable is less efficient to operate, since the dwell time of (some) vehicles can be high on transfer stations (Nielsen, 2005).

Transfer times, however, are not only determined by the schedules. Planning interchanges is a complex interaction between network, schedule, and physical integration (Saliara, 2014). These factors are also on a different scale level. Assuming a feeder network in combination with a pulse timetable, interchanges in the PT system become of great importance. Passengers are expected to transfer from bus to train at a pulse station. However, usually passengers avoid transfers, because of the provoked interruption in their trip (Saliara, 2014). Consequently, planning transfers and increasing reliability becomes extra important in such a network. Lee et al. (2017) mention five main variables for the reliability of transfers: distribution of arrival and departure times, walking time between the stops, planned transfer time, the frequency of lines, and the number of transferring

passengers. Transfer integration is needed to reach a high level of reliability in a (multimodal) network.

Information

Next, all necessary information of the whole PT system, in particular interchanges, must be easily accessible. When not all information can be reached quickly, for instance when the information is not provided at all, people will not even plan their journey (Terzis & Last, 2000). In a less extreme case, what and how information is provided to travellers will influence the way the system is used (Nielsen, 2005). For example, how a transfer point is depicted on a PT map can encourage or discourage travellers to transfer at the particular stop. When information integration is achieved, "the system is perceived as 'one', with a unified set of concepts and common language in the communication towards the users" (NEA et al., 2003, p15). A single image for the PT system (e.g. logos and joint marketing) are part of this. The primary objective is to inform people about travel possibilities within and outside the system (NEA et al., 2003). Borders in the system, such as different operators and transfers between modes, should not create a barrier to travel or transfer (Saliara, 2014).

Dziekan (2008) proposed ten measures that could enhance the ease-of-use of a PT system, in particular Stockholm. These measures are relevant for single operators, but in this context they can also be used to promote PT in a whole area. Amongst others, a good schematic map should be developed (such as depicted in figure 2.4). Besides that, all necessary information to enter the PT system should be available at all stops, in all buses, and on the internet. Different strategies should be developed, such as a tourist strategy, an information strategy, and a newcomer strategy. Finally, youth marketing should be more important, and cooperation with major travel destinations can help to make stops more visible. All measures are mentioned in table 2.5.

Table 2.5 | Ten measures that could enhance easy-of-use in Stockholm's PT system (Dziekan, 2008).

To do list for more attractive PT	
Provide a good schematic map	Stick to the information strategy
Provide all necessary information to use PT at each stop	Implement a tourist strategy
Provide more network information in buses	Invest in youth marketing
Provide more extensive timetable information at each stop	Develop a newcomer strategy
Promote the online travel planner	Cooperate with major destinations

Fares & tickets

An important aspect of operational integration for travellers is fare and ticket integration (NEA et al., 2003). Ticket integration is about the payment method for a trip. Fare or tariff integration refers to the price paid for a multimodal journey at one operator versus a multimodal trip with more than one operator (NEA et al., 2003). Often, fare and ticket integration go hand in hand. There are, though, cases in which ticket integration is applied, while fare integration is absent. For example, the Dutch PT smartcard can be used in all PT throughout the country, but the price (entry fee plus a distant charge) differs per concession and is in most cases paid per vehicle. This often has the consequence that passengers in a multimodal trip pay the entry fee several times. For example, when travellers change trains between different operators, they need to check out at the first operator and check in at the second operator (see figure 2.5).

Figure 2.4 | An integrated schematic map, including bus, regional train, and IC (Arriva, 2017).

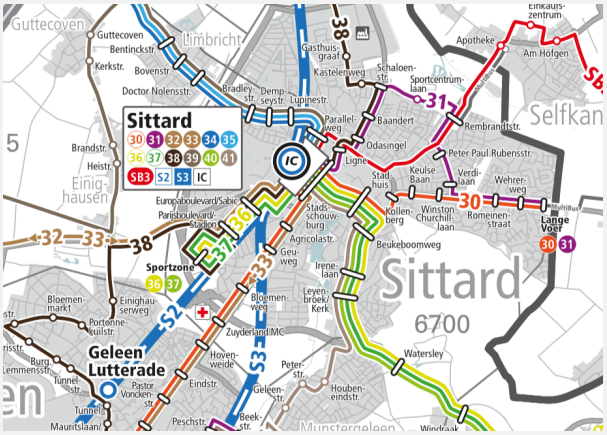


Figure 2.5 | Ticket integration without fare integration in the Netherlands.

An Integrated Tariff System (ITS) eliminates the need to purchase a ticket for each trip, which makes it easier for passengers to transfer from one line or mode to another (Saliara, 2014). A tariff system must satisfy two requirements to become integrated: no additional costs for transfers and all modes and services use the same ticketing system (Sharaby & Shiftan, 2012). Besides that, the availability of tickets is also a point of interest (NEA et al., 2003). Tickets can be valid for a short period or a whole season (Abrate et al., 2008), but can also be referred to special groups or trip purposes (Saliara, 2014). Introduction of an ITS has three desired contributions: shifting trips from private car or taxi to PT, creating new trips, and offering more options for travellers to travel faster (Sharaby & Shiftan, 2012).

A revolutionary feature of the London Underground at the beginning of the 20th century was the ability to change lines within the system using only one ticket (Potter, 2010). A lot of countries also implemented such a simple flat fee paper ticket in their PT system. Currently, a lot of those systems are replaced by more advanced ones. These are, however, not always integrated anymore. There seem to be two approaches to create an ITS using advanced smartcard systems (Potter, 2010). The first one is the integration of PT smartcards to cover more transport services. Another approach is that PT ticketing will be an add-on to regular debit and credit cards. This way seems to be a solution on a longer term.

For travellers, ITS only seems to have positive characteristics solely. Therefore, passenger growth can be expected when introducing an ITS. According to Abrate et al. (2008), an ITS has an expected positive impact on passenger demand of 2% in the short-run and 12% in the long-run in the cases researched. The advantage for PTAs is that it avoids competition between operators on this subject (Saliara, 2014). Consequently, PTAs are often needed to regulate the fare system and to decide how to distribute the collected revenue.

Vehicle management
Vehicle management is about efficient real-time control of vehicles in a TC centre. Coordinated traffic control ensures that passengers can travel seamlessly between all parts in a region (Nielsen, 2005). A coordinated traffic control centre can control both bus and regional train. This is especially important in the case of disturbances and disruptions when planned interchanges are not possible anymore. At this stage, integration can be reached by providing guaranteed interchanges, adequate information, and/or remedial services (NEA et al., 2003). A shared traffic control centre of bus and regional train can, for example, hold a bus to guarantee the interchanges, which would hardly be possible with more traffic control centres. The situation becomes more complicated in the interaction between regional and ongoing IC trains of several operators. Proper arrangements between the operators are essential in this regard.

2.3.3 Physical integration

Thirdly, physical integration plays a role in establishing an integrated PT system (Saliara, 2014). This mainly has to do with the planning and design of stops, stations, and transfer centres (Miller, 2003). Moreover, it is about the coordination of vehicle movements to reduce the interruption in case of interchanges. This interruption consists of delay, the need for orientation and walking between vehicles, and also often reduces safety. Physical integration aims to take away these barriers. All aspects of physical integration are usually the responsibility of the PTA or municipality. Physical integration, however, is already established in a lot of PT systems historically. It has not so much to do with multimodal concessions and is therefore at the border of the scope of this research. For that reason, the four aspects of physical integration will only be described shortly.

Access to facilities
PT facilities, such as transfer points, must be easily accessible to be able to compete with private car. Walking distances to stops must be short and attractive (Nielsen, 2005). The first aspect can partly be determined by the location (see below), but the second aspect can be achieved by safe and comfortable pedestrian routes (Nielsen, 2005). When a route is more attractive, passengers are willing to walk longer. Bike accessibility can increase the catchment area of PT. The same holds for park and ride facilities.

Location of facilities
The second aspect of physical integration, the location of facilities, refers to the establishment of transfer points. These must be located carefully (Miller, 2003). The largest transfer points should be on important locations where both land use (for example a city centre) and the PT network meet each other (Nielsen, 2005). Often, these are places with a lot of work concentrations, commercial activities, and local centres of activity (Nielsen, 2005).

Design of stations
Stations should be nodes in the PT system where transferring can be done easily. Barriers to transfer must be taken away as much as possible (Tarzis & Last, 2000). The physical design of stations can help to create a structured and pleasant place to stay station that overcomes the barrier to transfer. For example, in Singapore stations are continuously improved by refurbishing bus shelters, adding linkway from station entrances to bus shelters, and overhead bridges are added (Ibrahim, 2003). According to Nielsen (2005), the five most important issues of physical station design are creating short walking distances, the need for elevators and escalators, creating visibility between the main destinations to improve orientation and safety, accessibility needs for the disabled, and weather protection, light, and cleanness.

It is crucial for a PT network that can compete with private car that transfer points are designed well (Nielsen, 2005). Especially in the case where different operators are present at a transfer centre, integrated design of the station stimulates interchanges in the network. If critical transfers points do not function well, the demand for direct low-frequency lines will increase (Nielsen, 2005). The result of that is a fragmented, complex, and continuously changing system. Investments in rail infrastructure then cannot be done anymore (Nielsen, 2005). Well-designed transfers points are thus needed for a well-functioning feeder network, which is a common characteristic of multimodal PT concessions.

Control of vehicle movements

Controlling vehicle movements is the fourth aspect of physical integration. It is about the "coordination of vehicle movements for transfers to be safe without any conflicts between pedestrians and vehicle movement" (Saliara, 2014, p538). This allows passengers to transfer safely from vehicle to vehicle and improves smooth operations at transfer stations.

2.4 Conclusion

What is the difference between a unimodal and a multimodal public transport concession?

A PT concession is a permit for an operator to run PT for a couple of years in a particular region. During that time, competitors are excluded. An operator is contracted (obtains the concession) when it has won the tendering process organised by the particular PTA. When only one mode is tendered, the concession can be classified as unimodal. A multimodal concession is a concession where two or more modes are contracted simultaneously. Regional train and bus are contracted together in a multimodal concession is a form of organisational integration, meant to simplify operational integration. Operational integration is about the alignment of regional train and bus network layout, schedule, information, fares & tickets, and vehicle management. However, operational integration is not limited to a multimodal concession.

In literature, limited attention is paid on the different aspects of operational integration. The studies found are primarily based on case studies and focus on passenger growth or revenues. It is, therefore, difficult to determine the factors that influence the performance. Furthermore, most sources only focus on one of the aspects of operational integration, mainly network and schedule. Generally speaking, the studies show positive results of an integrated system. Weaknesses are hardly mentioned. Table 2.6 provides an overview of the strengths and weaknesses of operational integration in a multimodal concession, from the factors obtained in literature. It functions as a starting point for the rest of the research.

▶ **Table 2.6** | Overview of the theoretical strengths and weaknesses of the different aspects of operational integration in a multimodal concession.

Topic	Strengths	Weaknesses
Network layout (feeder network)	• Average TT gain for passengers (Bracun, 2012) • High loading factor and cost recovery (Petersen, 2009; Buehler et al., 2013) • Financial compensation train-bus (Bracun, 2012)	• On average more interchanges for passengers (Bracun, 2012) • Larger (revenue) risks (Bracun, 2012)
Schedule (pulse timetable)	• Minimises waiting time for passengers (Nielsen, 2005; Bracun, 2012) • Fixed frequency all week long (Bracun, 2012) • More travel option for passengers (Bracun, 2012)	• Complex interaction between network, schedule, and physical design (Saliara, 2014) • Passengers not able to avoid transfers (Saliara, 2014) • Stable and reliable running times needed (Nielsen, 2005; Lee et al., 2017) • Possible inefficient bus circuits (Nielsen, 2005)
Information	• The system is perceived as one (NEA et al., 2003; Bracun, 2012) • Influences the attractiveness and the use of the network (Nielsen, 2005)	
Fares & tickets (ITS)	• Easier and cheaper transferring (Saliara, 2014) • More travel options to passengers (Sharaby & Shiftan, 2012) • No fare competition between operators (Saliara, 2014)	
Vehicle management	• Seamless trips between all parts in a region (Nielsen, 2005)	

Operational integration cannot only be achieved by a multimodal concession. Some form of organisational integration is needed. Organisational integration is about coordination of planning and control tasks to ensure a smooth PT system for passengers. Therefore, it is the question which other coordination forms are possible. Chapter 3 deals with that question.

Chapter 3

Network Coordination

3. Network Coordination

3.1 Introduction

The aim when trying to diminish the modal boundaries between regional train and bus is to create integration. However, integration does not appear autonomously (NEA et al., 2003). It can only be achieved with some form of coordination. This coordination can be created by tendering out a multimodal concession. There are, though, more ways to do this. All approaches to coordinate a multimodal PT network are described in this chapter. The central question is: *How can the different planning and control tasks in regional multimodal public transport networks be coordinated?*

The structure of this chapter is as follows. In section 3.2, the stakeholders active in PT are defined, and the relations between them are described. Section 3.3 is about the planning and control tasks that need to be carried out by the different stakeholders. Some general coordination concepts are described in section 3.4. The topic of section 3.5 is coordination in multimodal PT networks. Finally, a conclusion is formulated in section 3.6.

3.2 Stakeholders

From an economic point of view, PT is a service provided by a company on an economic market. There is supply, demand, and a price that has to be paid to make use of the service (Van de Velde, 1999). In this market, different stakeholders are active to provide the services. The relationship between the stakeholders forms the basis of the different forms of coordination. For that reason, this section describes the different stakeholders in regional PT and the relations between them.

3.2.1 Identification

Within (regional) PT in a context network contracting, often four main stakeholders are defined: operator, PTA, passengers, and inhabitants. These stakeholders all have their goals, power, and instruments that can be used to reach the goal(s). In table 3.1, the main characteristics of these stakeholders are mentioned. Below, all four will be described shortly.

Table 3.1 | Overview of the goals, power, and instruments of the four main stakeholders in regional PT.

	Operator	**PTA**	**Passengers**	**Inhabitants**
Goal(s)	Maximum revenue, serving the contract, satisfied staff, happy passengers	Good quality PT, fair prices, reasonable return to operators	Safe, reliable, fast, simple, comfortable PT	Liveability
Power	High, dependent on contract	Very high	Individually: low Aggregated: high	Low
Instruments	Lobbying, investments, marketing, resource allocation	Policy creation, CT, budget allocation	Modal choice, lobbying in passenger organisations	Voting, protesting

Operator

In order to let PT vehicles run, an operator is needed. In a private environment, the operator is a private company responsible for offering PT services in a region. There also might be more than one operator in a multimodal PT network. The primary interest of a private operator is maximising revenue, which is often achieved by efficiently serving the contract. However, happy staff and satisfied passengers are essential as well. When an operator has been contracted, its power is significant but dependent on the contract form. In any case, the instruments of operators are lobbying, marketing, investments, and resource allocation.

Public Transport Authority

A PTA is a public organisation that has the competence to organise PT in a region. The political council, part of the PTA, determines the general transport and social policy (Van de Velde, 1999). High-quality PT can have several benefits for a city and citizens. Van Oort et al. (2017) describe five of them. These are effective mobility, efficiently organised cities, prosperity and wellbeing in cities, environmental benefits, and equity. Some of them, especially the last three, are also important for rural areas. The PTA represents the citizen interest and therefore often promotes PT in the general transport and social policy. When the transport and social policy is determined, the transport department translates the aims into mobility and accessibility standards. Also, a CT process is started. Hensher & Stanley (2008, p1144) define the goal of the PTA as "to provide a good quality, integrated and continually improving transit service that is available to all for a fair price, with reasonable return to operators that gives value for money under a regime of continuity." Since they are the ultimate responsible authority for PT, PTAs have a lot of power. Typical instruments of a PTA are policy creation, CT, and budget allocation.

Passengers

The stakeholder that makes use of PT is the passenger. Van Hagen (2011) has created an overview of the needs of passengers in the pyramid of customer needs (see figure 3.1) To let people make use of PT at all, the system should be safe and reliable (Van Hagen, 2011; Van Oort, 2011). Next, TT should be as short as possible, since it is often seen as a disutility. Passengers want to go as fast as possible from origin to destination. Besides speed, passengers want to travel easily, comfortably, and have a good customer experience (Van Hagen, 2011). The power of the passengers solely is relatively low. If services do not fit their needs, they can take another mode of transport. However, the aggregated power of passengers can be powerful, since operators and/or PTAs are dependent on the passenger (revenues). The demand in the system depends the success of the system. Therefore, passengers are often represented by passenger organisations.

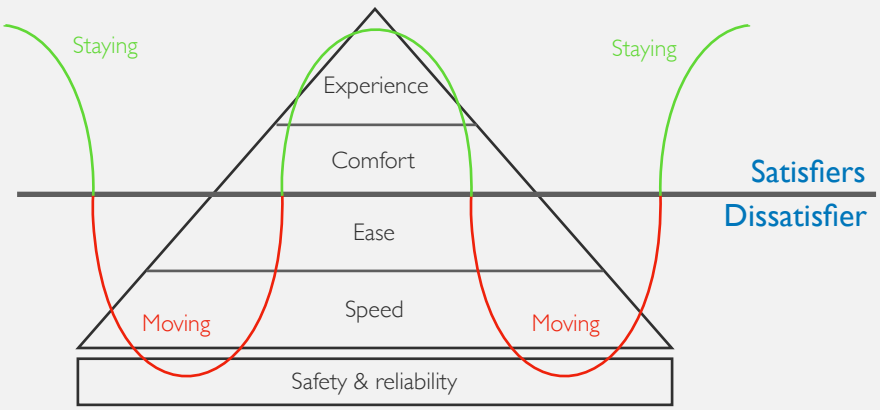
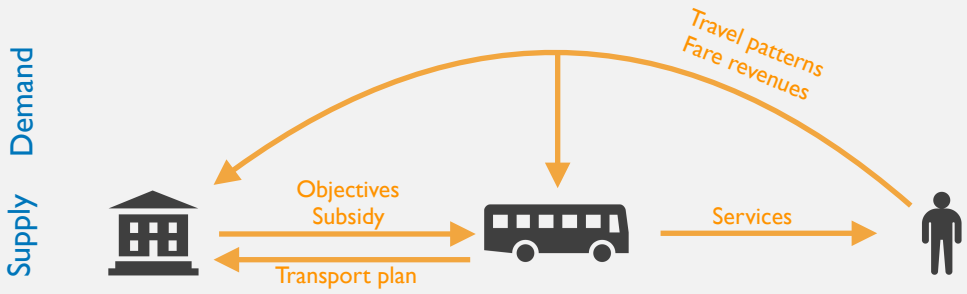


Figure 3.1 | Quality dimensions of PT for passengers, in order of importance (Van Hagen, 2011).



▶ **Figure 3.2** | Stakeholder relationship diagram of the three most important stakeholders in PT.

Inhabitants

Local communities or inhabitants in a region are a direct stakeholder since they are faced with the externalities of PT (vehicles). The goal of inhabitants is to live and work in a pleasant environment. In their view, PT should cause minimal nuisance. That creates their main perception of PT, which is very local. Their power is, therefore, low. Since inhabitants are also citizens, one of their instruments to affect the liveability is voting on the national, regional, and local governments. Besides that, protesting is an instrument.

3.2.2 Relationship

The aforementioned stakeholders are related to and dependent on each other. The relations between the first three stakeholders are depicted in figure 3.2. In the analysis, inhabitants are not further taken into account, because their power is low and their interest is less relevant on a high scale level. The PTA defines the goals and minimum requirements for PT. When an operator is contracted for a particular concession, it receives a subsidy to provide services. The contracted operator has submitted the best transport plan and must satisfy the objectives as defined by the PTA. This operator offers PT services to the passengers. Passengers make use of those services and the revenues either remain at the operator itself or go the PTA, dependent on the contract. Besides that, the PTA and operator get insight into the travel patterns of the passengers. Services can be improved, based on that information.

Concerning coordination issues, especially the interaction between the operator and PTA is essential. Therefore, this chapter and the next chapter focus on these two actors. The interaction between the operator and passengers, represented by the provision of PT services versus the resulting travel patterns, is the topic of Chapter 5.

3.3 Planning & control tasks

PT is supplied by a cooperation of the PTA and the operator. Before the services can be provided to passengers, several decisions have to be made (Van de Velde, 1999). These planning and control decisions are made on three hierarchically ordered levels: strategic, tactical, and operational. Strategic planning is about the formulation of general aims and the determination of the means (in broad terms). For example, profit targets, available budget, market share aims, area of supply, and definition of the primary target groups can be discussed (Inno-V et al., 2008). This is translated into transport policy, social policy, mobility standards, and accessibility standards (Van de Velde, 1999). On a lower level, tactical planning deals with the means that help to reach the goals defined. Here, the decisions on fares & tickets, network layout, schedules, and vehicle types are made (Inno-V et al., 2008). Finally, operational planning is the actual execution of the services in an efficient way. Here, the tactical aspects are specified into day-to-day practice. This includes the organisation of ticket sales, transfers & information, and personnel and vehicle management (Inno-V et al., 2008). Van de

Velde (1999) mainly focuses on planning tasks at all levels. However, Saliara (2014) mentions (real-time) control tasks also influence integration. Therefore, the terminology of Saliara (2014) is used.

The responsibility for the planning and control decisions are divided amongst the PTA and operator. A schematic overview of the planning and control tasks per actor is shown in figure 3.3. Vertically, the planning and control tasks carried out per actor are shown, while horizontally the functions are divided into strategic, tactical, and operational. Usually, strategic planning is the responsibility of the PTA. Since strategic planning often transcends the duration of concessions, a PTA is better capable of defining long-term strategies. Besides that, the PTA also has an interest in equity goals for providing PT, in contrary to operators. The political council of the PTA determines the transport policy and social policy, which serves as a planning framework for its transport department. The transport department, consecutively, establishes the mobility standards and accessibility standards. Operations itself must be provided as efficiently as possible. For that reason, operational planning is usually the responsibility of the operator. The division of duties at the tactical level depends on the contract form used. It can both be done by the PTA and the operator(s). Therefore, it is not specified in the figure.

The planning and control tasks that are not carried out by the PTA itself ask for coordination. The PTA wants their goals and interests to be represented in the services provided by the operator. There is, however, a conflict in interests between these stakeholders. Below, the different interest in the planning and control tasks part of operational integration (as described in Chapter 2) are described. These aspects are underlined in figure 3.3.

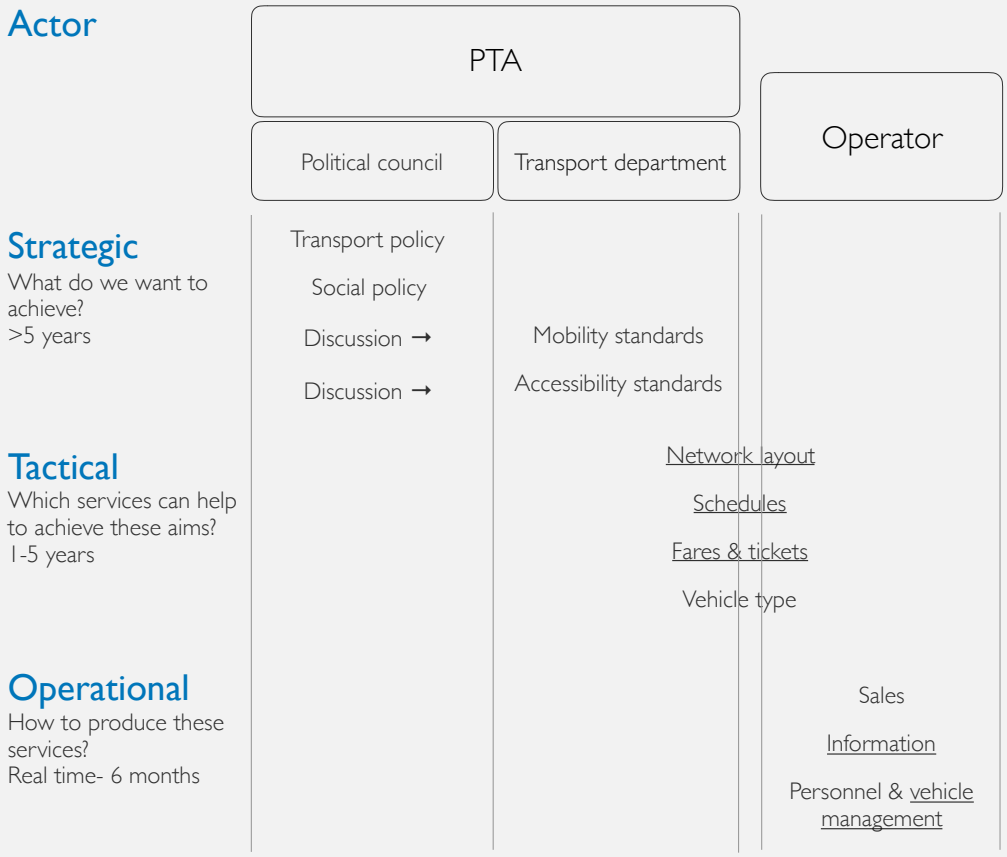


Figure 3.3 | Overview of planning decisions per level (horizontal) and actor (vertical) needed for providing PT, based on Van de Velde (1999) and Saliara (2014).

Network layout
Providing PT for everyone is an important aim of a PTA. More specifically, the disclosure of all towns in a region and fast connections to as many places as possible is in the interest of the PTA. This equity purpose can strike with the profit-driven operator's interest. An efficient network to run results in focus on main corridors instead of giving access to all locations. However, this is dependent on the contract form used by the PTA. In any case, a trade-off has to be made in the network planning.

Schedule
Network layout and schedule are intertwined with each other. Consequently, almost the same consideration as made in network layout applies to timetable coordination. The focus on livability and equity of the PTA results in a push for high frequencies on most lines. Contrary, the operator wants to run as efficient as possible, which is using as less vehicles as possible, unless more passengers can be attracted to the system.

Information
The aspect with the least interest difference between PTA and operator is probably information. It is in both interest for PTA and operator to provide good information on transfers, because it will attract new passengers. Operators prefer not spend too many resources on it, but the goal of providing good and useful information is, in general, the same.

Fares & tickets
From an equity point of view (PTA), tickets must be as cheap as possible to allow and stimulate everyone to use PT. When the focus is on a high cost coverage (operator), the total ticket revenues should be as high as possible. That can either be achieved by attracting a lot of passengers with a low fare or by a few passengers paying a higher fare for their journey.

Vehicle management
It is in the interest of both PTA and operator to have high punctuality of trains and buses. The situation becomes somewhat different in case of delays. The operator, then, has no direct interest in making connections to other trains or bus lines. Its primary interest is to keep driving on time with as less interruptions as possible. The PTA, now mainly representing the passengers, prefers to have a maximum number of guaranteed transfers.

3.4 Coordination concepts
To stimulate integration, as described in Chapter 2, coordination between the stakeholders is needed. According to Oxford Dictionary (2018), coordination can be defined as "the organization of the different elements of a complex body or activity so as to enable them to work together effectively." In the case of PT, coordination is meant to establish operational integration, i.e. a fully connected PT system for the passenger. This section describes what concepts can be used to achieve coordination.

When analysing coordination, often the concepts of Powell (1990) are mentioned (Sørensen & Longva, 2011). According to Powell (1990), there are three forms of economic organisation: market, hierarchy, and network (see table 3.2). These concepts are general and can be applied to all kinds of activities in society, including economic markets (Sørensen & Longva, 2011). Since PT is also carried out in an economic market of supply and demand (Van de Velde, 1999), the concepts are described hereafter and applied to PT. The three concepts are, however, ideal types and hardly found in practice in their pure form (Sørensen & Longva, 2011).

Table 3.2 | Forms of economic organisation (Powell, 1990).

Key features	Market	Hierarchy	Network
Normative basis	Contract - property rights	Employment relationship	Complementary strengths
Means of communication	Prices	Routines	Relational
Methods of resolution	Haggling - resort to courts for enforcement	Administrative fiat - supervision	Norm of reciprocity - repetitional concerns
Degree of flexibility	High	Low	Medium
Amount of commitment among the parties	Low	Medium-high	Medium-high
Tone or climate	Precision and/or suspicion	Formal, bureaucratic	Open-ended, mutual benefits
Actor Preferences or Choices	Independent	Dependent	Interdependent

Market

Using the market concept, coordination is organised by a contract. This contract states how exchange of 'benefits' is to take place between buyer and supplier (Powell, 1990). The contract defines what goods are supplied at what price. Other conditions can also be stated. This form of coordination is dependent on the existence of market prices (Håkansson & Lind, 2004). The market concept is a distant form of coordination. Actors do not need to collaborate. They are independent of each other. The contract defines the relationship between the actors. Consequently, no trust is required to draw up a contract. Enforcement of a contract can be achieved by court (Powell, 1990).

CT of concessions is a way of using market coordination in PT. Namely, the aim of CT for the PTA is to conclude a contract with an operator that fits best the needs of the PTA. This contract defines the ins and outs of the concession. Price is an important aspect in CT since one of the interests of a PTA is to get the best cost-benefit ratio for the provided services. In PT, the resulting contract of a CT process is the basis for hierarchical and network coordination.

Hierarchy

An authoritative regime can impose coordination by means of hierarchy (Powell, 1990). In hierarchical coordination, the coordinating actor must have the power to do so. This actor imposes the actor on a lower hierarchical level what to do. When hierarchical coordination is applied, activities can be perfectly adapted to each other (Håkansson & Lind, 2004), since one actor has all responsibility for a group of activities. The concept, however, relies on rules and formal power. Other consequences are that communication occurs in an employment relationship and actors are dependent on each other (Powell, 1990). Finally, previous interactions shape current ones, because hierarchical coordination is based on routines.

In PT, there is a clear hierarchical difference between PTA and operator. The PTA is responsible for PT and pays for the delivered services. Consequently, the PTA can impose the operator what to do under the condition that it is stated in the concession contract that the PTA has the right to do so.

Network

When formal coordination mechanisms (market or hierarchy) are absent, coordination through informal ways becomes possible (Chrisholm, 1992). Powell (1990) refers to network coordination when equivalent partners show mutual trust. Parties in network coordination seek for complementary strengths (Powell, 1990). Interdependence is a key word in this context because sub-partners are both dependent on each other (Chrisholm, 1992). Sanctions can occur but are normative rather than legal (Powell, 1990). Although inconsistency, conflict, competition, duplication, and overlap might occur during the process in an informal way of coordination, the result of network coordination may be successful (Chrisholm, 1992).

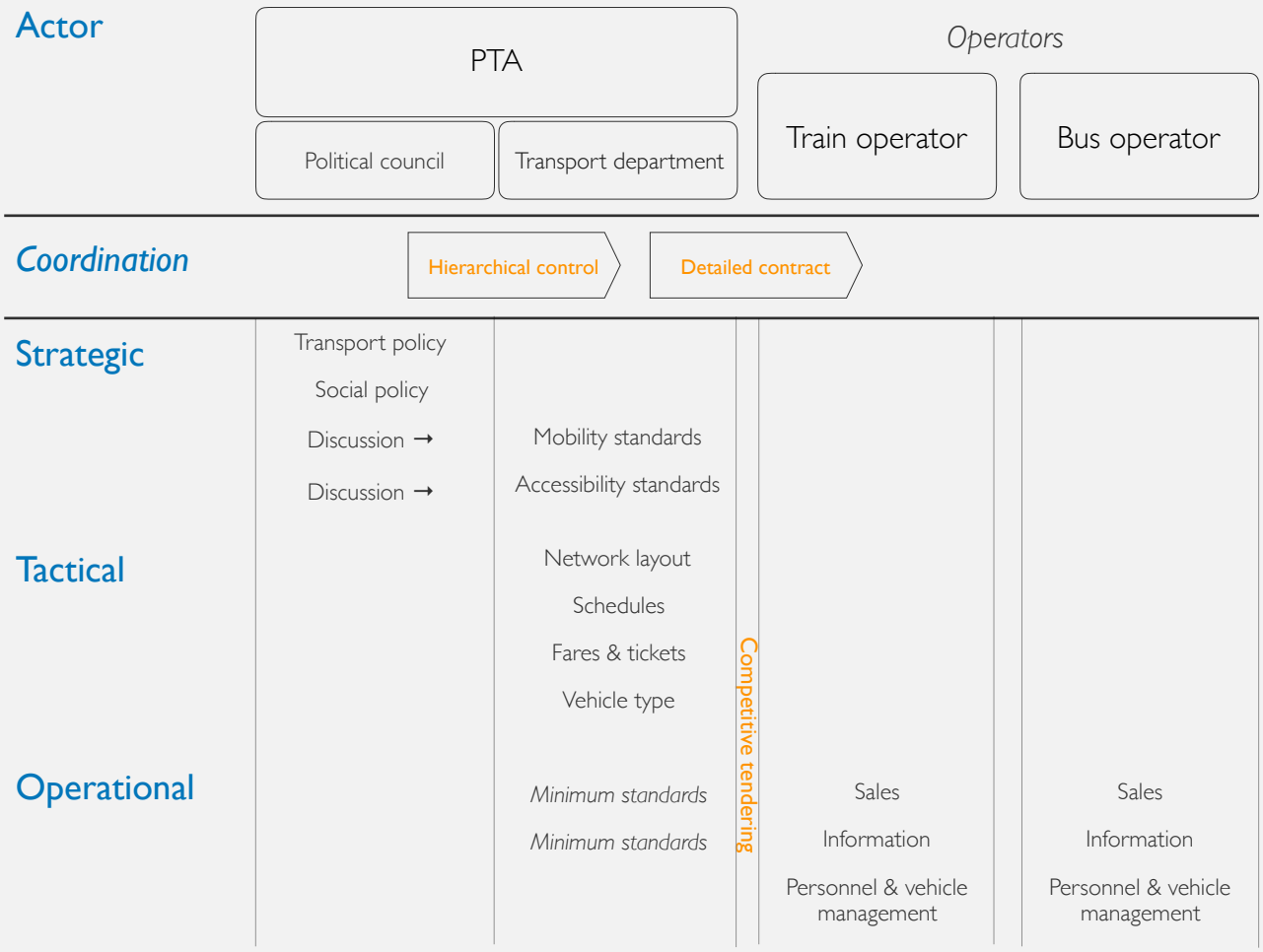
Network coordination can also be seen in PT. PTAs and operators deliberate a lot during the concession period. Especially topics that are not mentioned in the concession contract can be solved by network coordination. These subjects can often not be foreseen before the start of a concession. By negotiating, emerging issues can be tackled.

3.5 Coordination in multimodal networks

Generally speaking, market, hierarchical, and network coordination are all used in any concession. A tendering process in combination with the award of a contract is a form of market coordination. During the concession, the used organisational structures are often on a continuum between hierarchy and network. The actual form used can differ per planning or control task. This section describes how the aforementioned concepts can be used to classify coordination systems in multimodal PT networks.

Since the organisational environment influences what kind of coordination is dominant, firstly the different contract forms that can be used to tender multimodal PT networks must be classified. Only the situation of network contracting is considered, so there are only two ways to tender a multimodal network: unimodal or multimodal. The contracts, however, can also be further distinguished into remuneration forms (see also section 2.2). A gross-cost contract lays the revenue responsibility at the PTA. Net-cost, suppletion, and passenger revenue contracts (in this chapter sometimes referred to as 'net-cost contract') all put the financial responsibility of the concession at the operator's side. Combining these two characteristics (number of modalities and revenue responsibility) leads to four situations. These four situations can make use of different ways of coordination, but usually, a dominant form can be distinguished.

In a way, all coordination between the PTA and the operator(s) in a context of CT can be described as market, since a contract forms the basis of the coordination. However, the contracts still differ in, for example, the prescribed number of details by the PTA and the hierarchical level between the different stakeholders. For those reasons, new coordination concepts are introduced. These are based on the concepts of Powell (1990), but intermediate forms. Below, the four situations will be described in detail.

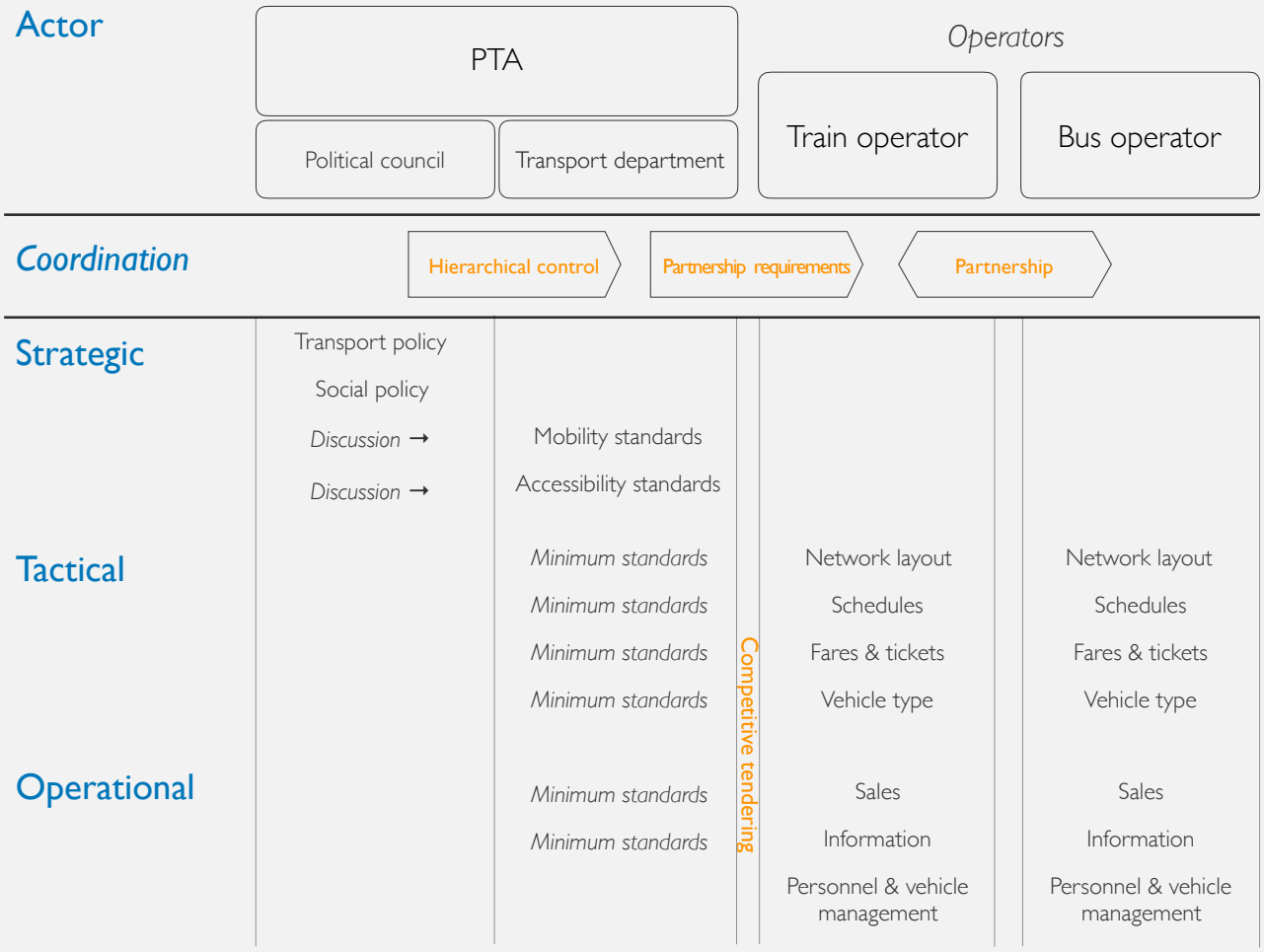


▶ **Figure 3.4** | Visualisation of contractual coordination with two unimodal concessions and revenue responsibility at the PTA, based on Van de Velde (1999) and Saliara (2014).

Gross-cost unimodal contract

In the case of gross-cost unimodal concessions, a detailed contract is made up, which lays the responsibility of both strategic and tactical planning at the PTA. Consequently, the PTA has a lot of freedom and flexibility to decide on how PT should look like and how integration must take place because that is stated in the contract. During the execution of the concession, the PTA can impose the operator what to do. For example, it is precisely defined how the network and the timetable look like, what to do in case of a disruption, etcetera. Theoretically speaking, operators do not have to collaborate. The operators only have to plan the operational tasks. This way of coordination can be called contractual coordination and is based on the hierarchy concept. A schematic overview of the actors, coordination, and planning tasks in case of hierarchical coordination is depicted in figure 3.4.

Contractual coordination is a distant form of coordination. The contract exactly prescribes how PT services look like. When the contract is written clearly, no discussion can arise about the content. However, the PTA cannot expect the operator to cooperate in a flexible way when the hierarchy is explicitly set down. That means that the PTA should be capable of organising tactical planning itself. A PTA may choose for this form when its interests are distinctly different from the operator's or when finding the cheapest operator is an important aim. Also, a long-term view (transcending concession durations) on PT development is possible this way. The downside is that the PTA takes a lot of risks, which usually governments do not prefer.

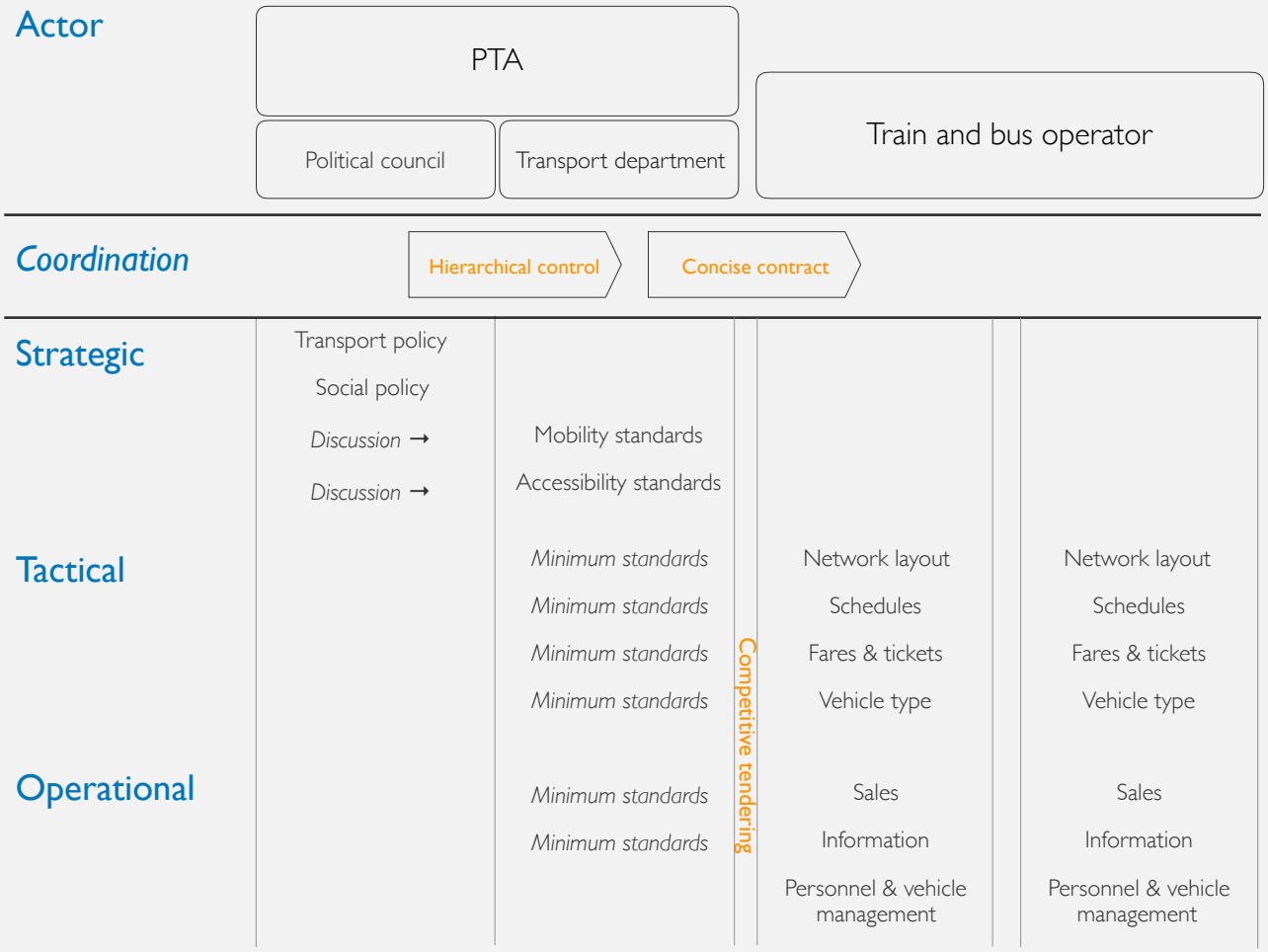


▶ **Figure 3.5** | Visualisation of partnership coordination with two unimodal concessions and revenue responsibility at the operator, based on Van de Velde (1999) and Saliara (2014).

Net-cost unimodal contract

When the operator is revenue responsible in a unimodal contract, it gets more responsibility for the tactical planning level. The only restrictions are minimum standards set by the transport department of the PTA. This way, the market orientation of private operators can be used to create an efficient PT network. That often also means that the operator has to work together with other operators on integration issues. A common way to do this is a partnership, which can be obliged by the PTA. In some cases, the PTA can also play a role in the partnership. The goal of a partnership is to define standards on the tactical and operational planning level that can help to increase integration. Figure 3.5 shows a visualisation of this approach, mentioned as partnership coordination.

A partnership usually creates more willingness at operators than in case of fixed obligations mentioned in the concession contract, which is the case in contractual coordination. After all, a partnership is based on trust between the parties. However, this partnership is not non-committal. The intended result is already evident. Only how to achieve this situation can be discussed. The fruitfulness of such a partnership thus depends on the flexible attitude of the stakeholders. If successful, a partnership can create benefits for both PTA and operators, since all actors can bring in their interests.



▶ **Figure 3.6** | Visualisation of internal coordination with a multimodal concession and revenue responsibility at the operator, based on Van de Velde (1999) and Saliara (2014).

Net-cost multimodal contract

In a multimodal concession, the operator of both bus and regional train obtains the same responsibility as in the situation of partnership coordination. Tactical planning is done by the operator. The PTA can define minimum standards for the operators to serve their (social) goals. The main difference now is that only one operator is at stake for two modalities. The operator in a multimodal concession is contracted at once so that tactical planning of regional train and bus can be done simultaneously. Coordination is namely internal in this configuration, without formal arrangements. This should be enough incentive for the operator to bring about a good level of operational integration. The only role of the PTA is to set minimal requirements concerning tactical and operational planning and integration. A schematisation of this situation is shown in figure 3.6.

The situation sketched before is relatively simple. For the PTA, only one actor is involved in train and bus operations. The operator can, to a large extent, work on its own. Also from a financial perspective, this situation can be beneficial. The operator can cover the costs of loss-making lines from the profitable ones. The PTA is not needed to allocate the financial resources. A possible drawback is that the operator follows its own goals too much, which is not in the passenger's or PTA's interest.

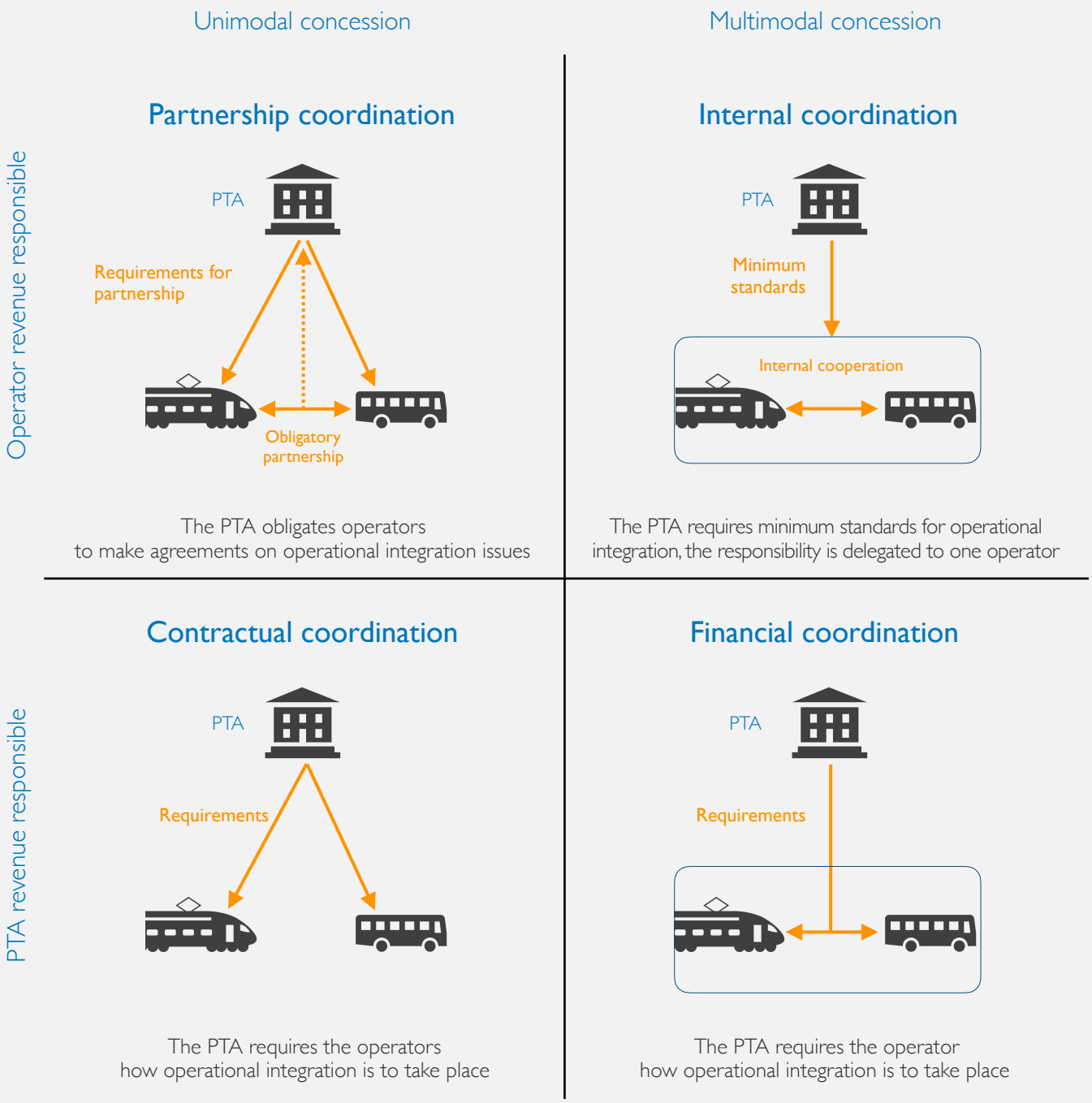


Figure 3.7 | Overview of four forms of intermodal network coordination.

Gross-cost multimodal contract

The fourth situation is a gross-cost multimodal contract. This contract form is the same as a gross-cost unimodal contract, but now only operator is contracted. It can be called financial coordination since the PTA has to provide exploitation subsidies to one operator only. The particular operator can exploit poorly occupied lines by the more profitable ones, which creates a structured situation for the PTA. However, this organisational structure hardly occurs in practice. In the Netherlands, no cases are observed. One of the main reasons to contract a multimodal network is that integration between the different network layers can be improved. If the PTA is revenue responsible, the operator cannot work on integration, because it is not allowed to change services. For that reason, usually internal or contractual coordination is used in those cases.

The situations described above are rarely simple. Only one PTA is involved, and there is no interaction with adjacent concessions. However, those factors do play a role in the coordination of planning and control tasks and might lead to complications. In cases where different PTAs are responsible for different modes (e.g. regional train and bus separated), conflicting interests may occur. Therefore, coordination between these PTAs is needed. Since a PTA is non-commercial and on the same hierarchical level as another PTA, the only way to do this is a network form of coordination. There are a lot of in-between forms possible, and it may have a substantial influence on PT operations. However, for now, it is outside the scope. The main focus is on coordination between one PTA and one or several operators in the same region. These are the three forms of coordination already described. They are depicted schematically in figure 3.7.

3.6 Conclusion

How can the different planning and control tasks in regional multimodal public transport networks be coordinated?

Regional multimodal PT networks can be coordinated in many ways. When looking at forms to establish operational integration, three coordination structures can be distinguished, based on contract forms.

- **Contractual coordination**: this coordination form can be used in unimodal gross-cost contracts. It is characterised by a large job package and responsibility for the PTA. Coordination in this way is the responsibility of the PTA and achieved by setting strict requirements for planning and control tasks. Operators do not need to cooperate since the concession contract states how integration is to take place on these topics.
- **Partnership coordination**: in case of revenue responsibility at the operator, partnership coordination becomes possible. Here, most of the tactical planning tasks are laid down by the operator. Unimodal concessions can be coordinated by partnership coordination. This way, the PTA sets requirements for an obligatory partnership and operators collaborate on integration topics.
- **Internal coordination**: it is also possible to tender a multimodal concession where the operator is revenue responsible. The matching coordination form here is internal coordination. Minimal requirements are set by the PTA. Laying the accountability for both regional train and bus at one operator should be enough incentive for that operator to reach a situation of full integration to a large extent.

It can be questioned what the difference in performance of the different organisational and coordination forms are in terms of integration. In the next chapter, various cases are introduced and linked to the coordination forms mentioned before. These cases will be explored to see to what extent integration can be achieved and what the pros and cons of the different organisational structures are on this topic.

Chapter 4

Case Studies

4. Case Studies

4.1 Introduction

The various forms of coordination differ in the way in which operational integration is achieved and which stakeholders are responsible for that. Until now, the question which mechanism is best able to achieve operational integration is underexposed. This chapter deals with that subject matter and also dives into the factors that influence the performance of a specific coordination mechanism. The expectation is that multimodal concessions perform better than unimodal equivalents. To test this statement, a case study is set up in this chapter. At the end of this chapter, the following question is answered: Which coordination mechanism is best able to achieve operational integration?

The following three sections each introduce a case in which one of the three coordination mechanisms is applied. This way, the different forms can be compared to each other. For all cases, interviews are conducted in which is asked how alignment between train and bus takes places, what the performance of the concession is on different forms of operational integration, and what the possible causes for that are. The interview guide and the interview summaries are attached in Appendix B. The interview data is combined with information from the plan requirements of the different concessions. The cases are elaborated separately first. Then, a structured comparison is made in section 4.5. Section 4.6 defines the lessons learned when talking about operational integration. In the end, an answer to the sub-question is given.

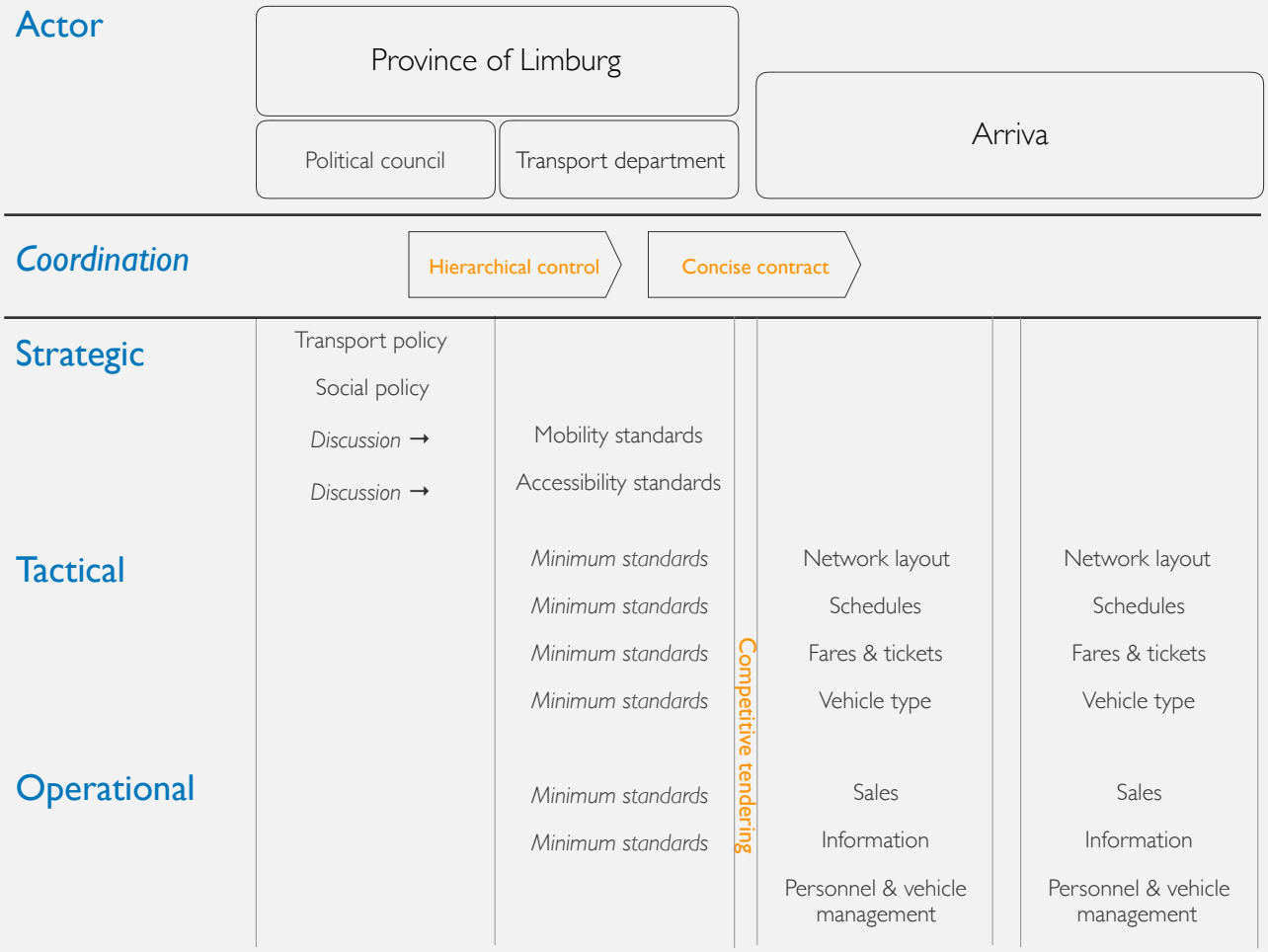
4.2 Case Limburg

The first case is the PT concession in the province of Limburg, a multimodal concession awarded to Arriva. It started in December 2016 and lasts for 15 years. The concession can be classified as large, with more than 200 buses and about 45 trains. Before December 2016, the PT network was split up into two concessions and included two regional railway lines. Already then, some changes towards an integrated PT system were made. According to former Veolia regional director Southern Limburg (Frank van Setten, personal communication, 16 October 2018), this was mainly the case around the decentralised railway lines. Concerning the rest of the network, the contract obliged the operator a minimum provision level by bus for each town, based on the number of inhabitants. Predefined frequencies and network layout were part of that. That was also the case around the non-decentralised railway lines. These two railway lines were decentralised in December 2016. From then on, one operator is responsible for virtually all PT in the province, except for some on-going IC trains.

One of the four central ambitions of the PTA, as mentioned in the program requirements of the concession, is a seamless PT system. It is stated, amongst others, that multimodality via a feeder network provides an optimal alignment between bus and train and translates into fare, ticket, and information integration (Provincie Limburg, 2014). The particular concession can be characterised as a net-cost contract because the operator has many possibilities to shape the PT system in its way. Tactical planning is entirely delegated to operator Arriva and only restricted by some demands from the plan requirements. The same holds for the operational planning. All in all, the coordination mechanism is almost equal to the theoretical situation of a multimodal concession described in Chapter 3. Figure 4.1 shows the division of responsibilities in the concession Limburg. Hereafter, all aspects of operational integration in this case are described.

Network layout

Concerning the requirements on network layout, the province of Limburg together with municipalities and some other stakeholders defined ‘Limburgnet’ (Provincie Limburg, 2014). Limburgnet is a shared vision on PT in the province and forms the basis of the PT network in the



▶ **Figure 4.1** | Visualisation of internal coordination in the multimodal concession of Limburg, based on Van de Velde (1999) and Saliara (2014).

current concession. It contains obligatory and voluntary links. There is a list of towns and stops that must be served by a particular line. Moreover, there is a list of connections that must be provided by the operator, for regional train and bus. Besides that, some 'searching areas' were defined where the contracted operator is asked to come up with a smart solution for a specific budget (Arjan Wiering, appendix B). The task of the contracted operator was to translate this vision into a network layout and extend it to a full network. During the concession, the network is developed further in a development team, a cooperation of the operator and the PTA.

Arriva has changed large parts of the network in Limburg into a feeder network (further elaborated in Chapter 5). Buses now better feed the trains (Sabine Kern & Lennard ten Damme, appendix B). The basis of the network is the railway lines (Arjan Wiering, appendix B). The number of passengers on these lines was high enough to increase the frequency and extend the services with new international connections and express trains. A positive cost-benefit ratio on these lines is used to finance the loss-making bus lines elsewhere (Arjan Wiering, appendix B). The question, however, is to what extent the network changes were initiated by the province or the operator. In any case, the network layout of both train and bus has been designed simultaneously by the tender team of Arriva. The internal cooperation was already initiated in the tender phase (Arjan Wiering, appendix B).

Schedule

The PTA has set minimal frequencies for the Limburgnet lines. Each line mentioned in the program requirements of the province contains a list of minimum frequencies per time slot. For example, the province requires a frequency of 2 buses per hour between 9 am and 3 pm. These time slots together cover the whole week (see for an example table 4.1). Operators are allowed to provide a higher frequency on the mentioned lines, but headways between vehicles must be spread equally as much as possible.

Table 4.1 | Minimal required frequencies of the bus line Malberg / Oud-Caberg - Maastricht Station on working days (Province of Limburg, 2017).

Time slot	6-7am	7-9am	9am-3pm	3-6.30pm	6.30-9.30pm	9.30-0pm
Frequency	4	6	6	6	4	4

The network layout to a large extent determines the frequencies and connections between the train and bus lines. In the feeder network in Limburg, pulse points were created to connect all lines. Frequencies of regional train lines and busy bus lines are heightened to focus on passenger growth. On the railway lines, at least frequencies of 2x/h are offered all day long, from early in the morning till late in the evening. This timetable strengthens the position of the railway lines as a backbone in the feeder network. Arriva designed the network layout and the schedule simultaneously, already in the tender phase with a joint train and bus team. That means, network changes are directly translated in a timetable to see the effects on it and the other way around. Since Arriva can control the whole system, it has more focus on optimisations (Arjan Wiering, appendix B). Besides that, there is a clear point of contact for all PT related issues.

Arjan Wiering also mentioned some side-notes concerning scheduling (appendix B). In some cases, it is possible that bus drivers can become a train driver as well. Although the required personality of both professions is different, it can be an interesting career path for bus drivers and allows for more scheduling options. Next, alternative bus transportation in case of a train disruption can be done by Arriva itself.

Information

The provision of (real-time) information about and promotion of PT services in Limburg is the responsibility of the operator (Provincie Limburg, 2014). What information should be provided is stated explicitly by the PTA. For example, real-time travel information must be provided at important transfer nodes in the network. Furthermore, the operator is obliged to provide information to national travel information systems. There are also rules concerning travel information for passengers who transfer.

In principle, all information for passengers is integrated (Arjan Wiering, appendix B). The most important form of communication, namely the travel information, is already integrated with the travel planners. However, in Limburg also a special PT app for Limburg, regional branding, special tickets, and other communication expressions are integrated. Another example is the transit map, which is depicted in figure 4.2.

Fares & tickets

As described above, the operator is revenue responsible in the concession Limburg. That means that the operator can also set fares and tickets. Of course, the national PT smartcard must be valid in all vehicles. Concerning the other tickets, the province has set extensive boundaries (Provincie Limburg, 2014). For example, some basic tickets, including interchange (train-bus) tickets, are required. Besides that, the PTA has set up a fare framework, containing maximum fares. To guarantee that

Figure 4.2 | An integrated transit map of Limburg (Arriva, 2017b).

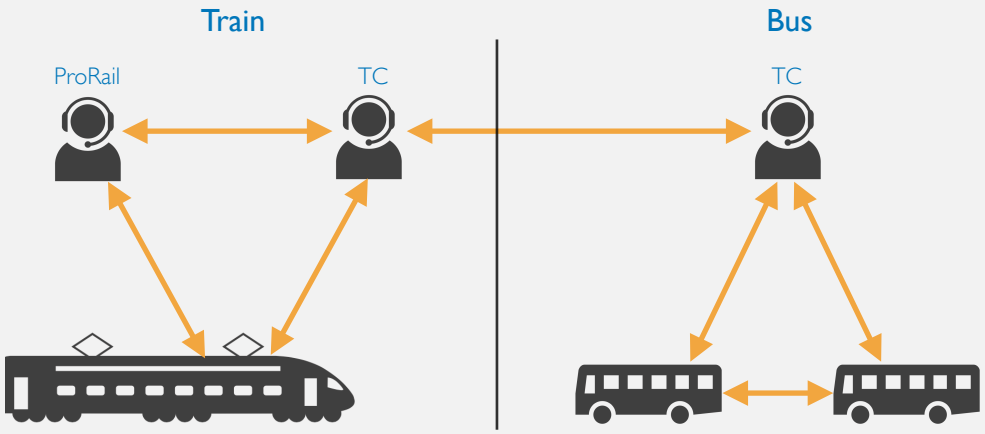
modal transfers within the concession boundaries are possible without high fees, the PTA demands that the boarding rate is not calculated twice when transferring within 35 minutes. The operator has the freedom to introduce extra tickets.

The regular prices for train trips on the regional trains of Arriva have become cheaper at short distances and a little more expensive on longer routes (see also the travel costs analysis in Chapter 5). Since the average train trip is 15 kilometres in Southern Limburg and 27 kilometres in Northern Limburg, travelling by train becomes more attractive this way (Arjan Wiering, appendix B). The abolition of the boarding rate in a multimodal trip stimulates passengers to travel by a combination of train and bus. This group of passengers can travel easier and cheaper (Sabine Kern & Lennard ten Damme, appendix B). Special tickets are both offered for one modality solely and both modalities. That has to do with the fact that combined tickets are often pricier than single mode tickets (Arjan Wiering, appendix B). These tickets are meant for passengers living in an area without a lot of train connections. Also, combined tickets are provided. Although it is difficult to estimate how much people use these tickets, it is clear that more interchanges are done, and the barrier to transfer from bus to train has decreased (Arjan Wiering, appendix B). The tickets are designed in the tender team and fully integrated.

Vehicle management

Vehicle management is the only factor of operational integration that is mentioned separately for regional train and bus in the program requirements (Provincie Limburg, 2014). Per modality, performance indicators and requirements are demanded, such as guaranteed interchanges within the network. The operator is asked to come up with creative ideas to ensure these interchanges and to improve punctuality. In the bid of Arriva, norms are made up for interchanges where it is defined at what delay vehicles may wait or not. These norms are depicted in a so-called connection diagram and specified per transfer (bus-bus, train-bus, or train-train). More specifically, bus drivers should get an announcement on the onboard computer when a transfer cannot be met, and every bus driver should contact the TC in case of delays to ensure interchanges (Boemaars, 2017).

In practice, guaranteeing interchanges train-bus when a train is delayed seems to be rather difficult, Boemaars (2017) observes in his study on interchanges in Limburg. This conclusion is confirmed by TC managers Rob Bergsma and Angelo Coenen and also by Arjan Wiering (appendix B). An important reason for that is the workload at the TC train on the moment delay occurs. As depicted in figure 4.3, the TC train must contact the TC bus at the moment a train is delayed, but in practice, there is no time for that. The TC train is working together with Infrastructure Manager ProRail to catch up the delay. Only incidentally, TC bus is informed about delays. It also happens that passengers notify the TC bus themselves via Twitter. The only case in which TC train informs TC



▶ **Figure 4.3** | Visualisation of the (formal) interaction between Traffic Control bus, Traffic Control train, ProRail, bus drivers, and train drivers.

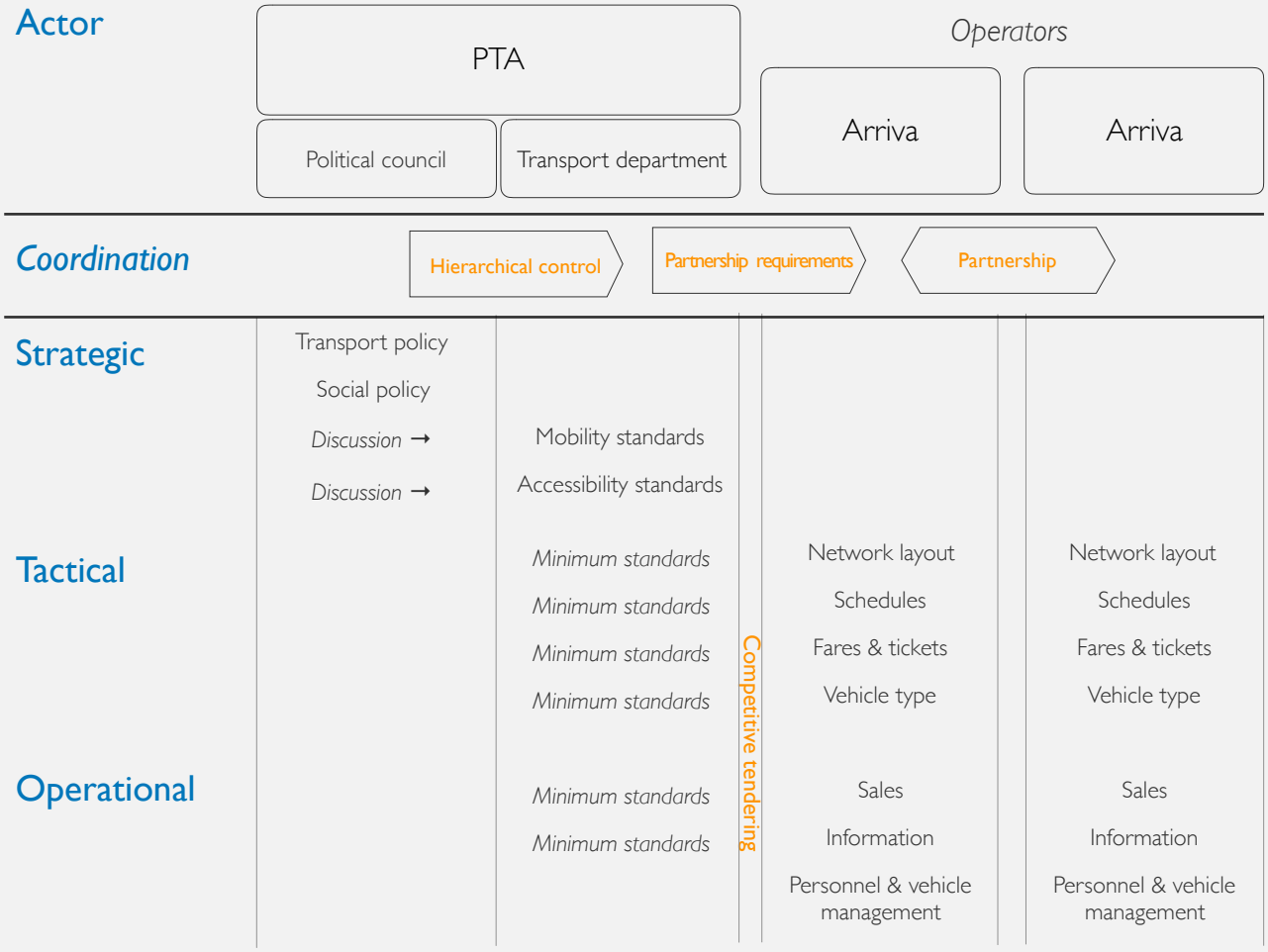
bus is in case of a disruption when trains cannot run for more than 30 minutes. Trains can almost never wait for buses, because of the high number of trains on Dutch railway lines and infrastructure constraints (e.g. single tracks).

There are technical solutions possible to inform TC bus in case of delays (Angelo Coenen, appendix B). Also, in the future, drivers should get an announcement on their onboard computer when a train is delayed. Currently, the biggest obstacle for that is that different systems are being used in train and bus (Arjan Wiering, appendix B). Besides that, physically bringing TC train and bus together can help to improve communication (if allowed in the contract). At the moment, train and bus operations are two separate departments within the same company. In the short term, extra personnel at TC train that is dedicated for transfers can be a solution. However, that still will not ensure that all buses wait. That has to do with the current contract. Strict punctuality norms for train and bus separately are included. The operator is penalised when vehicles are delayed, which is a counter-incentive for waiting on connecting lines (Rob Bergsma, appendix B). The province recognises the conflict between these norms but does not come up with a clear solution (Provincie Limburg, 2014). Since vehicle management will probably not improve shortly, Arriva is also working on improvements on the real-time travel information for passengers (Angelo Coenen, appendix B).

4.3 Case Fryslân

A net-cost contract, but then unimodal, is applied in the province of Fryslân. The province was aiming to tender a multimodal concession starting in 2020, but due to economies of scale, the regional train concession was again tendered together with the province of Groningen and Niedersachsen (D) (Wim Brethouwer, Appendix B; Provincie Fryslân et al., 2006). This regional train concession is currently awarded to Arriva and recently won again for the period 2020-2035. There are also two bus concessions, which are operated by Arriva as well. The railway lines are mainly located in the north of the province. Therefore, the focus is on this area with the corresponding bus concession 'Noord- en Zuidwest-Fryslân'. Note that the train concession 'Noordelijke treindiensten' transcends the provincial borders and is also located in Groningen (see also section 4.4). However, the plan requirements are defined per province and can, therefore, easily be split up into two parts.

Figure 4.4 depicts the organisational structure of the case. The provincial government is responsible for both the bus concessions and the part of the train concession that is located in Fryslân. A lot of tactical planning is delegated to the operator. The establishment of a partnership between PTA and operator is an important tool to work on integration issues. Below, each aspect of operational integration is treated in detail.



▶ **Figure 4.4** | Visualisation of partnership coordination in the unimodal concessions of Fryslân, based on Van de Velde (1999) and Saliara (2014).

Network layout

Concerning regional trains, no strict network layout requirements are set (Provincie Fryslân & Provincie Groningen, 2006). It is mentioned in the plan requirements that all stations have to be served. In the plan requirements for buses, the PTA has defined the minimum standards for PT supply in the region (Provincie Fryslân, 2012). The operator must use this as a basis for the submitted transport plan and is expected to propose some additions to this network in the form of packages. The province can purchase these packages separately. After the first year of operation, a partnership between the province, the operator, and other stakeholders is set up to improve the network layout for the future.

Figure 4.5 shows a part of the current railway and bus network in the area of Leeuwarden and Harlingen. In some places, a feeder network can be observed. However, the figure shows that that is not the case everywhere. On the particular trajectory, there is hardly interaction between the modalities. Regional business development manager of Arriva, Yvonne Dubben (Appendix B), explains (in general) that these kind of bus lines are stopping buses and aimed to serve all villages. The train connection is a fast and direct connection. Both lines serve another group of passengers and cannot just be eliminated from the network. Wim Brethouwer (Appendix B) also gives some reasons why in some part no feeder network is applied in Fryslân. According to him, that has to do with an unsuitable geographical structure with a lot of water, the fact that all passenger flows are directed onto the province capital Leeuwarden (different destinations within the city), and a separate

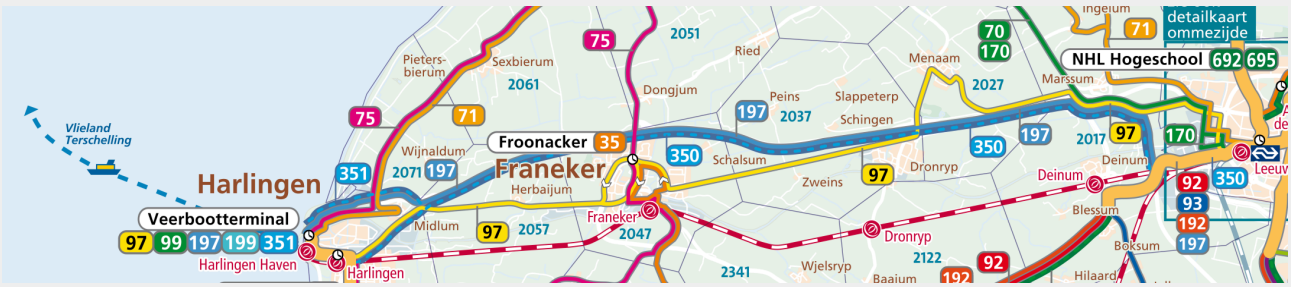


Figure 4.5 | Part of the current network layout in Fryslân (Arriva, 2017a).

tariff system for train and bus. Wim Brethouwer and Yvonne Dubben (Appendix B) agree on the fact that there is not so much parallelism between train and bus lines anymore. There must be a good reason for parallel bus lines. Otherwise, the PTA will question the need for it (Wim Brethouwer, Appendix B). However, the point remains that some bus lines could use some extra passengers. In the near future, the network in the rural areas will be redesigned to create a future-proof network (Wim Brethouwer & Yvonne Dubben, Appendix B).

Within Arriva, the train and bus concessions are controlled separately. Also, the PTA manages the different concessions separately (Wim Brethouwer, Appendix B). According to him, operators focus on the requirements from the province to win the concession. Consequently, that is at the expense of network integration.

Schedule

Corresponding to the demanded bus lines by the province, precisely defined frequencies per hour are stated (Provincie Fryslân, 2012). The operator must determine the exact departure and arrival times. Besides that, some maximum transfer times at certain stations are defined. That means a maximum interchange time from line x to line y is demanded. For the extra lines offered by the operator, there are fewer restrictions concerning the timetable. That is also the case for the railway lines. Only some minimum requirements are set by the PTA (Provincie Fryslân & Provincie Groningen, 2006).

In the process of making a transport plan, single tracks on most decentralised railway lines in northern Netherlands and connections at main stations cause an almost fixed timetable for the train, Yvonne Dubben explains (Appendix B). In the contract, the transport developers of train and bus are expected to work together on integration. Cooperation usually happens at least once per year. The train timetable is leading in that process because that takes more time and is more restricted. Both Yvonne Dubben and Wim Brethouwer (Appendix B) are of the opinion that the coordination of the timetables, especially interchanges, is going well. The main reason for that is a common interest.

Information

Both in the train and bus concession, the operator has the freedom to create its marketing strategy, including the way how information is provided to passengers (Provincie Fryslân, 2012; Provincie Fryslân & Provincie Groningen, 2006). Only a few restrictions apply to that. These restrictions mainly define which information must be provided by the operator and at what maximum price. For example, information on interchanges must be provided.

Wim Brethouwer (Appendix B) indicates that there is hardly integration on this topic and questions whether more integration is needed. Most people travel either by train or bus. Yvonne Dubben

(Appendix B) emphasises that travel planners are integrated already. Marketing statements and travel information of Arriva often contain train and bus information. An example is depicted in figure 4.5. The rest of the information is mostly segregated.

Fares & tickets

The PTA has defined some starting points for the determination of the fares in the bus concessions (Provincie Fryslân, 2012). It is the task of the operator to translate these aims into exact fares. However, consultation of a passenger consultative body is required. Besides that, the smartcard tariffs are defined by the province. On the railway lines, Arriva has made agreements with national rail operator NS on the acceptance of national products and their tariffs. Next to the national tariffs, the operator can propose new or special products and rates.

Recently, Arriva has equalised the tariffs for both bus concessions in Fryslân (Arriva, 2017c). Also, some new subscriptions for train and/or bus were added. However, only one of those subscriptions is valid for both train and bus. Besides that, transferring from bus to train still requires to pay the boarding rate twice. Yvonne Dubben (Appendix B) questions whether full tariff integration is needed in the context of Fryslân. A smartcard already is a form of tariff integration, and the number of passengers travelling by both train and bus is small. Wim Brethouwer (Appendix B) is in favour of tariff integration because it takes away a hindrance for passengers to travel multimodal. This is a typical chicken egg causality dilemma. Apart from that, it will become difficult to change the whole framework of tariffs within a concession, because the business case of the operator must remain positive and tariff integration will probably lead to loss of income at the operator (Yvonne Dubben, Appendix B). Currently, there is no push for tariff integration, but the provincial political council is already searching for years for a way to implement some form of tariff integration in all PT in the northern provinces (Yvonne Dubben, Appendix B).

Vehicle management

The idea of a partnership can be recognised on the topic of vehicle management. The bus operator is namely demanded by the province to set up a partnership with other operators to make agreements on connections between different operators in case of delays (Province Fryslân, 2012). The only restriction is the punctuality norms. They cannot be ignored in most cases. Based on the partnership, the operator must provide a plan on how to deal in different situations. Contrary, the train operator only has an information obligation towards the bus operator (Provincie Fryslân & Provincie Groningen, 2006). Besides that, the passengers must be notified on the trains and the platforms.

From the interviews with Rob Bergsma and Angelo Coenen (Appendix B), it becomes clear that the practice of TC is comparable to the situation in Limburg. The procedures and restrictions for waiting are the same. Consequently, waiting for a delayed train hardly occurs. Wim Brethouwer (Appendix B) explains that it is not a frequently discussed topic with the operator. There are hardly complaints about it, and it is currently unknown which interchanges are important. That has to do with the fact that Arriva is only limited allowed to combine smartcard data from train and bus.

4.4 Case Groningen

One of the largest PT concessions in the Netherlands regarding area size is the bus concession in the cooperating provinces of Groningen and Drenthe. The concession was awarded from 2010 to 2016 and extended two times for two years to Qbuzz. Recently, the new concession starting in 2020 has again been awarded to Qbuzz. The rail concession in this area, granted to Arriva, is under the shared responsibility of the provinces of Fryslân and Groningen (see also section 4.3).

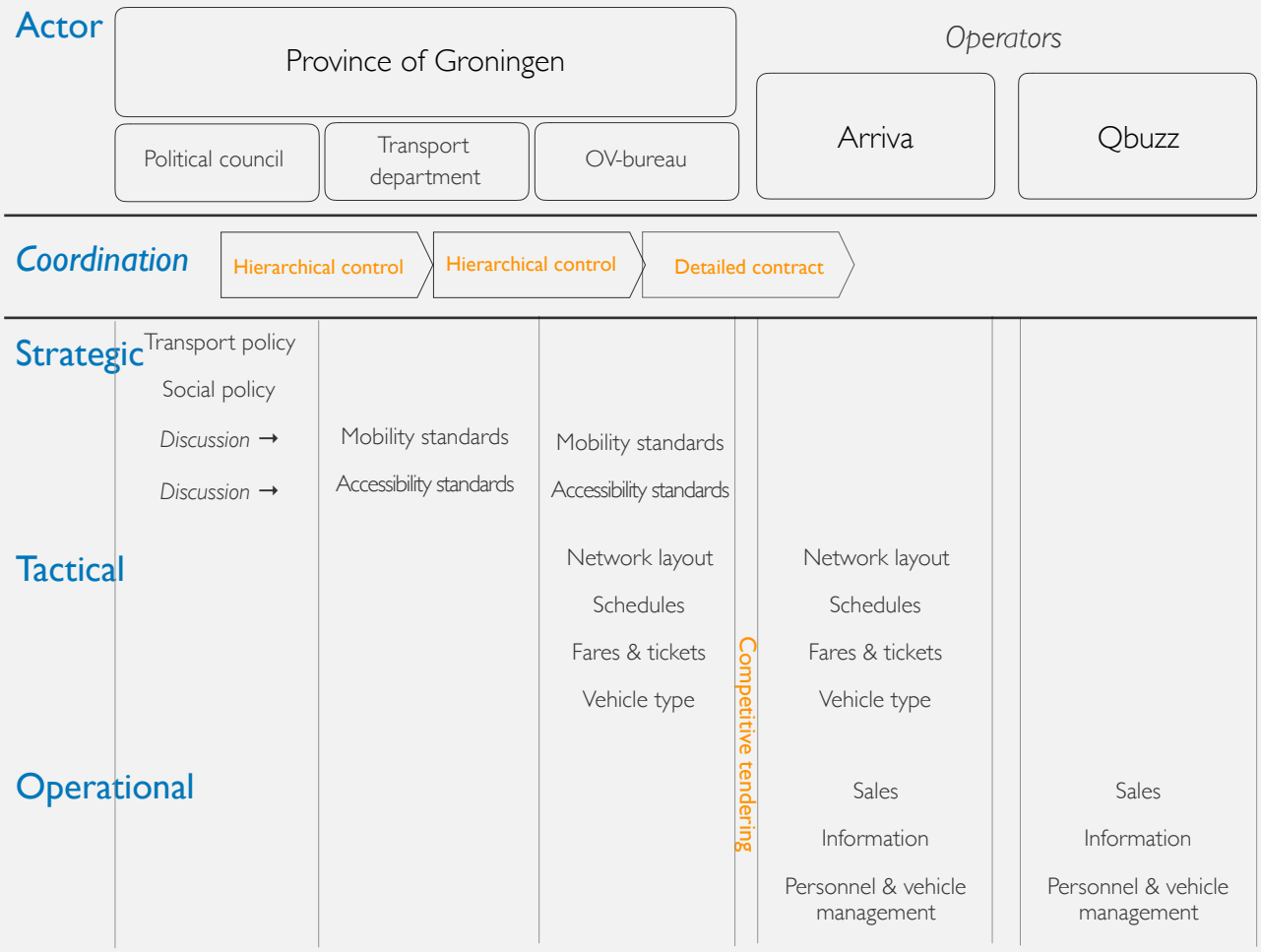
Since the coordination of regional train and bus services in Groningen is under the responsibility of different PTAs, a somewhat complicated situation arises. Two different coordination systems exist next to each other. Although the used visualisation method is not entirely suitable for this kind of hybrid structures, figure 4.6 tries to give an overview of the responsibilities per actor. The coordination mechanism of the train is closest to a theoretical net-cost contract with partnership coordination. In cooperation with Niedersachsen (D), the provinces of Groningen and Drenthe grant a concession for the shared regional train network. The operator itself is responsible for the tactical planning.

Contrary, the bus coordination is most close to a form of contractual coordination in a gross-cost unimodal contract. A complicating factor is the existence of an independent PTA for bus services, the 'OV-bureau', a legal body that is specifically established for this purpose and that operates on behalf of the provinces and municipality of the city of Groningen. It may exactly prescribe the operator what to do. In this case, tactical planning is under the responsibility of the PTA. A bonus-malus system based on passenger growth and quality is included to stimulate the operator to perform well. Since the gross-cost contract form is already used during a few previous concessions in Groningen, the concessionaire seems to be satisfied with this form of coordination. In the plan requirements of the concession 2010-2016, the OV-bureau also attribute the positive results to this form of coordination: substantial passenger growth (12%) against lower subsidy, one of the highest cost-coverage ratios in the Netherlands (51%), and reinvesting the revenues in enhancing the quality of PT (OV-bureau Groningen-Drenthe, 2008). Also, the success factors are mentioned, which are, amongst others, marketing & communication, an improved tariff system, and frequency improvements on busy corridors. The question is to what extent these factors also apply to the alignment of train and bus. That is described below.

Network layout

During the bus concession 2004-2009, all responsibility for the route network was laid down at the PTA (OV-bureau Groningen-Drenthe, 2008). However, more and more the knowledge of the operator was used in the development of the network. Therefore, in de concession 2010-2019 more focus is put on cooperation between the PTA and operators, but the OV-bureau remains responsible. It is explicitly mentioned in the program requirements that the operator is not expected to design a new network since the current network is functioning well (OV-bureau Groningen-Drenthe, 2008). A core network of lines that must be offered is depicted in a map and mentioned in the spatial vision of the province (Provincie Groningen, 2016). The specified connections are fixed for ten or twenty years and are, according to the province, indispensable for a well-functioning PT system. Two transport experts of the operator are expected to be available for cooperation with the PTA about the services offered. However, the PTA finally determines in case of disagreement. This way of reasoning forms a contrast with the rail concession, where only a few general aims are described concerning the stops (Provincie Fryslân & Provincie Groningen, 2006).

In practice, there is a lot of contact between the different stakeholders, but not regularly on the topic of network integration, both Yvonne Dubben and Jorne Bonte tell in the interview (appendix B). Achieving network integration is not captured in processes, but cooperation exists when there is a shared interest (Yvonne Dubben, appendix B). In that case, there is contact between Arriva and the



▶ **Figure 4.6** | Visualisation of contractual and partnership coordination in the province of Groningen, based on Van de Velde (1999) and Saliara (2014).

OV-bureau. There are examples where bus lines were cut out when a new railway line was opened. However, there are also cases in which financial interests are stronger. Often, the train operator is only informed by OV-bureau about network changes and has no say in it. Sometimes, the changed plans of the OV-bureau surprise train operator Arriva (Yvonne Dubben, appendix B). The province is politically responsible for the OV-bureau and therefore attends broad consultation meetings (Herman Sinnema, appendix B).

In the gross-cost contract of the bus, large network changes can be implemented by the PTA and operator during the concession. This is unlikely in a net-cost contract. An example in Groningen is the introduction of the Q-link lines, a product formula for stretched high-frequent regional buses. The plan requirement state that parallel connections (train and bus lines) must be avoided or serve other destinations (OV-bureau Groningen-Drenthe, 2008). Although in large parts of the province the parallel bus lines are cleared, there still is some parallelism between train and bus. An example is depicted in figure 4.7. In the interviews, Yvonne Dubben, Michel van der Mark, Herman Sinnema, and Jorne Bonte (appendix B) confirm the existence of some parallelism within the network. For Arriva, however, it is not such a big deal on the moment, since the steady growth of train passengers has led to capacity issues on most railway lines. Jorne Bonte (appendix B) explains that this situation mainly exists around the capital of Groningen. There, capacity issues and the fact that there are only a few stations in the city justify the extra bus lines. It is much faster for these passengers to travel directly to their destination by bus (Jorne Bonte & Herman Sinnema, appendix B). In most rural areas, a feeder network is applied, since there it is the most efficient way of organising the PT network (Jorne Bonte, Appendix B).

Schedule

A pragmatic approach is chosen by the provinces concerning the schedule for the railway lines. Only some minimum standards concerning the frequencies, based on the current network are required (Provincie Fryslân & Provincie Groningen, 2006). The bus timetable is drawn up in cooperation of the OV-bureau and Qbuzz. However, the PTA sets the quality demands and the minimum level of service provision. Besides that, the timetable must finally be approved by the OV-bureau (Jorne Bonte and Michel van der Mark, appendix B). The bus operator is expected to make agreements on transfers with other operators, but the PTA must always submit these agreements. The plan requirements state that the starting point is 'optimal connections' to (regional) trains (OV-bureau Groningen-Drenthe, 2008). It further mentions the train stations where this is applicable. These are almost all stations in the provinces. For the railway operator, nothing is stated about train-bus interchanges (Provincie Fryslân & Provincie Groningen, 2006).

There are hardly possibilities to change the train timetable since the interchanges to other trains and frequencies are fixed (Herman Sinnema, appendix B). Therefore, flexibility from the OV-bureau and Qbuzz is desirable. Cooperation between the OV-bureau and Arriva is not formally regulated but is conducted on a voluntary basis from a common interest: the passenger. However, Michel van der Mark (appendix B) explains that the changes in the timetable are only about minutes and more cooperation is not needed, therefore. Yvonne Dubben and Jorne Bonte (Appendix B) state that the schedulers of different operators can cooperate on schedule alignment. There is a general interest for good interchanges. Cooperation between stakeholders in the northern provinces is seen as an example for other regions, says Michel van der Mark (appendix B).

Figure 4.7 | Part of the current PT network in Groningen (Qbuzz, 2017a).

Information

Only general requirements for the information provision of the operator are demanded for the railway lines (Provincie Fryslân & Provincie Groningen, 2016). The OV-bureau sets more specific requirements and keeps the general information provision (promotion of PT) to travellers in-house (OV-Bureau Groningen-Drenthe, 2008). Specific information, such as timetables, is provided by the operator. The PTAs do not demand cooperation between Arriva and Qbuzz on the topic of information.

In the Netherlands, travel information is already nationally integrated with travel planners. (Yvonne Dubben, appendix B) These travel planners show all PT in a region, regardless of the operator. This is the primary source of information for most travellers and organised well. Regional information is mostly separated. A typical example of separated information is the Q-link map as depicted in figure 4.8. The map is clear, but the question is why trains, which also stop at stations like Delfzijl,

Zuidhorn, and Station Noord are not depicted on all maps. There have been pilots for an integrated website about all tickets in the region, but that seemed to be difficult since referring to individual operators remained necessary (Yvonne Dubben, appendix B). However, this initiative has caused more collaboration (Yvonne Dubben and Michel van der Mark, appendix B). An example is the promotion of shared tickets (Michel van der Mark, appendix B). The OV-krant, provided by the OV-bureau, is another example. In the latest editions, also train information is included. According to Herman Sinnema (Appendix B), these kind of initiatives are complicated, since a different view on marketing exists among the parties. All in all, there is a lot of cooperation on this topic, but the focus is restricted mainly to the joint products.

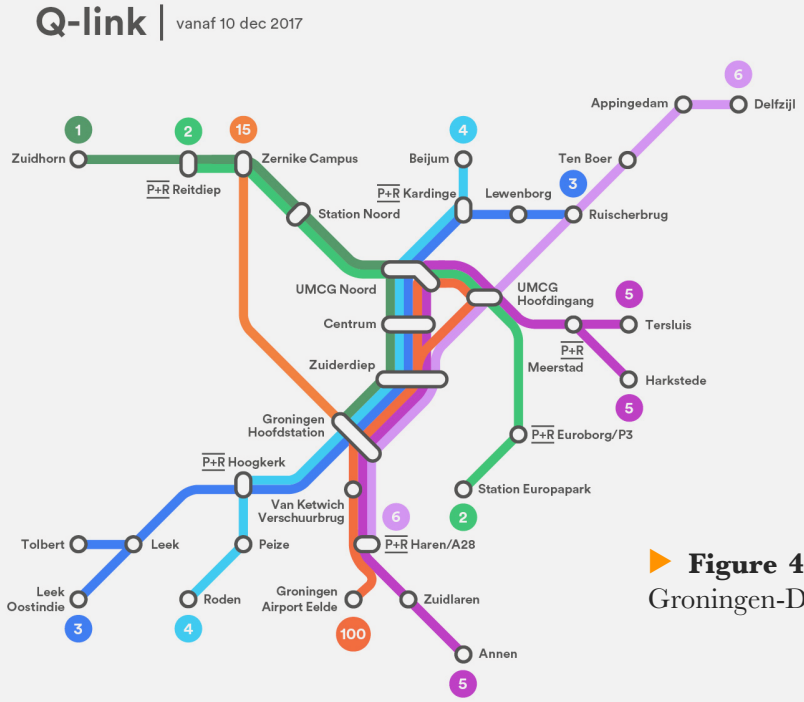


Figure 4.8 | Overview of 'Q-link' bus lines in Groningen-Drenthe (Qbuzz, 2017b).

Fares & tickets

Fares of both train and bus are aligned to national regulations. The national PT smartcard is valid. Distant charges of the smartcard on the buses in Groningen are determined by the OV-bureau. On the railway lines, the national tariffs of Dutch national railway operator NS are used. The OV-bureau itself develops regional tickets for the bus. In the plan requirements, some tickets and corresponding fare are mentioned (OV-bureau Groningen-Drenthe, 2008). The operator must provide these. Contrary, the train operator has more freedom to develop new regional tickets.

In practice, a sharp separation between regional train and bus tickets can be observed. Both Yvonne Dubben and Jorne Bonte (appendix B) argue, however, that a national smartcard is already a form of ticket integration. In buses in Groningen-Drenthe, about 90% of all passengers travel using this card, and most passengers only travel unimodal (Jorne Bonte, appendix B). So, there is no direct interest to invest in more integration. Fare integration is also arranged limitedly. For example, the boarding rate has to be paid twice in a multimodal trip. Concerning regional tickets, two integrated products for regional train and bus are available. The first one is the 'Sterabonnement Noord-Nederland', based on a zonal system. It is valid in all buses in Groningen and Drenthe, most trains of Arriva, but not on NS (regional) trains (Yvonne Dubben and Michel van der Mark, appendix B). Recently, a new product called 'Dalvoordeel Noord-Nederland' is added to that (Yvonne Dubben, Michel van der Mark and Jorne Bonte, appendix B). It is a yearly subscription for 40% discount on all buses and trains in the three northern provinces and only valid in the off-peak hours.

The absence of an ITS is an eyesore for politics, that proves the essay of Douma et al. (2018) in the regional newspaper. Accordingly, there is hardly progress in the process of creating an integrated fare for all PT, Yvonne Dubben explains (Appendix B). That mainly has to do with the separation of financial responsibility. However, it can be questioned how vital tariff integration in this context is. Both Yvonne Dubben and Jorne Bonte (appendix B) mention the fact that only a small group of passengers travel by train and bus, while the financial division of revenues from integrated tickets will be a complicated process. It is also unknown how passengers travel exactly since smartcard data over concession boundaries is too sensitive information for operators to share (Herman Sinnema, appendix B).

Vehicle management

The bus operator is expected to make agreements about transfers in case of delays with other operators (OV-bureau Groningen-Drenthe, 2008). There are no strict requirements on this topic. The only requirement for the train operator is an information provision requirement to other operators, including the bus operator (Provincie Fryslân & Provincie Groningen, 2006).

From the interviews with Rob Bergsma, Angelo Coenen, and Jorne Bonte (Appendix B), it becomes clear that there is hardly interaction between the TC train of Arriva and the TC bus of Qbuzz. The same mechanisms as in Limburg and Fryslân apply here, but the existence of an extra operator complicates the situation. Bus drivers of Qbuzz are not informed about delays of trains. Only in case of disruptions, the TC of Qbuzz is notified and can, for example, inform bus drivers about expected crowds (Jorne Bonte, Appendix B).

4.5 Comparison

It was expected that the implementation of a multimodal concession would lead to the best performances on operational integration topics. To get a better overview of the differences in performance, the three cases are compared in this section. Table 4.2 presents a comparison between the cases regarding cooperation on the five operational integration topics. Cooperation is either voluntary or required. Furthermore, it can be fixed or ad-hoc. Thirdly, internal and external cooperation is possible, dependent on the organisational structure. In some cases, there is hardly cooperation, which is mentioned as well. These four variables are filled in in the table and are described below.

▶ **Table 4.2** | Comparison of the cooperation on the five operational integration aspects in the three cases.

Case	Limburg	Fryslân	Groningen
PTA	Provincie Limburg	Provincie Fryslân	Provincie Groningen (train) OV-Bureau Groningen-Drenthe (bus)
Contract	Multimodal net-cost	Unimodal net-cost	Unimodal net-cost (train) Unimodal gross-cost (bus)
Coordination	Internal	Partnership	Partnership (train) Contractual (bus)
Network layout	Voluntary fixed internal cooperation	Voluntary ad-hoc internal cooperation*	Hardly cooperation
Schedule	Voluntary fixed internal cooperation	Voluntary fixed internal cooperation	Voluntary fixed external cooperation
Information	Voluntary fixed internal cooperation	Voluntary fixed internal cooperation*	Hardly cooperation
Fares & tickets	Required fixed internal cooperation	Hardly cooperation	Hardly cooperation
Vehicle management	Hardly cooperation	Hardly cooperation	Hardly cooperation

* This is a limited form of cooperation.

Network layout

Comparison of the activities on network integration shows significant differences. In Limburg, the network layout of train and bus has been designed in an integrated way. A full feeder network has been applied there. The fact that data and knowledge are available for both modes within the company allows for better alignment and creates more solution space. In Groningen, the bus lines are designed in the interest of the OV-Bureau, which is not necessarily in accordance with the interest of train operator Arriva. There are large parts of the network changed into a feeder network, but that is not the case everywhere. Three main reasons are mentioned for bus lines serving the same market as the trains, namely overcrowded trains, a (much) lower TT for passengers, and the financial interest of the OV-bureau to run buses itself. In Fryslân, the in-between case, there is some ad-hoc cooperation between the train and bus division of Arriva. A geographical structure that is not suitable for a feeder network, a lot of water, a focus of transport flows on different parts in the capital of the province, and a focus of operators on the requirements in the (separate) contracts are reasons mentioned for the absence of a feeder network. All in all, the network layout has best been integrated in Limburg.

Schedule

A critical constraint when designing a timetable for the train is the infrastructure. Especially on regional railway lines, single tracks are no exception. That is the situation in each of the cases. In Limburg, the situation is even more difficult, because regional trains have to fit between the ICs of national railway operator NS. The point is: there is hardly space to change the timetable when taking into account train-train interchanges. Consequently, the bus timetables have to be adjusted to the train schedule. In Limburg, the timetable has been designed together with the network layout. Internal communication is used to create a pulse timetable. Also in Groningen, there is cooperation between schedulers of the OV-bureau/Qbuzz and Arriva. Together, they work on interchanges. A difference is that the network layout in Groningen is not prepared for a pulse timetable. The cooperation is voluntary. In Fryslân, the situation is comparable to Groningen. It can be concluded that the differences in this topic are relatively small. In all situations, there is cooperation, because it

is a common interest for PTA and operators. An advantage for Limburg is the continuous cooperation between train and bus schedulers and the joint development of network and timetable.

Information

Travel information in the Netherlands is integrated nationally to a great extent. Travel information websites and apps contain all routes and timetables to plan a journey across the country, regardless of the concession. The differences in passenger information between the concessions come along when talking about information on special tickets and promotion. In Limburg, regional PT information for passengers is also integrated to a great extent. The PT system is treated as a whole. For example, the corporate identity on buses and trains is the same. Contrary, information in Groningen is highly segregated. There are some initiatives to merge information, specifically concerning the integrated tickets. For the rest, it has yielded little concrete to date. That has mainly to do with different views on marketing and limited cooperation on other integration topics. In Fryslân, the situation is in-between. Some forms of expression, especially concerning the timetables, are integrated, but there is no fixed cooperation, and the focus seems to remain on the separate modalities.

Fares & tickets

For some years, in the Netherlands ticket integration is realised on a national level via a PT smartcard. Meanwhile, by far most people in PT travel by smartcard, and there is not so much to gain on this topic anymore. On the subject of fare integration, some achievements can be made. The main benefit for passengers in Limburg is the abolition of the boarding rate at transfers. However, this is mainly a benefit for passengers travelling by both train and bus. This is, of course, more often the case in a feeder network. In Groningen and Fryslân, there are not so many travellers travelling by train and bus, because there is no feeder network in (large) parts of the province. Therefore, it is often stated that there is no direct need to introduce fare integration. This argument works in both directions. It may also be possible that passengers do not travel by train and bus since there is no network integration. In any case, passengers in Groningen have to pay twice the boarding rate in some cases. That is also what happens in Fryslân. Regional tickets are integrated in Limburg, but hardly in Fryslân and Groningen. In Fryslân and Groningen, there are only a few tickets for bus and train, and these are meant for specific passenger groups. The cooperation on this topic is minimal, the financial consequences are too significant, or the passenger flows are unknown since no smartcard research is carried out.

Vehicle management

The contracts on vehicle management differ from concession to concession, but usually share the statement that the operator has to make a plan on how to offer train-bus connections. Often the bus operator must have a policy on this, because of infrastructure constraints and train-train connection trains cannot wait on buses. Also, the practice on this topic hardly differs. In each of the cases, vehicle management is a point of attention. There are not so many differences between one or two operators. Buses sometimes can wait on trains, but the procedure via TC train and TC bus seems to be too complicated and unworkable. Extra personnel, physically bringing both TCs together, and technical improvements are proposed solutions. An advantage in situations with one operator is that alignment in equipment used in trains and buses is possible, which can accelerate the implementation of information systems in the future. In all cases, it is expected that this topic will get more attention the coming years.

4.6 Lessons learned

From the cases analysed, different lessons can be learned. These lessons concern the organisation around operational integration, both for multimodal and unimodal concessions. Before embarking on the content, a few remarks about the research method have to be made. A pitfall of interviews is that only a few people give their opinion on a topic, which does not provide a full picture of the real situation. By questioning at least two stakeholders in each concession and by using also written (contractual) information, it is tried to diminish this effect. Also, the interviewer bias is a risk. The interviewer can influence the respondents. By using a number of fixed questions as a basis for all interviews, the influential role of the interviewer should be reduced. Thirdly, only three cases are analysed. Usually, the more cases are researched, the better the analysis becomes. Due to time constraints and partly a lack of suitable cases (especially gross-cost unimodal), the study is done for three cases.

Despite some scientific reservation, a lot of useful statements are made in the interviews. In this section, the statements are generalised and categorised into general statements about working together between client and contractor and between concessions. Besides that, some statements about the five parts of operational integration are listed. The lessons learned are shown in table 4.3 and briefly discussed below.

General

In order to achieve operational integration, cooperation between PTA, train, and bus operator is essential. Therefore, the involved stakeholders must be pushed to think in multimodal solutions. Especially in the case of Groningen, that is an issue. The division of the PTA for train and bus, there, causes a difference in interest between them on some levels. An organisation with one PTA having a strong development focus (often translated in a gross-cost contract) or a multimodal concession as in Limburg is more suitable to work on integration. Namely, one stakeholder has control over the whole PT chain, which gives more solution space. A typical example from the case of Limburg is the use of buses to serve the station Heerlen de Kissel, because an international extension of the railway line led to a time shortage in the train schedule. In such an organisation, there is a clear point of contact for all PT related issues and an incentive for one of the stakeholders to work on integration. An additional supporting condition in a multimodal concession is a culture in which train and bus staff meet each other, and some personnel is employable for both modalities. This may help to experience the PT system as a whole.

Another valuable lesson concerns the passenger smart card data. Usually, all stakeholders only have overview of a part of the whole PT system. Sharing passenger data may help operators and/or PTAs to get a better overview of what is happening and how the current situation can be improved concerning integration.

Network layout

For operators, there is a financial interest to provide a feeder network when the regional train and bus contract is integrated into a multimodal concession. Namely, the costs in a feeder network can be lowered and the cost-coverage increases. The operator, then, optimises the network as a whole, instead of only one modality and can oversee the whole financial situation. That is the case in Limburg. In situations with unimodal concessions, the revenue responsibility should not obstruct integration. In Groningen, the own responsibility for revenues creates an incentive for the OV-bureau to transport as many passengers as possible. That translates, among others, in parallel bus lines. Revenues increase at the expense of the train operator. Taking away this incentive, for example in the theoretical case that both PTAs are integrated, network integration would be more supported. However, it requires a different attitude from the PTA.

Financial reasons are not the only reasons mentioned not to implement a feeder network. In Fryslân, an unsuitable geographical structure would hold the application. Next, in the two northern provinces, a large group of passengers commutes or visits the province capital, Leeuwarden or Groningen. By creating short-circuits for these passengers, TT may decrease tremendously. Finally, in the province of Groningen, trains are already overcrowded and feeding onto them will even enlarge the number of passengers, which is not desirable.

Schedule

Well-designed interchanges are an essential feature of a PT network. Generally speaking, transfers are in the interest of all stakeholders, because it improves the network as a whole and attracts people to the PT system. Almost all interviewees confirm that. That shared interest is enough reason in each organisational structure to provide good interchanges. Another reason for the well-functioning cooperation is that such a long-term coordination question is suitable for a procedure. A benefit of a multimodal over a unimodal concession is, though, that network and schedule can be designed simultaneously. This is, theoretically speaking, also possible when a PTA takes that role.

A shared interest does not mean that the alignment of timetables is a simple activity. An important constraint in the designing of a timetable is the national railway timetable or timetable of 'neighbouring' rail operators. When providing interchanges to other trains while taking into account the infrastructure, the train timetable is almost fixed. Consequently, the flexibility must come from the bus operator.

Information

An important condition for a successful marketing strategy is a shared vision among stakeholders. In Groningen, this was mentioned as a reason why integrated marketing campaigns are not feasible, although all stakeholders have an interest in good information and communication to passengers. When only one stakeholder is directly involved, in a multimodal concession, it is easier to achieve full information integration. In Limburg, this is the case, as demanded by the PTA.

Fares & tickets

Fares are a large revenue share for the operator. Revenues are an important assumption for operators when setting up a business case for a concession. Abolition of the boarding rates in a multimodal trip often leads to loss of income. For that reason, operators are hesitant to change them during the concession. That makes it challenging to establish fare and tickets integration within a running concession. This is mainly the case in unimodal concessions, as applied in Fryslân and Groningen. Also, uncertainty about the end of the concession may play a role in this.

Another reason why the abolition of the entry fee is often not established is the fact that only a handful of people travel by train and bus in one trip. This argument is mentioned in Fryslân and Groningen. One could also argue that it is even easier to arrange in that case. However, the fact that there is only a relatively small group of multimodal passengers (also) has to do with the network. A feeder network and fare integration must go together. In a multimodal concession, it is more likely that an operator will come up with full fare and ticket integration because it serves as a stimulus for passengers to use the feeder network as meant. In a unimodal concession, it can be achieved by demands from the PTA. Note that unimodal tickets remain necessary for unimodal passengers.

Table 4.3 | Lessons learned from the case studies, categorised per operational integration level.

Level	Lesson learned
General	• **A multimodal concession or a PTA having a strong development focus allows to control the whole PT chain**, which gives more solution space on several topics, a clear point of contact for all PT related issues, and an incentive to actually improve integration. • **Combining smartcard data can help to improve on different levels of integration**, because data from different concessions, modalities or operators gives insight into the full trips of passengers instead of a piece of the network. • **A corporate culture focused on integration may help to improve it.** On all levels both train and bus must be represented and interact with each other. • **A multimodal concession allows for combined train-bus drivers**, which is beneficial for scheduling train replacement buses, holiday schedules, and career paths.
Network layout	• **(Financial) responsibility of PTA and operator plays an important role** on what kind of network is implemented. • **Financial compensation is an advantage of a multimodal concession** and ensures the existence of a substantial bus network. • **Inhibitions** for the adjustment of a network into a feeder structure may be unsuitable geographical structures, passenger flows to one major destination where short-circuits are preferred, or already overcrowded trains.
Schedule	• **Good interchanges are a common interest** for PTA, train, and bus operator, because it is an attractor for passengers. This interest transcends the different organisational structures. • **Train timetables are set in stone**, caused by infrastructure constraints, concurrence with other operators, timetables of other operators, and train-train interchanges. Bus schedules have to be plugged in on this. • **Network and schedule can be designed simultaneously in a multimodal concession**. The effects of network changes, then, can directly be seen in the timetable (of train and bus) and may lead to a better PT supply.
Information	• **A joint interest** for all stakeholders is to offer good traveller information. • **A shared vision on marketing is needed** among the stakeholders to collaborate fruitfully. • **A multimodal concession or gross-cost contract are an easy way to arrange information integration**, because all information is applicable at one stakeholders.
Fares & tickets	• **Reasons not to introduce integrated fares (and tickets)** in current and unimodal concessions are existing business cases and arrangements that cannot be simply changed, the possibility of income loss for the operator, no perceived added value for passengers (depends on distance), and uncertainty around a possible operator change at the end of the concession. • **A feeder network and integrated fares and tickets mostly have added value together**. Stakeholders see no interest in introducing integrated tickets when there are no multimodal travellers and the other way around. • **Unimodal tickets remain necessary** for passengers to places only accessible by bus, because they are cheaper than multimodal tickets.
Vehicle management	• **Trains cannot wait** on delayed buses, because of infrastructure constraints and train-train interchanges. • **The current bus holding procedure in all concessions is inefficient and ineffective**, because train traffic controllers have no time to contact TC bus for regulating interchanges. Extra dedicated personnel at TC, phsically bringing both TCs together, and technical solutions on the longer term may help to improve train-bus transfers. The same equipment in train and bus is an advantage when implementing this. • **Punctuality norms for buses may obstruct waiting for trains** and could be replaced by passenger punctuality norms.

Vehicle management
Waiting buses in case of a train delay is difficult to arrange, as has become clear in all cases. The situation is most difficult in Groningen, where two operators need to work together, but the practice hardly differs between the cases. Also in Limburg, it is a point of attention. Vehicle punctuality norms in the contract sometimes may obstruct proper vehicle management and should preferably be replaced by passenger punctuality norms. However, even more important is the current procedure. This procedure, in which train and bus driver communicate via TC train and TC bus, is too complicated and therefore hardly used. A good communication system and a procedure is needed to achieve better real-time integration. On the short-term, extra personnel at the TC, dedicated for transfers, may help to improve vehicle management. Physically bringing both TCs together can help as well, but that depends on the specific plan. On a longer term, technical solutions become able to communicate real-time delay information to bus drivers.

4.7 Conclusion

Which coordination mechanism is best able to achieve operational integration?

The case studies indicate that there are two ways to ensure train-bus integration. The first way is creating a multimodal concession. Delegating all the tactical and operational planning tasks to one operator, with some minimum requirements, creates a financial incentive for the operator to integrate on all levels. The operator has more solution space, which creates opportunities for an integrated PT system. Network layout and timetable can be designed together for train and bus, and an integrated fare system will enhance this network. For passengers, there is a clear coherent PT identity and point of contact.

A second organisational structure that may support operational integration is a unimodal gross-cost contract. This is the 'Verkehrsverbund' model. In this type of contract, it is primarily the function of the PTA to clearly demand how integration is to take place. The PTA must take a role as tactical planner and design the full network, determine the fares and tickets, and provide information to passengers. This type of contract is not fully encountered in the case studies but seems to be promising. Instead of the operator in a multimodal concession, the PTA now has the incentive to control the whole system. Most benefits in a multimodal concession can also be obtained in this configuration. However, it requires a totally different and sometimes discussed position of the PTA.

Both structures, however, will not lead to a better-integrated system perse. A lot of other factors play a role in that. Amongst others, unsuitable geographical structures, passenger flows to one major city, and overcrowded trains can inhibit network integration. Differences in vision on marketing can obstruct information integration. Integrated fares can be introduced when business cases are not influenced negatively, also a feeder network is introduced, and there is not too much uncertainty about the end of the concession. Generally speaking, the (financial) interests of PTA(s) and operator(s) must be aligned with each other as much as possible. That will lead to the best results on integration. The in-between situation, in which the operator is revenue responsible will, due to that, most often lead to a network that is not fully tuned between modes. Also within a company, the division of a bus and train department can be strong.

This chapter mainly focused on the organisation of integration and how the defined aspects of operational integration can be achieved. However, the exact benefits for passengers are not researched yet. In the following chapter, a smaller part of Limburg is taken to see the effects of a feeder network and pulse timetable for passengers.

Chapter 5

Network Assessment

5. Network Assessment

5.1 Introduction

Operators often introduce feeder networks in multimodal concessions to increase efficiency. One of the aims is to decrease duplication of lines, especially between train and bus, which should result in a higher occupancy rate in the remaining lines and vehicles. This way of reasoning, however, seems to be mainly a benefit for the operator. Passengers are faced with additional transfers. From their view, other network structures having more direct lines might be better capable of matching the demand. There are, however, also beneficial aspects for passengers. For example, total TT might decrease, or the trip fare might be lower. Besides that, a larger part of the trip is done by train, which most travellers prefer over a bus.

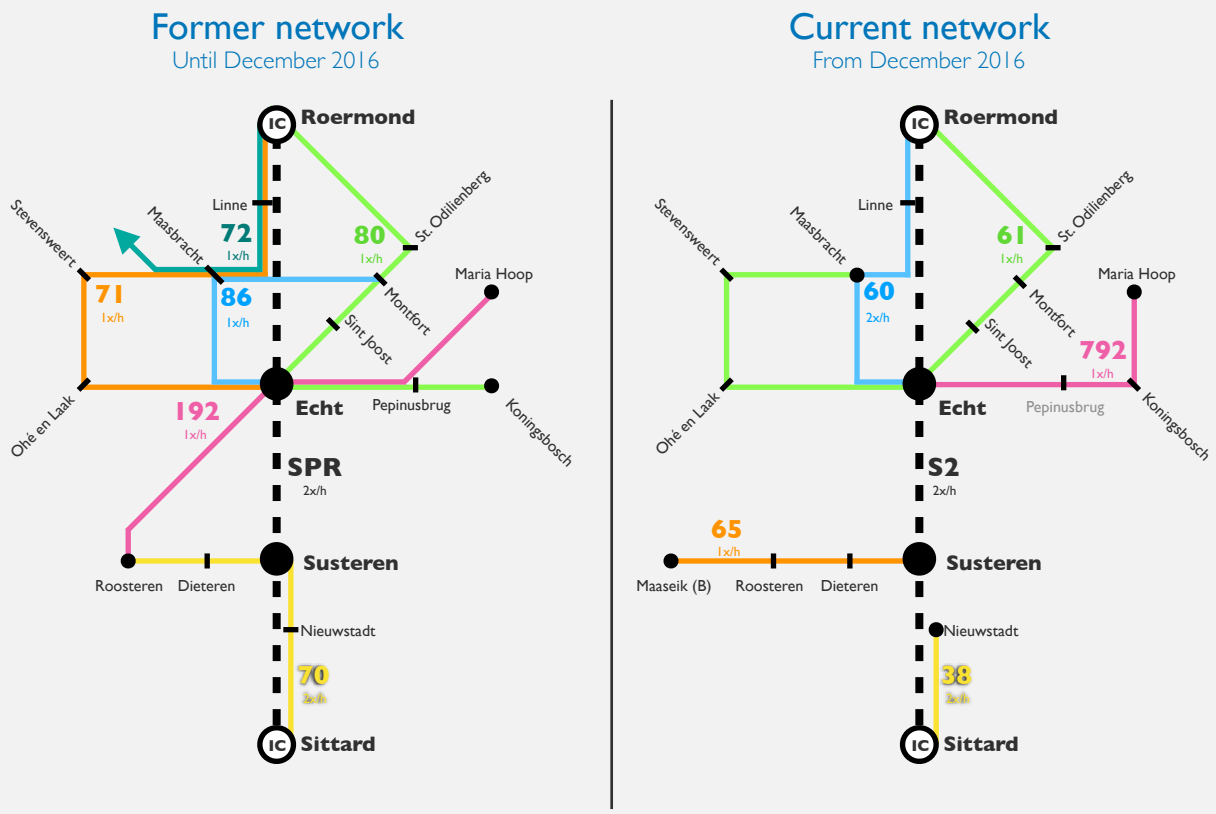
This chapter is about the effects of feeder networks on passengers. Using a case study, a network that has changed into a feeder network is analysed before and after. By doing this, a threefold goal should be achieved. First of all, the analysis gives insight into the size of multimodal trips as part of the total number of OD pairs and the need for coordination in that respect. In other words, the size of the problem becomes clearer. The second goal is about the difference between travel patterns within and without a feeder network. Finally, from a broader perspective the analysis aims to show and generalise the functioning of the main transfer points in the network. This kind of information can be used when changing other PT networks. The central question is *What are the effects of an integrated public transport network on passengers?*

An introduction to the case is described in section 5.2. It is expected that a feeder network will affect both the TT and the travel costs of passengers. Subsequently, the two main analyses in this chapter concern these topics. In section 5.3 and 5.4, the method for analysis and the results of the Weighted Generalised Travel Time (WGTT) and Travel Costs (TC) analysis are explained. An answer to the research question is given in section 5.5.

5.2 Case description

A case study is used to research the functioning of a feeder network. The particular case is part of the concession Limburg, introduced in Chapter 4. More specifically, the PT around the railway line between the cities of Roermond and Sittard is chosen. Arriva realised a feeder network when it took over the concession in December 2016. Parallel bus lines next to railway lines were redirected to feed the railway line, and the frequency of the railway line was heightened to 2x/h all day long. There are two main reasons why this area is chosen for analysis instead of other feeder networks. First of all, the area of interest can be demarcated relatively easily. The study area is a very small part of the Netherlands. On the smallest point, it only has a width of 5 kilometres. There are hardly international connections. Besides that, the stops served by Arriva are to a great extent the same as the stops served by Veolia. The relatively minor differences on this topic make the case suitable for comparison.

Both networks are schematically depicted in figure 5.1. The original maps provided by the operators are added in appendix C. As the maps show, the primary connection between Roermond and Sittard is a railway line. National railway operator NS operates IC trains there, and a regional train calls at the stations of Echt and Susteren. Around these towns, a few bus lines are now feeding the trains. These are the bus lines 60 (Echt-Maasbracht-Roermond), 61 (Maasbracht-Ohé en Laak-Echt-Montfort-Roermond), 65: (Susteren-Maaseik), and 792 (Echt-Koningsbosch-Maria Hoop). Their main task is to pick up passengers from the stops and take them to the nearest railway station. There are still some more or less parallel bus lines. That has to do with towns next to the railway line not served by train. Buses are still needed to call these places. An example is Linne.



▶ **Figure 5.1** | Schematic maps of the PT network around Roermond and Sittard until and after December 2016.

During the concession of Veolia until December 2016, the train and bus networks were much more separated from each other. NS operated both IC and regional trains. Although the railway network was the same, the bus network seems to be created independently from the railway line. Connections from bus to train were often poorly timed. Some bus lines followed part of the route of the regional train, for example between Echt and Susteren. The equivalent bus lines in the Veolia network are 70 (Sittard-Susteren-Roosteren), 71/72 (Roermond-Maasbracht-Echt), 80 (Roermond-Echt-Susteren), 86 (Echt-Maasbracht-Montfort), and 192 (Echt-Koningsbosch-Maria Hoop).

In the current network, a pulse timetable has been applied at both Echt and Susteren. The buses arrive right before the regional trains from both directions approach the station and leave when both trains are departed. Some bus lines have the same frequency as the trains. Others only give connection once per hour. The regional train and bus networks are highly intertwined. Especially at the station of Echt, it can be observed. In figure 5.2, time-distance diagrams show that the connections between regional train and bus are improved.

To be able to compare the situation before and after, the borders of the case must be determined precisely. This is done by taking the aforementioned train and bus lines into account and cutting out the parts where a bus line shares part of the route with a bus line other than mentioned before. This method allows having an overview of the travel patterns of all passengers within the borders of the case. The only parts of bus lines that are not taken into account are near the cities of Roermond and Sittard. The stops that are regarded in the analyses are the most important stops of each town, i.e. the most centrally located one.

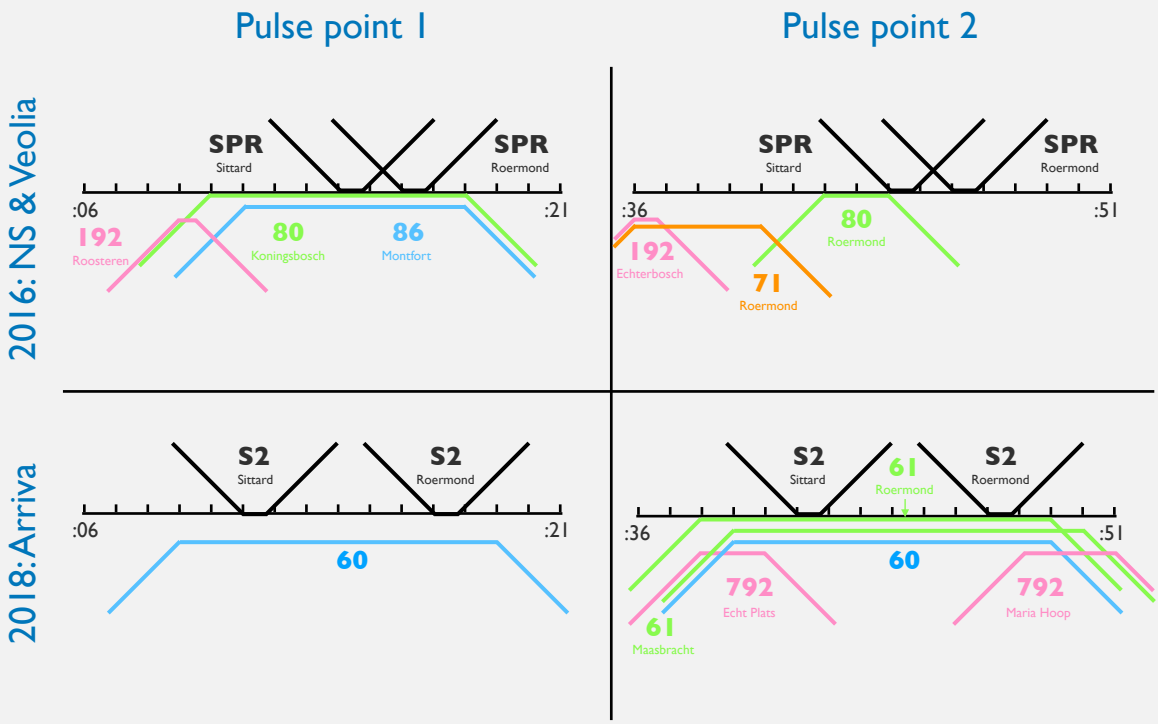


Figure 5.2 | Time-distance diagrams of regional train and bus at Echt station in the current timetable of Arriva and the former timetable of NS and Veolia.

5.3 Weighted Generalised Travel Time

It is often stated that the introduction of a feeder network leads to, amongst others, shorter TTs for passengers because the interchanges have improved, and more passengers can travel part of a trip by train. In this analysis, that statement is tested for the case introduced before using a WGTT analysis. Below, the research method, the results, and a sensitivity analysis are described.

5.3.1 Research method

To be able to do the TT analyses, several datasets are selected and serve as input. An overview of all data used is depicted in table 5.1. For both networks, data about the stops and the distances between them. Also, the 2017 fares of all operators are obtained. Thirdly, timetable data of both the NS / Veolia network and the Arriva network of the relevant regional train and bus lines are used. Next, smart card data from the current PT network of Arriva is obtained. This data consists of all check-ins and check-outs on the particular lines over November 2017. Also, smartcard data from Veolia (November 2016) is collected. However, since there is no information about the NS trains in that period, this data is only used for validation.

Table 5.1 | Overview of the data used in the analyses.

Veolia / NS network December 2006 - December 2017	**Arriva network** December 2017 - now
Distances between all stops	Distances between all stops
Boarding rate and kilometre price 2017	Boarding rate and kilometre price 2017
Timetable 2016 *Train, bus lines 70, 71, 80, 86, 192*	Timetable 2018 *Lines S2, 38, 60, 61, 65, 792*
Smartcard data (bus) *Average of November 2016*	Smartcard data (regional train and bus) *Average of November 2017*

The analyses are conducted for different time situations. The primary analysis uses the ridership on an average working day. Also, an analysis of Sundays is made. Sunday is the quietest day in the week in PT, which gives the most significant difference with working days. It shows how a feeder network performs with lower frequencies. There are hardly service changes during rush hours, so it is not needed to take that aspect into account. All analyses are done using Excel. Hereafter, the different analyses are described in more detail.

The first analysis calculates the Weighted Generalised Travel Time (WGTT) of passengers within the network. Weighted in this case means based on real demand and generalised refers to the disutility passengers experience in a trip. A few steps are needed to come to the end result. These steps are depicted in figure 5.3 and described hereafter.

Figure 5.3 | Three steps to calculate the WGTT.

1. Timetable

Firstly, the timetable information of Arriva, Veolia, and NS is obtained and compared ('Timetable'). The TTs from stop to stop are deduced from this information and stored in an OD matrix containing all shortest TTs, including transfer time. For simplicity reasons, in most towns only the most central stop is taken into account. The only exception is Echt, the central pivot in the network, where next to the station four other stops are taken into account.

2. (Generalised) Travel Time

Passengers value the various components of a trip differently (Vandewalle & Steenbergen, 2006). Perception of passengers can be added to the TT elements by coefficients (betas). This is called the Generalised Travel Time (GTT). It is calculated as a summation of waiting, in-vehicle, and transfer times. Formula 1 shows the components of the GTT in math and table 5.2 provides the used coefficients in this study. Hereafter, the elements are explained in more detail.

$$GTT = \beta_1 T_{waiting} + \beta_2 T_{bus} + \beta_3 T_{train} + (\beta_4 T_{transfer} + P) \quad (1)$$

$T_{waiting}$ = waiting time for bus or train
T_{bus} = in-vehicle time in the bus
T_{train} = in-vehicle time in the train
$T_{transfer}$ = time between alighting and boarding at a transfer station
β_{1-4} = coefficient of a TT element
P = transfer penalty (per transfer)

Table 5.2 | Coefficients of TT aspects (Abrantes & Wardman, 2011; Bunschoten, 2012; De Keizer & Hofker, 2013).

Component	Value
Waiting time	2.18*
In-vehicle time bus	1.28*
In-vehicle time train	1.0
Transfer time	2.18*
Transfer penalty	12.8*

* All factors are scaled, as explained under 'In-vehicle time'.

Waiting time

The first component of the GTT is the waiting time for train or bus at the beginning of a trip. For high-frequent services (10-minute headways or lower), passengers can be expected to arrive randomly at a stop. Average waiting time, then, is half of the headway between the vehicles (Osuna & Newell, 1972). In the case of Roermond-Sittard, though, the maximum frequency is 2x/h. Consequently, passengers adjust their arrival at the stop or station to the scheduled departure time (Van Oort, 2011). The literature on the arrival rates of passengers in such cases is limited (Van Oort, 2011). Vuchic (2005) describes the relationship between the waiting time between the planned and unplanned arrival of passengers (see figure 5.4). An unplanned arrival leads to an average waiting time of half the headway, as already described. For PT services having a higher headway, the actual waiting time is 5 minutes on average. The waiting time for headways between 10 and 20 minutes is highest and more than five minutes. Since the minimum headway of the bus and railway lines around Echt and Susteren is 30 minutes in both cases, an average waiting time of passengers of 5 minutes is used in the analysis. It could be argued that people arrive earlier for the train than for bus because train passengers can be expected to travel longer and therefore attach more value to a reliable journey. However, this aspect is not taken into account in this analysis, since most traffic is regional. Also, access time is not taken into account, because it has not changed by the new PT network of Arriva. Veolia served the same stops as Arriva now.

Passengers usually do not like waiting time. It is therefore valued higher than in-vehicle time (Abrantes & Wardman (2011). A meta-analysis by these researchers shows an average value of 1.7 for this aspect of travelling in PT. This value is used in this analyses. However, due to scale factors (see also 'In-vehicle time'), the value is heightened to 2.18.

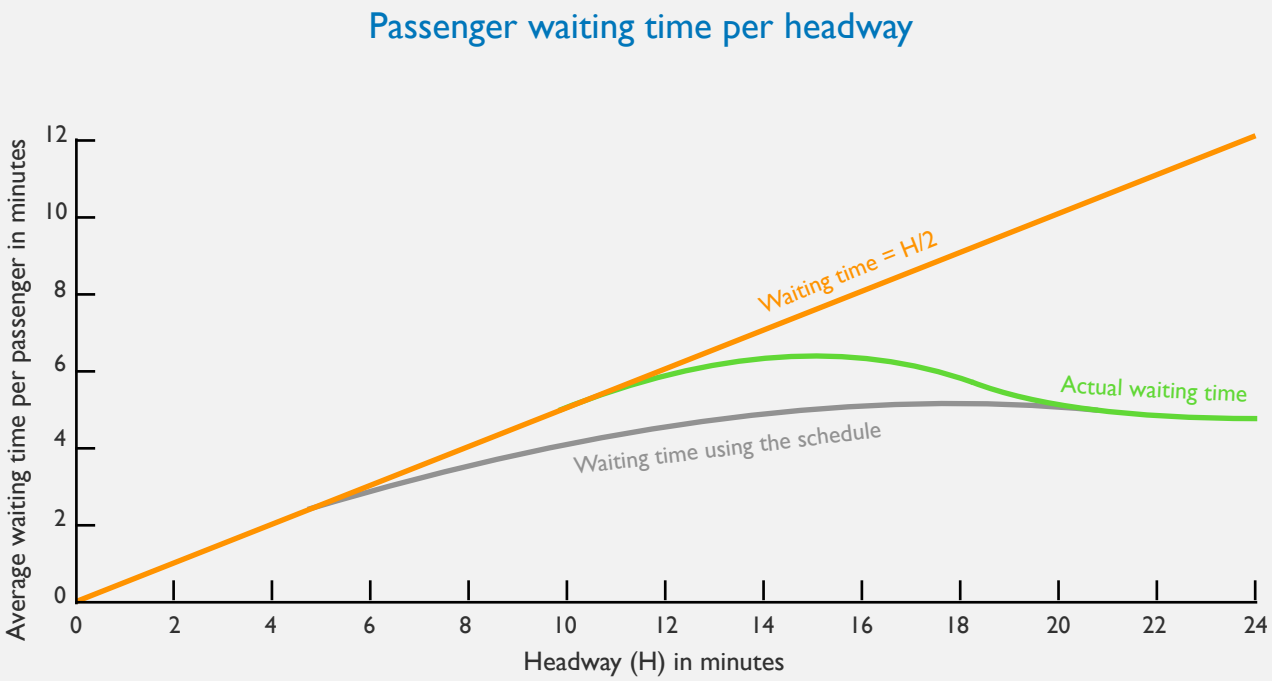


Figure 5.4 | Average waiting time as a function of headway size H (Vuchic, 2005).

In-vehicle time

The valuation of in-vehicle time is used as a reference to the other aspects of the GTT. It is therefore valued as 1 in table 5.2. However, a difference between the valuation of in-vehicle time for train and bus can be observed. Bunschoten (2012) researched the preference for tram over bus in an urban context and found a preference for the tram, which has mainly to do with the atmosphere, characteristics and travel information. Using a traffic model, he found a ratio of 0.78 between the perception of in-vehicle time between bus and tram.

A (regional) train can be expected to perform even better than an urban tram. After all, more comfort is offered in a train, and the speed is higher. Therefore, the ratio of 0.78 can be used but is a conservative estimation in this case. Since a coefficient of 0.78 for in-vehicle time train is unnatural, the in-vehicle time for bus is increased by the same ratio, leading to a value of 1.28. Due to this, the other coefficients need to be scaled as well. The resulting values can be found in table 5.2.

Transfer time

Transfer time is, in fact, the same as waiting time: loose time at a stop or station. However, sometimes walking is also part of the transfer time. Since walking at the stops and stations is minimal in this network and does not differ between the current and former network, it is not further taken into account. Transfer time is regarded as waiting time, and the beta is therefore valued the same with a (scaled) value of 2.18.

Passengers usually avoid transfers, because it is an annoying and unreliable part of the total trip. For that reason, an extra penalty for transferring is included in the formula. De Keizer & Hofker (2013) and Lee et al. (2014) researched interchanges. According to them, the transfer penalty should be based on different factors, such as the reliability of the services, transfer type, and the amount of baggage a passenger takes. However, there is no information about most of the factors. In the current models, usually a transfer penalty of 10 minutes is used. Therefore, this value is also used in this analysis but then scaled to 12.8.

3. OD matrix
The second step comprises the translation of Arriva smart card data of both regional trains and bus lines into an OD matrix. The OD matrix shows per combination of origin and destination how much passengers travel between these stops. For two reasons, this OD matrix is used in both the current and the former situation. That is because of a lack of smartcard data from the situation before 2016. Only the bus data is available. Besides that, the cases become better comparable when the travel patterns have not changed. TT differences then cannot be explained by changes in the travel patterns. However, a consequence of this approach is the assumption that supply does not influence demand.

4. Weighted Generalised Travel Time
Finally, the WGTT for both networks can be calculated as a multiplication of the GTT matrices and the OD matrix. The results for both networks can be compared to each other. Visualisations are possible in several (delta) matrices, but also (schematic) maps can be made to show the differences quickly. The results of the analysis are treated in section 5.4.

Both analyses are based on some assumptions, making it possible to compare the old and new concession with each other. The most critical assumption is that travel patterns have not changed over the years. The OD matrix of November 2017 also represents the travel patterns of November 2016. Some examples show that this is not really the case. For example, the connection Maasbracht-Echt has improved in the new network and is faced with passenger growth from 27.4 to 51.1 on an average working day. Contrary, on the corridor Nieuwstadt-Susteren, where the direct connection is lost, the average number of passengers on a working day has decreased from 7.9 to 0.0.

Some other assumptions are made as well. These assumptions are mainly about the travel behaviour of passengers within the system. Some assumptions must be made because of data availability. Below, an overview of the assumptions is given.
- Passengers always take the fastest connection, also when additional interchanges are needed.
- There are no disruptions. All buses and trains are punctual so that the travel and transfer times are predictable.
- Passengers are used to the changes in the network made by Arriva.
- Passengers are not disabled and able to transfer from bus to bus or bus to train (and v.v.) within two minutes.
- Frequencies do not influence people's need to travel by PT.

As explained, some different TTs analyses are done. To be clear, table 5.3 provides an overview of the terminology used. There are two variables used. The first one is the use of the OD matrix, which gives insight into the real passengers in the system instead of all possible connections. The second variable is the presence or absence of TT coefficients to model the perceived TT.

Table 5.3 | Overview of the four different forms of TT.

	Objective TT	**Perceived TT**
All OD pairs	Travel Time (TT)	Generalised Travel Time (GTT)
Actual demand	Weighted Travel Time (WTT)	Weighted Generalised Travel Time (WGTT)

5.3.2 Results

The unweighted TTs give a first indication of the differences between the networks. In the current network, during working days, the unweighted TTs between all OD pairs within the scope are ranging from 7 to 83 minutes with an average of 34.1 minutes. That can be compared to a range from 7 to 90 minutes and an average of 34.7 for the Veolia network. For all OD pairs, on average TT has decreased with about half a minute. However, this (small) change in average TT is not necessarily caused by the introduction of a feeder network. For example, in theory, a tighter timetable can lead to shorter TTs between directly connected stops, but in practice, the TT may be still the same. In any case, the difference is small.

When looking in more detail, some losers and winners regarding TT can be identified. Table 5.4 gives an overview of the relative differences in TT. The main towns that are faced with an increase in TT are the ones that lost a direct connection to a transfer point. Examples are Nieuwstadt, Roosteren, and Dieteren. Contrary, some larger towns, such as Sittard, Susteren, and Maasbracht and some stops in Echt are faced with TT decreases since the transfer times are reduced at the pulse stations. Some transfers were timed poorly in the former network. For example, the planned transfer at Echt from the train coming from Sittard to bus line 71 was 26 minutes. The introduction of the pulse stations improved the connections, both train-bus and bus-bus.

The obtained OD matrix gives insight into the main travel patterns in the Echt-Susteren region. On an average working day, about 5,500 people travel within the region. The relative importance of the transfer points can be described by the fact that more than 75% of all passengers travel from or to Roermond, Echt, Susteren or Sittard. However, about 4,000 passengers are only travelling by train between Roermond, Echt, Susteren or Sittard. This group of passengers is not faced with any changes in the system, since they do not need to transfer at all. In that regard, this group of passengers is not interesting for the analysis, but it does influence the average heavily. For that reason, the train passengers are left out in the following analyses.

Table 5.4 | Overview of the relative changes in TTs between all OD pairs during working days.

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		50%	-26%	70%	182%	-29%	48%	64%	51%	42%	4%	-20%	81%	46%	229%	-21%	-22%	-23%	0	54%	-7%	-13%	37%	-8%	34%
Echterbosch - Etb	45%		24%	-33%	28%	24%	-25%	-31%	-70%	-23%	25%	18%	13%	-28%	24%	-41%	-28%	26%	129%	-31%	-24%	3%	-21%	3%	0%
Echt, Kelvinweg - Ekw	-22%	-20%		-45%	-72%	33%	-36%	-43%	27%	-32%	-54%	0	0	30%	68%	45%	50%	38%	54%	-38%	-33%	-29%	-34%	0	-5%
Echt, Noorderpoort - Enp	49%	-28%	15%		-83%	0	-45%	0	4%	-44%	-5%	-37%	-9%	0	39%	25%	28%	19%	44%	0	0	-26%	-39%	-33%	-6%
Echt, Plats - Eps	93%	24%	-73%	-37%		0	-12%	-32%	-61%	36%	-15%	-32%	84%	-23%	97%	-69%	-72%	81%	479%	13%	-18%	45%	-7%	57%	24%
Echt, Station Arriva - Ec	-29%	0	11%	0	0		0	0	-7%	0	4%	5%	67%	0	100%	11%	14%	0	33%	0	0	0	0	0	9%
Echt, Zuiderpoort - Ezp	26%	48%	-56%	11%	-70%	-11%		9%	-51%	0	35%	0	116%	13%	33%	-53%	-55%	0	24%	17%	10%	-38%	0	-48%	-2%
Hingen - Hin	43%	-28%	9%	-13%	-81%	-9%	-44%		0	-36%	-7%	-36%	-11%	0	61%	17%	19%	13%	39%	0	0	-8%	-32%	-11%	-5%
Koningsbosch - Knb	46%	-86%	17%	0	-64%	12%	-56%	0		-52%	29%	-33%	-80%	26%	57%	23%	-13%	32%	25%	33%	20%	-3%	-49%	-4%	-5%
Laak - Lak	30%	40%	-55%	8%	-63%	-7%	0	7%	-47%		81%	0	92%	11%	29%	-48%	-50%	0	27%	14%	9%	-24%	0	-29%	1%
Linne - Lni	-27%	10%	-42%	-11%	-50%	-20%	39%	-10%	-4%	35%		8%	33%	-2%	19%	0	0	6%	-26%	-10%	-3%	-18%	45%	-21%	-2%
Maasbracht - Mbt	-21%	9%	-13%	3%	-62%	5%	0	-11%	0	0	18%		37%	94%	45%	6%	6%	13%	-20%	3%	26%	-6%	0	-7%	5%
Maria Hoop - Mrh	60%	-27%	45%	-24%	59%	61%	-15%	-22%	-59%	-14%	40%	-19%		-20%	38%	-26%	-10%	34%	161%	-22%	13%	20%	-13%	24%	12%
Montfort - Mft	35%	-25%	18%	-6%	-64%	-5%	-38%	0	0	-34%	104%	153%	-9%		36%	13%	14%	-9%	33%	0	0	-14%	-31%	-17%	7%
Nieuwstadt - Net	167%	0	36%	91%	71%	55%	-10%	80%	50%	-9%	33%	26%	19%	61%		68%	73%	38%	132%	77%	47%	11%	-8%	200%	57%
Pepinusbrug - Pep	55%	-76%	23%	85%	-72%	22%	-37%	69%	-8%	-30%	36%	16%	-68%	35%	74%		14%	32%	-21%	47%	25%	-4%	-30%	-5%	8%
Pey - Pej	56%	-73%	20%	91%	-76%	14%	-41%	71%	-7%	-40%	35%	13%	-65%	33%	76%	0		30%	-25%	47%	24%	-9%	-33%	-12%	6%
Roermond - Rm	-24%	-22%	30%	-37%	12%	-7%	-38%	-31%	14%	-16%	13%	13%	-2%	0	64%	27%	30%		-22%	-18%	0	-4%	19%	-6%	0%
Roosteren - Rst	0	124%	-23%	114%	493%	44%	142%	103%	41%	119%	6%	-7%	186%	82%	186%	-19%	-20%	0		100%	65%	-12%	100%	-6%	79%
Sint Joost - Sjt	40%	-27%	8%	-10%	-72%	-8%	-43%	0	0	-38%	-6%	-35%	-10%	0	42%	16%	17%	12%	37%		0	-17%	-34%	-22%	-7%
Sint Odiliënberg - Sob	30%	-21%	5%	-4%	-56%	-4%	-32%	0	0	-30%	88%	15%	-8%	0	35%	10%	11%	0	28%	0		-11%	-27%	-13%	1%
Sittard - Std	-21%	-36%	-9%	6%	-7%	-7%	-53%	5%	-7%	-48%	5%	-6%	-19%	4%	5%	0	0	-4%	-18%	5%	3%		-43%	-9%	-11%
Stevensweert - Svt	26%	33%	-58%	7%	-56%	-5%	0	6%	-43%	0	110%	0	73%	10%	25%	-44%	-45%	16%	25%	12%	8%	-20%		-24%	2%
Susteren - Srn	0	-38%	-6%	18%	6%	0	-59%	14%	-4%	-52%	10%	-4%	-20%	9%	240%	6%	7%	0	0	13%	6%	0	-46%		4%
Average	31%	-8%	-5%	14%	-5%	8%	-17%	12%	-9%	-13%	28%	2%	24%	18%	77%	-3%	-2%	17%	54%	15%	8%	-8%	-12%	0%	

The passenger TT differences in the network can be analysed when taking into account the real demand. Table 5.5 shows some average (passenger) TTs within the network. The values are categorised into the type of day (working day versus Sunday), weighted or unweighted TT, generalised or ungeneralised TT, and the network (NS / Veolia versus Arriva). Also, the differences are depicted. In all cases, the average TT is lower in the Arriva network, ranging from -1.3% to -12.2%. Due to the fixed demand, the relative changes are quite constant between the case of objective and perceived TT. That means the parts of a trip that are penalised (transfers) are quite constant over the networks. The feeder network has realised an overall TT reduction. For all OD pairs, the additional interchanges are justified by either a decrease of transfer time or a total TT reduction on a trip. Otherwise, there should be differences in the outcome of the generalised and ungeneralised networks. The percentage of passengers travelling by both train and bus is about 5% in the former network and 6% in the current network. When leaving out the direct train passengers, that number increases to about respectively 19% and 21%. Note that these are only bus trips within the demarcated area.

The results for Sundays are somewhat different. That mainly has to do with the fact that some bus lines are replaced by demand responsive solutions. That is the case for bus line 80 (partly), 86, and 192 in the NS/Veolia network and bus lines 65 and 792 in the Arriva network. There is no data available about those demand responsive solutions. Consequently, passengers can only travel by bus to relatively good accessible places. That causes the drop of the WGTT on Sundays. It is, therefore, difficult to compare the networks on Sundays. There seems to be a lower average TT in the Arriva network.

Table 5.5 | Average passenger TTs in minutes for the different PT networks.

		Objective TT			Perceived TT		
		NS / Veolia	Arriva	Δ	NS / Veolia	Arriva	Δ
Working day	**All OD pairs**	36.8	34.1	-2.7 -7.3%	74.0	66.9	-4.1 -9.6%
	Actual demand	23.7	23.4	-0.3 -1.3%	39.2	38.2	-1.0 -2.6%
Sunday	**All OD pairs**	41.8	36.8	-5.4 -12.0%	83.5	73.3	-8.2 -12.2%
	Actual demand	21.7	20.2	-1.5 -6.9%	33.9	30.3	-3.6 -10.6%

Two side notes must be made in the context of these values. Firstly, it is observed that the driving times between stops sometimes are extended a bit in the current timetable. For example, the driving time between Roermond and Linne was 11 minutes in the old network and 13 in the current. This may have to do with congestion on the road. The number of passengers between Roermond and Linne/Maasbracht is substantial. Consequently, these two minutes have an adverse effect on the Arriva network, while it has nothing to do with the feeder network. Without this effect, the differences in TT should be even higher.

A second effect also tackles the Arriva network negatively. It is noticed that Veolia used an 8-seater minibus on line 86 (Echt-Maasbracht-Montfort). Although it cannot be proved irrefutable, it is likely that these kind of vehicles are less attractive for passengers than regular buses. Looking at the number of passengers between Echt and Maasbracht (around 55 per direction), it is inconceivable that all these passengers took this line, although it is the fastest route. When passengers took line 71

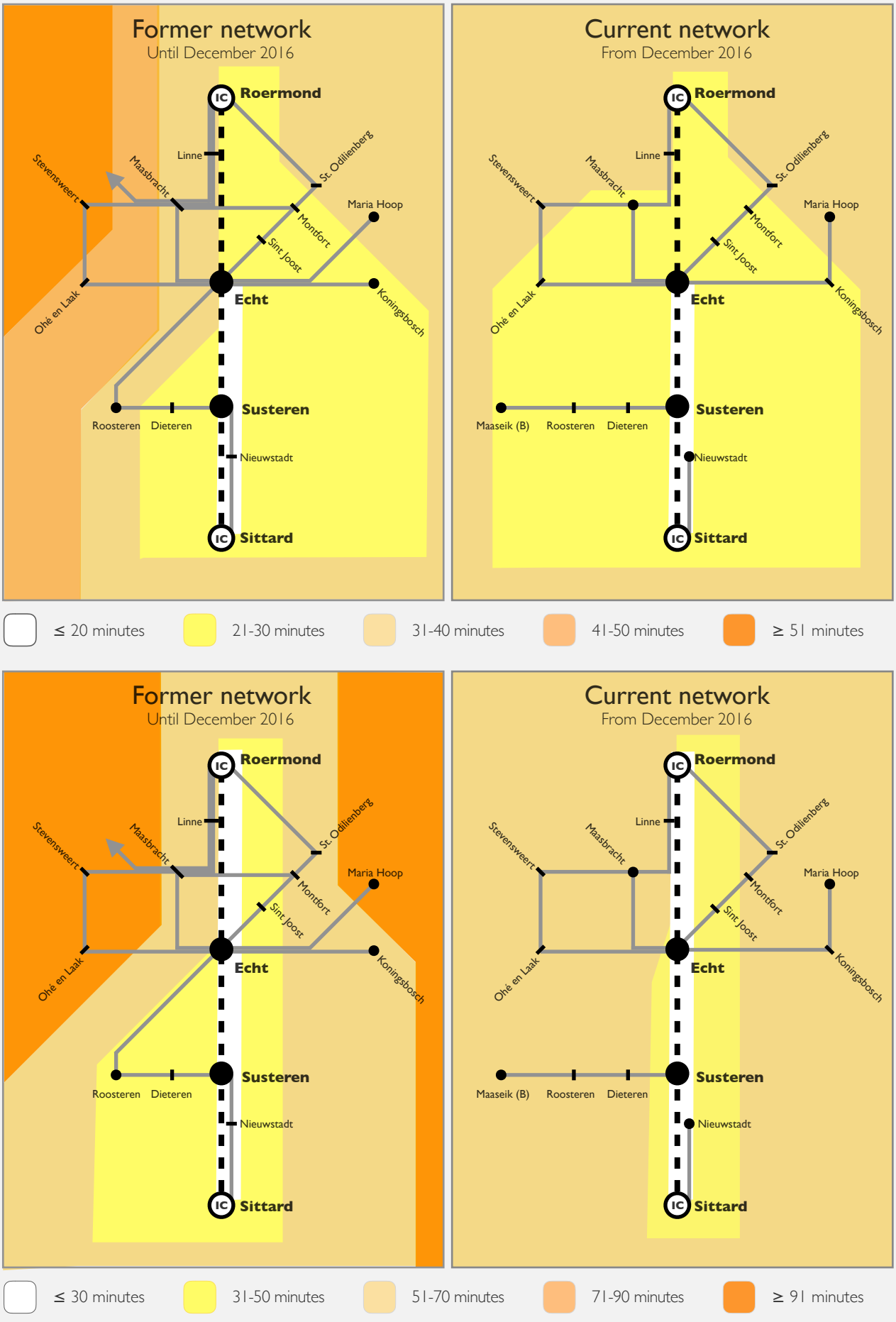
for this OD pair, the TT would be around 10 minutes higher. This also influences the averages, since it again is a relatively busy connection. All in all, the average TT in the Veolia network is probably higher than depicted.

Although average TTs give insight into the functioning of the networks as a whole, they do not provide insight into what happens within the network. For that reason, the top 10 of stops where the WGTT has decreased is mentioned in table 5.6. There are, in fact, two categories to distinguish. First of all, some OD pairs have a relatively small number of passengers but are faced with a tremendous decrease in TT due to the introduction of a new direct line. The second category of OD pairs has a more substantial demand, but a smaller TT change. In this case, the TT change is mainly caused by a decrease of transfer time. This can directly be related to the pulse timetable, which is applied in Echt. Some other cases are in between these two.

Table 5.6 | Top 10 winning towns in the WTT analysis.

From	To	Former TT	Current TT	Pax Arriva	Main reason
Echt, Plats	**Koningsbosch**	61	24	3.4	New direct line
Echt, Kelvinweg	**Linne**	50	23	4.0	New direct line
Sittard	**Laak**	50	26	3.4	Strong decrease transfer time
Maasbracht	**Sittard**	34	32	38.8	Small decrease transfer time
Sittard	**Maasbracht**	33	31	37.4	Small decrease transfer time
Koningsbosch	**Echt, Plats**	69	25	1.6	New direct line
Linne	**Echt, Kelvinweg**	36	21	4.0	New direct line
Sittard	**Stevensweert**	56	32	2.4	Strong decrease transfer time
Sint Joost	**Maasbracht**	57	37	2.7	Strong decrease transfer time
Montfort	**Sittard**	35	30	10.5	Small decrease transfer time

It is shown that the average TT in this feeder network has decreased compared to the former network. Therefore, it is interesting what influence it has on passenger growth. Blumenthal Consulting (2005) developed some simple elasticities about passenger growth based on the introduction of Bahn 2000 in Switzerland. Accordingly, a TT reduction of a certain percentage leads to a passenger growth of the same percentage. In other words, the elasticity is -1. This elasticity, however, is derived for train usage. The study does not say anything about the effect on buses. Nevertheless, it is the best indicator for passenger growth that can be used for now. Therefore, it is applied to the case of this feeder network. As discussed, a TT reduction of about 1.3% on working days has been realised. Consequently, a passengers growth of about 1-2% should be possible on the longer term. However, the generalised and unweighted cases all have a more substantial TT reduction. Consequently, more significant growth is not inconceivable. The Veolia data gives reason to think in a passenger increase of about 5%.



▶ **Figure 5.5** | Schematic isochronic maps of the ungeneralised (above) and generalised (below) TTs including transfer time from Sittard station in the former and current network on a working day.

Another question is which connections have improved. Figure 5.5 gives insight into the travel patterns within the region. It shows the (G)TT from the city of Sittard to the other destinations for objective and perceived TT components. It was an aim to increase the accessibility of the network to the south, where Sittard is located. The different colours show the different categories of TTs. For the generalised TT components, it can be seen that the best accessible places are the stations on the railway line. Most towns laying around the railway line can be reached within 30 minutes. At the east side of the railway line, the places show a comparable TT. However, in the west of the maps, some differences can be observed. The towns Ohé en Laak, Stevensweert, and Maasbracht are better accessible in the current network. That mainly has to do with the pulse timetable that improved the interchanges at Echt. In the new network, all stops are accessible within 40 minutes.

There are some similarities and some differences between the case of objective and perceived TTs. A main similarity is the good accessibility of the places Susteren, Echt, and Roermond. Also, the TT distribution is comparable. Most sites are reachable within 50 passenger minutes, and at the west the accessibility is relatively bad. However, the situation there has become even worse in the NS/Veolia network. Stevensweert, for example, has a TT of 110 passenger minutes. That means, the GTT on that OD pair has a value of 110. That is mainly the result of a transfer of 26 minutes that is penalised. In the feeder network, GTTs of more than 40 minutes do not even occur.

A few conclusions can be drawn, based on the WGTT analysis. First of all, a few advantages of the feeder network and pulse timetable can be mentioned. A remarkable improvement is the enhanced bus-bus and train-bus connections, mainly caused by the pulse timetable. Furthermore, the network has improved by the introduction of some fast new bus lines directly connecting several towns. These two are the main factors leading to a decrease in TT, especially for longer distances in the case. Besides, some additional plusses are found: a new cross-border destination is added (Maaseik, Belgium), during evenings and weekends higher frequencies are offered on the regional railway line, and some bus lines have a higher frequency as well. These aspects do not directly result from the analysis but are clear benefits for passengers. Some drawbacks for passengers can be mentioned as well. The most important is the loss of direct bus connections. For some towns, a significant detour has to be made in the new network. Also, some lines are faced with a frequency reduction.

The benefits and drawbacks can also be assigned to different passenger groups, which is done in table 5.7. This table gives insight into the distribution of the advantages and disadvantages. Passengers who used to travel solely by bus and still do that in the new network benefit from the improved bus-bus connections. The main drawback for them is the disappearance of some bus lines. But since they still travel by bus, the impact of that is probably low. The passenger group travelling via a multimodal trip in the old and new situation is faced with the same effects, but now for train and bus. These two groups together form the vast majority of all passengers in the system. The group where it is all about, the passengers forced to travel multimodal in the feeder network, is only about two percent. The main drawback for them is the addition of new transfers. However, they often can travel faster in the new network.

The feeder network seems to be a success story for most passengers as well as operators(more efficient). Yet, a few remarks have to be made. Changes in travel patterns, namely, cannot be observed in this analysis and might influence the outcome, either positively or negatively. It might, for example, be that passengers who used to get on-board on a local bus and travelled by bus to their destination now go by bike to the nearest train station. Consequently, more passengers drive by train than before, but buses have a lower occupancy rate. However, these kinds of consequences do probably not have a significant effect on the outcomes of the analysis since the in TT changes are small.

Table 5.7 | Indication of the main reasons of TT changes per passenger group. Note that solely train passengers are left out in this analysis.

Arriva / NS / Veolia	**Unimodal**	**Multimodal**
Unimodal	±80% of passengers • Interchanges bus-bus improved • Higher frequencies on some bus lines • More direct bus lines • Direct connections lost • Extra destination added • Train timetable repeats itself all day long	±2% of passengers • Interchanges train-bus improved • Higher frequencies on some bus lines • More direct bus lines • Extra destination added • Train timetable repeats itself all day long • Extra transfers
Multimodal	*Not relevant*	±18% of passengers • Interchanges train-bus improved • Higher frequencies on some bus lines • More direct bus lines • Extra destination added • Train timetable repeats itself all day long

5.3.3 Sensitivity analysis

A sensitivity analysis is executed to test the reliability of the results. The values used in the WGTT analysis are varied to see the effect on the results. More specifically, the betas of in-vehicle time bus, transfer time, and the transfer penalty (betas not equal to 1) are raised and lowered by ten percent. The waiting time at the first stop is not taking into account, because it is constant for all trips. By doing this per input variable, the effect of each of these variables on the output value (average WGTT) can be observed. In the sensitivity analysis, again the OD pairs around the railway line are left out because the mentioned betas do not influence the passenger TT of these passengers. Now, the sensitivities become better visible. The results of the sensitivity analysis are shown in table 5.8. Vertically, the different betas are mentioned with the value used in the analysis. These values are varied by plus and minus ten percent, and the outcome is depicted right of it. The maximum delta between the analysis outcome and the varied value is represented next to it. The analysis is only varied out for working days because the results of Sundays are less valuable due to the non-operated bus lines.

Table 5.8 | Sensitivity analysis for the betas in-vehicle time bus, transfer time, and transfer penalty on working days.

	Resulting WGTT NS / Veolia				**Resulting WGTT Arriva**			
Beta	**-10%**	**Anal.**	**+10%**	**Max Δ**	**-10%**	**Anal.**	**+10%**	**Max Δ**
In-vehicle time bus (*1.28)	37.3	39.2	41.1	5.1%	36.3	38.2	40.2	5.2%
Transfer time (*2.18)	38.8	39.2	39.6	1.0%	37.9	38.2	38.5	0.8%
Transfer penalty (+12.8)	38.9	39.2	39.5	0.7%	37.9	38.2	38.5	0.8%

The results show that the effect of the in-vehicle time bus is highest in both networks and reasonably sensitive. An effect of a little more than 5% indicates that some passengers can take the train for part of the trip, but not everyone. The result is somewhat higher in the Arriva network. That probably has to do with the absence of alternative routes in the network. However, the differences are small. That means that although the bus network now feeds the train, the relative TT by bus in the network has remained almost the same. So, for people who prefer not to travel by bus, this feeder network is not a solution to decrease the number of bus trips. Consequently, a solution for these passengers would be to extend the railway line or add extra stations on it.

Transfer time and transfer penalty, the other factors, are more robust than the in-vehicle time bus. Changing the transfer time or penalty has hardly effect on the outcomes. That is probably caused by the fact that the number of transfers and the transfer time of all trips made is relatively low. The transfer time in the Arriva network is lower compared to the Veolia network, while the effect of the transfer penalty is higher. So, the total transfer time has decreased in the new network, but the number of transfer has increased. That has to do with the increase of multimodal trips.

It can be concluded that all three coefficients are robust because none of these can influence the outcome (WGTT) heavily or the proportions between them. In any case, the WGTT in the Arriva network is lower. On balance, passengers benefit from the new network regarding TT. In case there are a lot of people with reduced mobility, implementing a feeder network might not be the best solution. Especially the increasing number of transfers then is inconvenient.

5.4 Travel costs

The second analysis comprises the calculation of non-reduced trip fares for passengers. A feature of the multimodal concession Limburg is fare integration, which means that in case of a multimodal trip a passenger does not pay the boarding fare twice, but only at the beginning of the trip (when interchanges are done within 35 minutes). The concept is already explained in section 2.3.2. The goal of this section is to get an overview of the benefits and drawbacks for travellers. That is done by a comparison of trip fares in the former and current network. The research method and results of that analysis are described below.

5.4.1 Research method

Passengers travelling by PT can use a lot of different tickets. All these tickets have different terms and conditions, such as validation, class, and allowance of transfers. Additionally, there are seasonal tickets available. The big differences between these tickets make a comparison of old and new tariffs a rather complex activity. For that reason, in this analysis only the full ticket price is taken into account. It indicates the effects of fare integration on passengers, but cannot be used to say something about travellers owning a seasonal ticket, for example. The main advantage of the

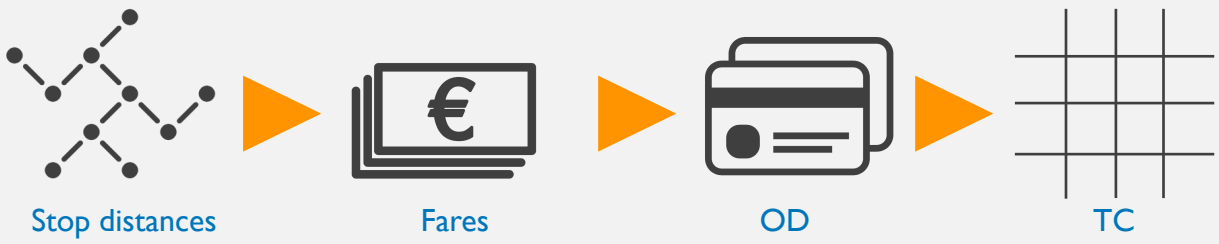


Figure 5.6 | Three steps to calculate the TC.

multimodal concession Limburg is probably the integration of annual tickets for train and bus. However, tickets are more segregated between regional train and IC. Anyway, this analysis mainly is about the effects of fare integration for non-regular travellers paying the full fare.

The method to calculate the full travel costs is comparable to the way the WGTT is calculated (see figure 5.6). It starts, however, with the calculation of the stop distances on all lines. Based on these distances, the trip fares for all OD pairs can be calculated. For comparability reasons, the PT fares of NS and Arriva for the year 2017 are used. Combining the fare matrix with the OD matrix leads to a matrix about the travel costs of the real demand. It is assumed that people optimise their trips on TT, as calculated in the WGTT analysis. That means that in some cases cheaper alternative routes are available. In the Arriva network, that is not such an issue, since there are not so many alternatives. However, in the former network, some passengers can travel unimodal by bus to save on costs. Besides that, the analysis can be made without assumptions, since everything can be expressed in monetary values. That is why no sensitivity analysis is included in the research method.

As mentioned before, the price structures of the different operators are used but based on the price levels in 2017. That means, for example, that the kilometre price for the bus of 2017 is used for both Veolia and Arriva buses. The current PT fare price in Limburg consists of a fixed boarding fare and a kilometre fare. The current NS fare until 8 Kilometres is a fixed fare of € 2.30 for the second class. After 8 kilometres, the kilometre fare is about € 0.10-0.20 per tariff unit, which is, in this situation, comparable to kilometres. The formulae to calculate the trip fare for respectively the current situation (Arriva) and the old situation (Veolia/NS) are depicted below. Table 5.9 provides the exact values for all variables.

$$F_{new} = (EF * T + 1) + (D_{bus} * KF_{bus}) + (D_{train} * KF_{train}) \quad (2)$$

$$F_{old} = EF_{bus} + (D_{bus} * KF_{bus}) + EF_{train} + (D_{train} * KF_{train}) \quad (3)$$

F = Trip fare
T = Number of transfers outside 35 minutes
EF = Entry fee
TT = Total TT in minutes
D = Distance travelled (if >8 in former network)
KF = Kilometre fare

Table 5.9 | Train and bus tariffs under the NS / Veolia and the Arriva regime, based on the price levels in 2017.

	Train		**Bus**	
	NS	**Arriva**	**Veolia**	**Arriva**
Boarding rate	€2.30 (until 8 tariff units)	€0.89	€0.89	€0.89
Kilometre fare	€0.10 or €0.20	€0.186	€0.169	€0.169

5.4.2 Results

Based on all OD pairs, the analysis shows that the trip fares in the NS / Veolia network were between €1.09 and €7.71, compared to a range of €1.09 - €6.80 in the current network. It can be observed that the priciest connections have become cheaper. On average over all OD pairs, the price paid for a trip has decreased by 9.3% (see 'TC' in table 5.10). Also, the average GTC fares are lowered by -5.3% and -3.0%. Since the bus fares are set equal, the primary cause must be either the difference in train fares or the abolition of paying the fixed fare twice in a multimodal trip. Both explanations also elaborated below.

Table 5.10 | Average (generalised) travel costs in the different PT networks.

	NS / Veolia	Arriva	Difference
TC	€3.56	€3.23	-€0.33 -9.3%
GTC Working day	€2.82	€2.67	-€0.15 -5.3%
GTC Sunday	€2.33	€2.26	-€0.07 -3.0%

When taking the OD matrix into account, a remarkable outcome concerning the GTC can be seen: the average fare paid by real passengers has increased. The underlying reason is the differences in train fares by NS and Arriva. The different prices till 25 tariff units are depicted in figure 5.10. There are two differences between the fare structures. The first difference is the relatively high boarding rate charged by NS for passengers travelling only a few kilometres. Next to that, the price

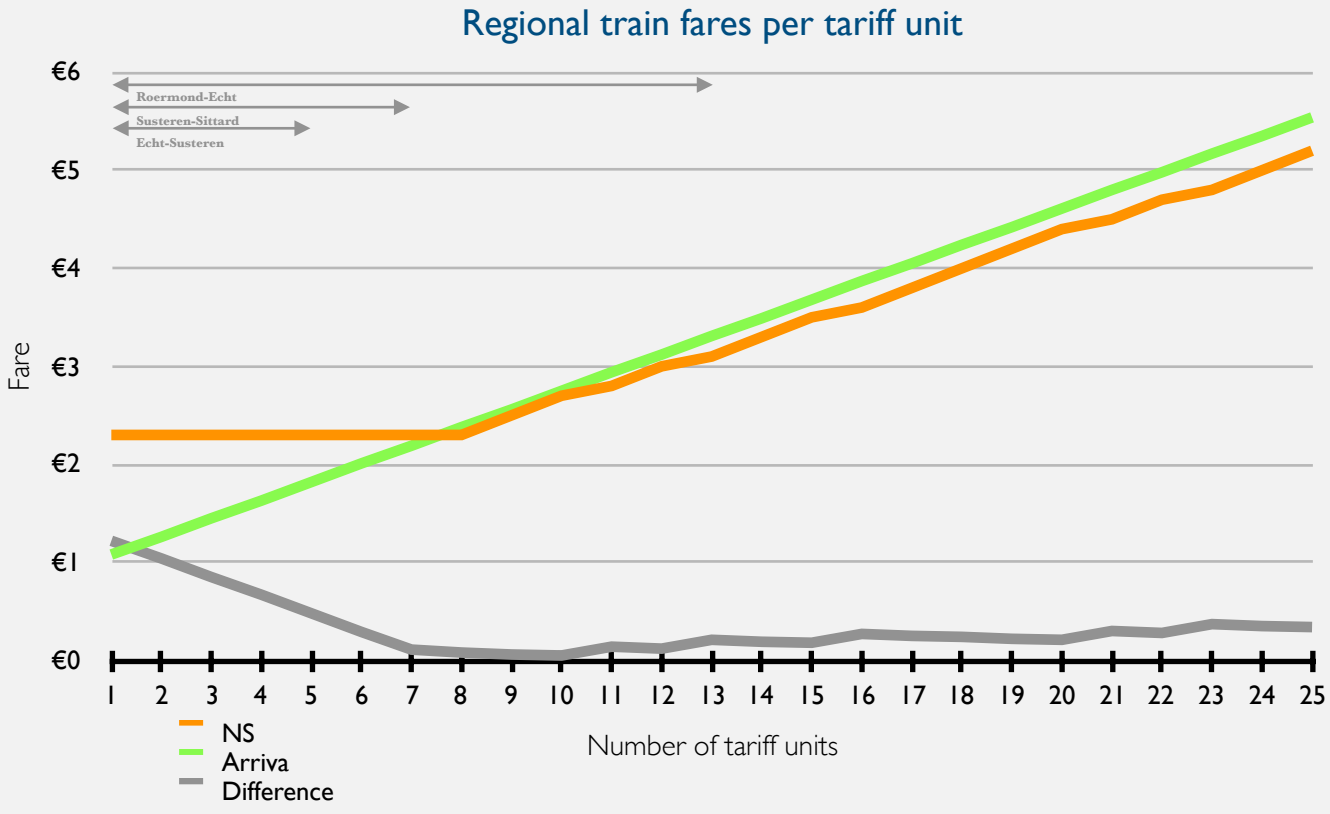


Figure 5.7 | Train fares of NS and Arriva in 2017 per tariff unit and the distances between the relevant stations.

paid after eight tariff units is more degressive than the Arriva tariff. The break-even point is about 8 kilometres, and the main price differences are in very short and long distances. Consequently, passengers only taking the train from Echt to Susteren or Susteren to Sittard benefit from the new fares. However, this group of passengers is tiny compared to the chunking group of travellers on longer distances. The small fare difference is, this way, causing a higher average fare for Arriva passengers. In numbers, the group of passengers only travelling by train on a distance equal to or higher than 7 kilometres is 70% of all passengers within the demarcated area and >99% of all solely train passengers. All these passengers are faced with a fare increase up to €0.37 and even higher when changing to NS trains in Roermond or Sittard. So, just like the WGTT analysis, this group of passengers profoundly influences the outcomes, while it is not the main focus group of the investigation. For that reason, it is disregarded in the results and averages (as well as in table 5.10).

While a lot of passengers are disadvantaged by the new tariffs, others are not. Multimodal travellers benefit from the abolition of the boarding rate when using the train. Also, since some routes have become faster in the new network, they are often shorter as well. This causes a fare decrease. As described before, this is, for example, the case for the direction of Sittard. However, that is compensated by travellers who are forced to travel multimodal now often travel more kilometres and pay a higher price. An example is the fare on the route Stevensweert-Roermond, which has been raised from €2.59 to €4.70. Although the TT is shorter, these passengers do not benefit financially.

To conclude this part, most multimodal passengers are faced with a lower price for their journey. There are, however, some groups of passengers that are confronted with higher travel costs. However, it is difficult to distinguish the effect of the feeder network and fare integration. The fare, namely, often depends on the distance travelled, which is determined by the network. Yet, there is something to say about the effects on different passengers group. An overview is depicted in table 5.11. As can be seen, most traveller groups benefit from the new price structure (represented by a '+'). In some cases that has to do with the change of modality in the new network, that consequently is priced differently. This is mainly an effect of the feeder network, rather than the introduction of fare integration. For example, there is a group of passengers that has changed from bus to train, which is more expensive. For passengers travelling only by bus, there are no differences at all. There are, in fact, two groups of passengers disadvantaged by the new fare structure. The first group is the group that only travels by regional train over a distance longer than 7 kilometres. The train fare for distances longer than 7 kilometres is higher than before. This is a political choice of the PTA. A second group is forced by the new network to travel multimodal and consequently drive more kilometres than before (although it might be faster). The extra kilometres must exceed the abolition of the boarding rate. The trip they now make is cheaper than in the NS / Veolia era, but more expensive than the trip they made before. It is difficult to say something about the price elasticity for these passengers. Kennisinstituut voor Mobiliteitsbeleid (2018) concludes from literature research that a large bandwidth can be expected. The bandwidth is dependent on motive, term, and modality.

Table 5.11 | Indication of the distribution of fare changes per passenger group.

NS / Veolia \ Arriva		**Unimodal**		
		Bus	**Train**	**Multimodal**
Unimodal	**Bus**	+/-	-	Longer - Shorter ++
	Train	+	>7 km - <7 km +	
Multimodal		+		++

5.5 Conclusion

What are the effects of an integrated public transport network on passengers?

The most common form of an integrated PT network is a feeder network in combination with a pulse timetable. These two belong to each other. The case study turns out that synchronising transfers using a pulse timetable can significantly decrease TT for passengers. Since both train-bus transfers as well as bus-bus transfers are improved in this way, most passengers benefit from the new structure concerning TT. Also, the upgrade of frequencies and the introduction of direct bus lines is beneficial for passengers. The main drawback is that some direct bus lines have vanished in the new network. On balance, passengers benefit from this integration, but only a few percents of those passengers changes from a unimodal trip to a multimodal one. A vast majority still travels by train or bus solely.

Also from the perspective of costs, most passengers benefit in the new situation by lower average fares. Fare integration can lead to cheaper fares for multimodal passengers. However, that is mostly dependent on the decisions of the PTA. The group of passengers that has a (much) longer trip regarding kilometres, although it might be faster, is affected negatively. However, that is more attributable to the feeder network than fare integration.

The case researched in this chapter is a typical example of a multimodal concession with internal coordination. It already became clear in Chapter 4 that this type of concession is likely to have a well-functioning integrated PT system. The next chapter again uses a case study to see how a current network can be improved concerning integration and what (external) factors influence that decision positively or negatively.

Chapter 6

Implementation

6. Implementation

6.1 Introduction

As shown by Chapter 5, a feeder network in combination with a pulse timetable can have positive effects for passengers. Though, a lot of PT concessions in the Netherlands are not equipped with such a network. Chapter 4 gives several reasons for that. Amongst others, conflicting interests and poorly organised cooperation between train and bus operators might play a role in those cases. In this final chapter, the focus is on how the lessons learned in this study can be used to achieve a form of integration in a real non-integrated situation and what external factors influence the organisational decision behind that. Also, a generalisation of these factors is made, as a step towards the conclusion. The particular case is the future of the regional trains on the railway lines Groningen-Zwolle and Leeuwarden-Zwolle. These lines are designated for decentralisation in the coalition agreement of the national cabinet (Bureau woordvoering kabinetsformatie, 2017). At the end of this chapter, an answer to the following question is given: *What factors influence the implementation of an integrated public transport system?*

A description of the case that is elaborated in this chapter can be found in section 6.2 After that, the current (bus) network is discussed, and improvements from an integration point of view are proposed. Section 6.4 is about how these network improvements can be achieved in an organisational structure. An assessment of all options is done there. A stakeholder's interest analysis is done in section 6.5. Finally, the sub-question is answered in the conclusion.

6.2 Case description

The central case of this chapter concerns two railway lines, of which the regional services are designated by the Dutch cabinet for decentralisation (Bureau woordvoering kabinetsformatie, 2017). The railway lines are located in the north of the Netherlands and surpass the provinces of Groningen, Fryslân, Drenthe, and Overijssel. Both railway lines are so-called 'state lines'. These state lines were built on behalf of the government in the second half of the 19th century to catch up with the backlog of railway line construction in the Netherlands. Both railway lines are electrified in 1952/1953. Currently, they are the only rail connection from the north to the Randstad area in the west of the Netherlands.

Figure 6.1 depicts a schematic map of the case in question with the underlying bus concessions and their durations. Both

Figure 6.1 | Schematic map of the railway network between Groningen-Zwolle and Leeuwarden-Zwolle and bus concessions (including operators) around it.

railway lines start in Zwolle and go to Meppel. After that, the railway lines to Groningen directs to Hoogeveen, via Assen, to Groningen and the trains with direction Leeuwarden run via Steenwijk and Heerenveen. At the moment, the lines are part of the main rail network concession, which is operated by national railway operator NS. NS runs ICs and regional trains over it. Due to infrastructure constraints at Zwolle, the regional train from Leeuwarden ends at Meppel. The northern railway lines, depicted around Leeuwarden and Groningen, are currently operated by Arriva and also discussed in Chapter 4.

6.3 Network analysis

In Chapter 4, some points of attention concerning network integration in Fryslân and Groningen are mentioned. The case of this chapter is partly located in these provinces but focuses on the interaction between the NS railway lines and the buses. There is no feeder network applied in this case, and therefore it is assumed that some inefficiencies in the network can be identified. This section describes these inefficiencies and focuses on possibilities to introduce a feeder network, which can help to reduce these efficiencies. In this section, the current parallel bus lines are mentioned, possible new stations are described, and a possible timetable is created. Part of this section is an update of Janse de Jonge (2012), who assessed the particular lines on behalf of the minister after the new railway plan proposal of Federatie Mobiliteitsbedrijven Nederland (2011).

Parallel bus lines

An essential and easy-to-recognise indicator for inefficiencies in the network is the existence of parallel bus lines, next to the railway lines. A quick analysis shows a number of these lines within this network. Table 6.1 shows the bus lines that are observed to be (partly) parallel to the mentioned railway lines. They are directly parallel. That means, their primary function is to transport people between two rail-accessible villages and sometimes a few towns in-between. In each bus concession, at least one bus line is mentioned. When looking at all lines, it can be seen that on most parts of the railway lines parallel bus lines are observed. Heerenveen-Meppel and Beilen-Meppel are the only exceptions.

For these bus lines, the number of timetable hours can be estimated. Janse de Jonge (2012) did that already with a timetable hour price of €59.21 and €243,959 operating costs for a bus per year. The outcome is a saving of 8,870 timetable hours or € 3,940,623 per year. However, the assumptions and calculation method are not entirely clear. Besides that, some bus lines have changed in route or frequency. Therefore, a new estimation is done by using the TT and multiply that number by the number of trips per week and year. It is an estimation and not a calculation because the TTs can vary over the day, different timetables can be used over the year, and the number of trips can differ per direction. However, it is an indication for the inefficiencies in the network. A price of €100 per timetable hour can be assumed, of which is about 50% subsidy. Timetable hours during rush hours are more expensive, but this number is realistic throughout the day. It results in a reduction of approximately €3,000,000 per year by cutting out all these lines. Note that not all these lines can just be closed. Often, alternative PT for some towns must be created. Besides, in some cases, extra rolling stock has to be purchased. The total savings will, thus, probably be lower.

Table 6.1 | Overview of parallel bus lines to the railway lines Groningen-Zwolle and Leeuwarden-Zwolle and estimated timetable hours per week.

Concession	Line number	Origin	Destination	Extra served towns	Frequency working day [veh/h]	Timetable hours two directions [h]
Noord- en Zuidwest-Fryslân	**28**	Leeuwarden	Heerenveen	Wirdum	2	199.5
	95	Leeuwarden	Akkrum	Wirdum Wytgaard Reduzum	1	122.1
Zuidoost-Fryslân	**17**	Heerenveen	Wolvega		1	58.5
Groningen-Drenthe	**22**	Assen	Beilen	Hooghalen	1	100.53
	309	Assen *M.L. Kingweg*	Groningen		4/2	368.33
Midden-Overijssel	**40**	Zwolle	Meppel	Rouveen Staphorst	2	269.5
		Meppel	Steenwijk	Nijeveen	-	32
				Total timetable hours per week		1,150.46

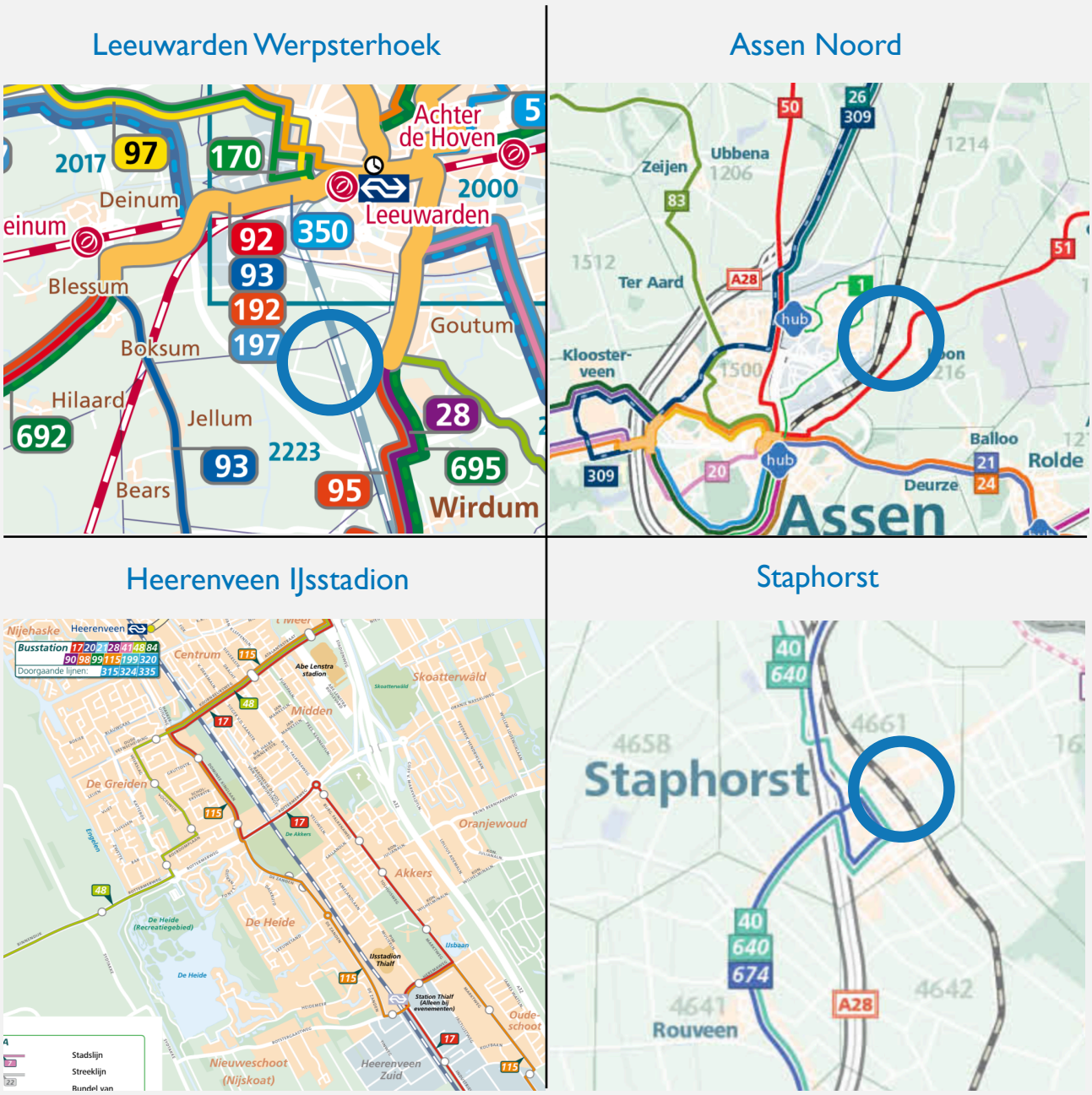
Serving all towns is often part of the mobility standards of a concession. Consequently, a solution for the centres served by bus only has to be found. Introduction of new stations on the railway lines to serve these villages is one of the possibilities. A railway station is often more attractive than a regional bus. On the particular railway lines, a few new stations are eligible to be realised. When these stations serve as pulse stations, some other network changes are possible as well. There are, for example, a lot of bus lines between Groningen-Assen and Groningen-Emmen. By introduction of pulse stations, probably some of these lines can be shortened and feed the regional trains there.

New stations

Pulse stations are an essential part of a feeder network. They serve as points of interchange for passengers. Currently, the number of stations on the particular railway lines is relatively small. That mostly has to do with, in Dutch terms, the sparsely populated areas the lines pass. Four stations are proposed in this study. Some PT maps of the locations are depicted in figure 6.2. The network opportunities of these stations are mentioned hereafter.

A new station that is already planned is called Werpsterhoek. It is located in Leeuwarden and will be located in the south of Leeuwarden and serve the inhabitants in the new district that is built there currently. Besides that, it could serve as a P+R station. The current agreement states that the station will be established when a determined number of houses and other buildings is completed. It can be questioned whether this station is relevant for a feeder network, but it is a planned expansion and therefore relevant when talking about the future of the railway lines around Leeuwarden.

Heerenveen IJsstation is an already existing railway station, south of the Heerenveen station and next to the ice skate stadion. It was opened in 1975, but due to the small number of boarding and alighting passengers already reduced to an event station two years later. At the moment, the station is not served at all, not even during events. According to current operator NS, the (financial) drawbacks of placing check-in and check-out poles and extra personnel do not weigh against the



▶ **Figure 6.2** | Four possible new stations on the railway lines Groningen-Zwolle and Leeuwarden-Zwolle (Arriva, 2017a; Qbuzz, 2017a)

revenues from additional passengers (Leeuwarder Courant, 2017). However, the station has the potential to serve a large part of the south of Heerenveen by train, when bus lines are adapted to that situation. The bus line serving this part of the city currently, 17, can be diminished or minimised on this part of the route. A fixed frequency of two trains per hour will also improve the service in this part of the city.

A third possible new station is Assen-Noord. In the northern part of Assen, there is already a bus node called M.L. Kingweg. In the map, it is depicted with the sign 'hub'. Four bus lines serve this stop, which functions as a shortcut for the northern part of Assen to Groningen. The bus stop is, however, not linked to a train station, while it is not that far away from the existing railway line. When a new station Assen-Noord is opened at this location, the service for passengers can be improved. There is no need for a bus line from Assen to Groningen because passengers can get onto

the train. This means that bus line 309, mentioned above, can be reduced to a city line from the west of the city to Assen-Noord.

Until 1935, the village of Staphorst - in-between Zwolle and Meppel - had its own station. Staphorst is a village with about 8,700 inhabitants and is located next to the railway line. For many years, a new station is a wish of the municipality. Currently, bus line 40 serves the town in combination with the villages of Rouveen and Nijeveen, close by. A new station can be located within the built-up area in Staphorst. Then, the whole bus line can probably be eliminated, while passengers are served even better than the situation right now. The only disadvantage is the widely-ranging built-up area of the villages.

Timetable

New stations cannot directly be added to the existing schedule. All endpoints on the particular lines, Zwolle, Leeuwarden, and Groningen, have a node function for the whole region. In Zwolle, for example, a vast majority of trains arrive and depart within a timespan of 10 minutes, two times per hour. Adding extra stations on one railway lines would disturb the connections. Another point is the bottleneck Meppel-Zwolle, which all trains from either Leeuwarden or Groningen have to pass. An extra station, such as Staphorst, has to fit between the other trains. Federatie Mobiliteitsbedrijven Nederland (2011) indicates that Dutch Infrastructure Manager ProRail has approved the proposed timetable with extra stations. According to them, only some minor investments (switches and tracks) are needed.

Two main efficiencies are often implemented by regional operators when they take over train services. These improvements speed up the arrival and departure procedure at stations. By the way, these interventions are not reserved for regional operators. First of all, regional operators often introduce new and faster accelerating rolling stock. An example is the FLIRT3, a train that is commonly used in the Netherlands for regional train services. Currently, NS mainly uses ICM3 trains on the particular railway lines. This rolling stock is actually meant for IC services and not as fast as a regional train. Table 6.2 compares both trains to each other. Using the formulas $a = P/mv$ and $t = v/a$, the mass and power can be used to calculate the theoretical acceleration to 100 kph. As can be seen, the FLIRT is somewhat small in terms of capacity, but tin acceleration superior. The time savings made by these faster accelerating trains can be used to serve the new stations.

Table 6.2 | Comparison of an ICM3 of NS and a FLIRT3 of Arriva.

Train type	**ICM3**	**FLIRT3**
Operator	NS	Arriva (Limburg)
Length [m]	80.6	63.2
Number of seats	2nd class: 163 1st class: 35 Other: 30 Total: 228	2nd class: 139 1st class: 12 Other: 19 Total: 170
Mass [t]	144	94
Power [kW]	1248	Limited from 3000 to 2250
Theoretical acceleration time to 100 kph [s]	89	32

However, only faster rolling stock is not enough. Dwell time of trains at stations is also be reduced by regional operators. Currently, NS uses a minimum dwell time at stations of 42 seconds. This can be reduced by 12 seconds when one-man operation is introduced. The driver, then, operates the doors. Infrastructure Manager ProRail allows operators to use their own norms, such as for dwell time (ProRail, 2017). Arriva uses a norm of 30 seconds for a stop, which thus can save 12 seconds. Using FLIRT3 or other fast accelerating rolling stock in combination with shorter dwell times at stations can save a few minutes to serve Leeuwarden Werpsterhoek, Assen Noord, Heerenveen IJsstadion, and Staphorst.

Pulse points

When pulse points are introduced, it is necessary that opposite trains meet each other within a few minutes at the station. That allows creating interchanges to and from each line. An estimation about the current passage times at the proposed stations is done and depicted in table 6.3. Leeuwarden Werpsterhoek is, as can be seen, not suitable as a pulse station. There is almost a 15-minute interval between the arrival of both directions of the regional train Meppel-Leeuwarden. Contrary, Heerenveen IJsstadion seems to be more eligible for this concept. Namely, the trains of both direction approximately arrive within a timespan of two minutes at the station. On the other railway lines, Groningen-Zwolle, the station of Assen Noord also has an arrival pattern where opposite trains meet each other almost at the station. Finally, Staphorst is already somewhat less suitable timing with a timespan of 7 minutes between the opposite trains. In the future, trains towards Leeuwarden may also stop here when the line is extended to Zwolle.

Table 6.3 | Estimation of passage times at the proposed stations in the current timetable.

	Groningen-Zwolle	**Zwolle-Groningen**	**Leeuwarden-Meppel**	**Meppel-Leeuwarden**
Leeuwarden Werpsterhoek	-	-	:22 / :52	:07 / :37
Heerenveen IJsstadion	-	-	:12 / :42	:14 / :44
Assen Noord	:10 / :40 (rush hour :24 / :54)	:15 / :45 (rush hour :10 / :40)	-	-
Staphorst	:29 / :59	:06 / :36	-	-

In the current timetable, feeding the stations of Leeuwarden Werpsterhoek and Staphorst will become difficult when looking at pulse points. However, these are also stations hardly having parallel bus lines. Also, one-sided transfers can be offered. In the case of Staphorst, it might be possible to vanish bus line 40 as a whole. The functions of these line in the city of Zwolle can be taken over by city lines. In the case of Leeuwarden Werpsterhoek, there is not any bus line yet.

Heerenveen IJsstadion has, as described already, the potential to serve the southern part of Heerenveen. Only bus lines 17 and 115 serve the station and the rest of Heerenveen-south. Bus line 17 is mainly parallel to the railway line from Heerenveen to Wolvega. When opening the railway station, the line can probably be removed. For the stops within Heerenveen, research is needed to see whether or not a new bus line is desirable for this part of Heerenveen. Bus line 115 serves a part of Heerenveen and other villages nearby and then continues to Assen. It is therefore not parallel or serving the same market and can remain. A decision has to be made concerning transfers: the bus can only connect to trains at either Heerenveen IJsstadion or Heerenveen.

At Assen Noord, another pulse stations can be created. Bus line 309 can at least be shortened to this station. A regular city line could replace it. When a good connection is established, the TT for passengers on this line will reduce or at least remain the same. Both the bus line and the railway line currently have a frequency of 4x/h during rush hours, which can be aligned with each other. Some other bus lines potentially can be connected to the station as well, but that depends on the travel patterns on the particular lines. More research is needed to get insight into those travel patterns and solutions.

6.4 Coordination analysis

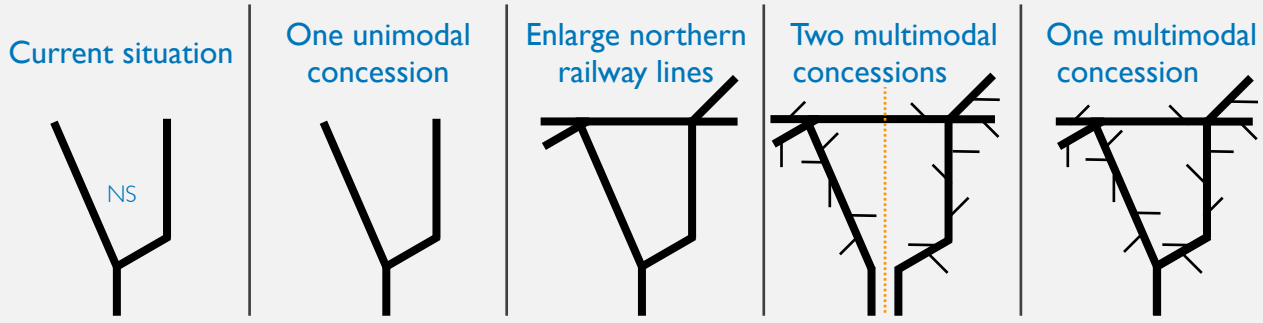
While from a network and passengers' perspective it is clear that improvements on the topic of train-bus integration are possible, the question remains which form of coordination is possible and suitable for this case. Both railway lines are longer than 100 kilometres and surpass four bus concession areas in total. A multimodal concession would have to a huge concession area. The bus concession Groningen-Drenthe is already a substantial concession. The question is whether the benefits of a larger concession outweigh the financial risks and reduced competition. Therefore, different options for the organisation around the railway lines are evaluated. Firstly, the possibilities are described. Next, the pros and cons are being mapped to determine a preferred alternative finally.

Alternatives

A few organisational directions are possible and visualised in figure 6.3. The null scenario or current situation is the organisational form in which NS keeps running both the IC and regional train services. In this situation, the railway lines are not decentralised at all. The bus concessions can remain the same as well. That is also the case when the particular railway lines are decentralised and tendered to a regional operator in one new unimodal rail concession. Before the procurement procedure can start, an authorised PTA has to be set up. This is probably a cooperation of the different provinces. Adorning an entirely new PTA is not necessary for the third option, where the current northern railway lines are extended with the two regional trains to Zwolle. In the plan requirements for the new northern rail concession, a specific condition is dedicated to the expansion of services. It is stated that the concessionaire needs to fully cooperate with the clients' desired changes, such as expanding train services and new stations (Provincie Fryslân et al., 2017). Also in this case, no organisational change concerning the bus concessions is needed. Finally, a multimodal concession can be tendered. It can be either split up into two concessions around both railway lines or an integrated concession. Both cases require cooperation of governments to act as one PTA.

Pros and cons

To best be able to compare the alternatives, from all options the pros and cons from an integration perspective are schematically depicted in table 6.4. Since train-bus integration is the main topic of



▶ **Figure 6.3** | Visualisation of five ways to tender the railway lines Groningen-Zwolle and Leeuwarden-Zwolle.

this study, the five aspects of operational integration are added as criteria. Next to that, some general viability indicators are used to see whether an alternative is feasible at all. The resulting analysis, thus, mainly focuses on integration. Others aspects are relevant in the decision as well, but not treated here. An example is IC-regional train integration. In most alternatives, different operators will operate trains next to each other, which requires coordination in that field. However, there already is experience with that in Limburg and also in other countries, such as Great Britain.

All the alternatives have been set against the current situation. For that reason, zeros are depicted for the null scenario. In the other cases, plusses depict an expected improvement of the situation on that topic, while minuses tell the opposite. In some cases, also plus/minus signs are added. This represents either an (expected) unchanged situation or the situation depends on the choices of the PTA. In the remainder of this part, the pros and cons are explained per alternative.

Table 6.4 | Overview of the expected pros and cons of the five alternatives.

	Alternative	Current situation	One unimodal train concession	Enlarge concession northern railways	Two multimodal concessions	One multimodal concession
	Concession type train	Main rail network (net-cost unimodal)	Net-cost unimodal	Net-cost unimodal	Net-cost multimodal	Net-cost multimodal
	Concession type bus	Gross/net-cost unimodal	Gross/net-cost unimodal	Gross/net-cost unimodal		
Viability	**Number of PTAs**	0	-	+/-	+	++
	Cooperation between governments	0	-	-	+/-	--
	Financial size	0	++	+	+/-	--
	Concession duration*	0	++	+	-	--
	Number of operators	0	-	+	+	++
Integration	**Network layout**	0	+/-	+/-	++	++
	Timetable	0	+	+	+	+
	Information	0	+/-	+/-	+	++
	Fares & tickets	0	+/-	+/-	+	++
	Vehicle management	0	+/-	+/-	+	+

* To what extent (relevant) current concessions expire at the same time.

As the current situation is not desirable from an integration point of view, the simplest solution is to create a separate concession for the two railway lines. A regional PTA, then, becomes responsible for the operations on the railway lines. The first question, then, is what PTA can do this. At the moment, there is no regional PTA that has the legal authority to tender this large concession, because it is situated within four provinces. Consequently, probably a joint organisation of the different provinces must be established for this task. It is also possible to use the same construction as applied for the northern railway lines: a cooperation of different provinces. Thereafter, when a legal body is authorised, a form of contractual coordination must be applied to arrange train-bus integration. Otherwise, the situation as it is right now will probably not change. The PTA can, for example, forbid to operate parallel bus lines or reward plans that stimulate integration. The success of train-bus integration largely depends on the PTA in this organisation. Another point of attention is the possibility that the number of operators increases compared to the current situation, which complicates the situation.

At the moment, Arriva is already contracted for the concession northern railway lines 2020-2035, between and around Leeuwarden and Groningen. It is possible to integrate the railway lines Groningen-Zwolle and Leeuwarden-Zwolle in that concession. In that case, one or two provinces have to be added as a PTA. There is no need to set up a whole new organisation. The provinces of Drenthe and Overijssel can relatively simple join. The bus concessions may remain the same, but when nothing is changed in the coordination, a feeder network will probably not become a reality. The physical boundaries do not need to change, but the PTA must take a stronger role in the PT planning process in the form of contractual coordination, just like the alternative before. A possible weakness of different PTAs responsible for train and bus must be prevented. Again, the PTA can influence the success of the train-bus integration. The fact that the same operator will operate the northern lines and the new railway lines can make integration between them more manageable. Also, through-connections can be initiated by the operator. A complicating factor for that is the combination of the electrical new lines and northern diesel lines. There are, though, different solutions for that.

Another option is to split up the two railway lines and to tender them separately. Both concessions, then, can include buses in either Groningen-Drenthe or Fryslân. From an organisational perspective, the OV-bureau and the province of Fryslân can act as PTA for one of the multimodal concessions. The question here is where which concession contains the railway line Leeuwarden-Groningen. A drawback is the possible existence of three operators on the track Meppel-Zwolle. Train-bus integration seems not to be an issue in this concession, but two remarks must be made. Firstly, before the concessions start, all current concession must be expired before this concession begins. Especially for the northern railway lines, that is going to be an issue since the new contract is recently awarded until 2035. Besides that, integration between the two concessions remains a point of attention. Passenger flows in the three northern provinces are crossing each other and integration, especially fare integration, between the two concessions is therefore desirable. Around the railway line Leeuwarden-Groningen, specific arrangements must be made for the train-bus integration there.

The most comprehensive alternative introduces a sizeable multimodal concession in the provinces of Groningen, Drenthe, and Fryslân. In this multimodal concession, the advantages as observed in Limburg can be applied. A full feeder network and a pulse timetable can be used to improve the pressed network. This construction solves the coordination issues between the multimodal concession in the alternative mentioned before. Another advantage of this concession over alternative four is the fact that only one operator runs regional trains between Meppel and Zwolle. Although this idea seems interesting, some downsides confirm that this alternative is not feasible. A cooperation of the provinces of Groningen, Fryslân, Drenthe, and Overijssel must act as PTA. This probably requires too much cooperation. Secondly, the financial risks an operator has to take are

way too enormous for most potential operators. Finally, the introduction of such a multimodal concession will become tough, since all current concessions have to be merged into one.

Assessment

As already stated in the beginning of this report, integration cannot be achieved anywhere in a PT system. One operator, then, must operate all modalities, which is simply too large and complex for both (cooperating) PTA(s) and operator. Hence, a trade-off has to be made between viability and train-bus integration in the different alternatives. In the current situation, there seems not so much to gain anymore in terms of train-bus integration. NS focuses, logically, on their core business, of which these lines are only a corner in the network. The regional PTA has no say about the operations and will probably not invest in the railway lines, since revenues will not flow back into the region. Both PTAs and operators, then, have no interest to operate a feeder network. Fare and information integration are virtually unachievable. Therefore, the other options are worth to be weighed.

Chapter 4 ends with the conclusion that operational integration can probably best be achieved by either a multimodal concession or a PTA that highly influences tactical planning. In fact, that is the choice here as well. As becomes clear from table 6.4, the role of the PTA concerning integration during the concession is very important in alternative two and three, while alternative four and five are characterised by a (more) complicated start-up period and responsibility for integration at the operator. However, the two extreme alternatives (two and five) score worse on viability indicators then their neighbours, but virtually the same on integration aspects. Alternative two hardly offers benefits compared to the current situation, while alternative five is too ambitious in terms of size. For that reason, alternative three and four seem to be a better choice.

A consideration between alternative three and four is tough, because the choice mainly depends on the decisive factors. Obvious benefits of a large northern railway concession are relatively easy implementation, possible on-going trains (over the stations of Leeuwarden and Groningen), and no increase in the number of operators. On the other side, the concession traverse four bus concessions, train-bus integration heavily depends on the PTA, and four provinces need to cooperate as PTA. Two multimodal concessions have the advantage of probably well-organised train-bus integration by the operator, it mostly fits in current PTA organisations (Fryslân and OV-bureau), and the number of operators is limited to a maximum of three. However, the concessions will become large, implementation is difficult since a lot of current concessions must be merged, and arranging integration at the concession borders is an issue.

At the moment, alternative three is much more viable than four. Two current concessions (regional train and bus Groningen-Drenthe) are recently tendered again, which heavily blocks the organisational possibilities for ten to fifteen years. Only when those concessions have ended, it is possible to create a multimodal concession. Until that time, having weighed all the arguments, it seems to be best to at the two railway lines to the northern railway concession. This is a short-term feasible solutions, since a clausule has been included that extra railway lines can be added to the concession. PTAs can start to invest in new stations and maybe some infrastructure. The establishment of a feeder network and pulse timetable is dependent on the PTA. This new role for the PTA requires more guidance in the contract and more involvement for the PTA during the concession. In Groningen-Drenthe, that can be relatively easy established by the OV-bureau. In Fryslân, it will become possible at the start of the new bus concession in 2022. In that concession, points can be handed out for train-bus connections or no points can be awarded for parallel bus lines. Also the integration of tariffs, regional tickets and information provision require a greater interference from the PTA. On a longer term, a multimodal concession belongs to the possibilities again.

6.5 Stakeholder's opinions

In 2011, the Federatie Mobiliteitsbedrijven Nederland presented the 'new railway plan', in which it was proposed to tender, among others, the aforementioned regional railway services in a multimodal concession. Janse de Jonge (2012) assessed the proposed plans on behalf of the minister. He advised the minister a pragmatic approach with trial and error. More specifically, his advice for Groningen-Zwolle was positive and for Leeuwarden-Zwolle negative, because of the synergy benefits in the first case. In fact, this advice is most closely related to alternative four as described before. Some other lines were recommended to decentralise as well. The minister followed the advice and the first regional train services that were decentralised were located in Limburg. Also, the line Zwolle-Enschede was tendered. Based on the performance and evaluation of those concessions, new lines could be added in the future. Currently, the lines Groningen-Zwolle and Leeuwarden-Zwolle are under investigation.

The reactions of the different stakeholders after the announcement of the minister to follow up the advice gives an indication of the interests on this topic (NRC, 2012; NOS, 2012). Railway operator NS, back then concessionaire of all the particular lines, was against decentralisation. Arguments NS uses are a lack of passenger benefits and the fact that decentralisation costs money. Other arguments mentioned by NS are tariff differentiation and poorer train-train connections. Some political parties agreed on that (NRC, 2012). Labour union FNV also shared that opinion and adds the argument of a general decreased accessibility when the lines are decentralised (NOS, 2012). Most arguments do not perfectly match the proposed plans, which indicates the underlying interests of the stakeholders. For NS, probably financial interest play an important role. FNV is afraid of deteriorated working conditions.

Also some conservative responses from the provinces are also noticed. NOS (2012) says there is resistance against decentralisation at some provinces. An argument they mention is the bad timing of the plans (NRC, 2012). Changes on the track take a lot of time and all train and bus concessions have just been awarded for ten or fifteen years. Although this is a valid argument on itself, there seems to be little courage to look at (major) improvements in the PT system. That might have to do with limited public attention of the problem, appears from informal personal communication. Apparently, the current PT systems are not perceived as insufficient by passengers. Also, the expected complicated organisational structures might tame the enthusiasm. It seems that these factors are external negative factors for implementation.

6.6 Conclusion

What factors influence the implementation of an integrated public transport system?

Although two coordination forms show to be most suitable to improve train-bus integration in general, a lot of other factors play a role in the determination of a suitable coordination system in the case of the railway lines Groningen-Zwolle and Leeuwarden-Zwolle. An updated network analysis shows that savings of about €3,000,000 can be obtained, mainly by scratching parallel bus lines. Four new stations are promising. One-man operation and faster rolling stock can be used to be able to serve these stations without a lot of extra TT. Since the current coordination mechanisms seems not capable of establishing these efficiencies, five alternatives (ranging from current situation to one multimodal concession) are defined to find the most capable coordination system for this case when looking at integration. Two alternatives appear to be best capable to achieve train-bus integration and meet the viability conditions. Enlarging the northern rail concession and introducing two multimodal concessions around both railway lines are both possible. The latter is most suitable for train-bus integration, but requires a long lead-time and effort from the PTAs. Besides, is only possible after a decade, because new concessions have been awarded recently.

Enlarging the current northern rail concession is easier to implement and on the moment the most viable solution. However, integration is largely dependent on the efforts of the PTAs.

When weighing the alternatives, a lot of external factors are important. Current interests play an important role, especially those of operators of directly awarded contracts and labour unions. Operators are financially driven and labour unions represent the employees. These interests are, therefore, predictable to a certain extent. As mentioned already, the duration and size of on-going concessions can also block some of the alternatives. Furthermore, the public attention is limited. The current situation is often seen as 'normal' and the discussion about integration mainly takes place behind the scenes. Finally, complex organisational structures can keep off PTAs from implementation.

Chapter 7

Conclusions, Recommendations & Discussion

7. Conclusions, Recommendations & Discussion

7.1 Conclusions

What are the pros and cons of contracting out regional multimodal public transport concessions for travellers, authorities, and operators instead of regional unimodal concessions?

A PT concession is the right to operate PT in a demarcated area and is usually obtained by an operator after winning a procurement procedure. Often, different concessions for separate modalities exist next to each other in the same district, but also an integrated or multimodal concession is possible. In a multimodal concession, both train and bus (and possibly other modalities) are tendered once. In theory, multimodal concessions would lead to better (operational) integration, because competition between train and bus operators has disappeared and internal coordination can be used. For passengers, an integrated PT system would mean a good aligned (feeder) network of train and bus, resulting in improved connections at pulse stations and lower TTs. Besides that, information would be tuned to each other, fares and tickets would be fully integrated, and vehicle management would be organised thoroughly. In that line of reasoning, it is assumed that operators benefit from a multimodal concession by having opportunities to operate more efficiently. PTAs would benefit from the incentives for the operator in the contract to perform well, which simplifies the coordination task.

Our study shows that a multimodal concession indeed can lead to a better integrated PT system, to a large extent. From these analyses, a SWOT analysis is made to give a clear overview of all positive and negative factors of a multimodal concession, both internally and externally. All three stakeholders are present in the factors, but often not mentioned separately. The SWOT analysis is depicted in figure 7.1. Several analyses have provided the insights. The internal factors are mainly based on a qualitative (interview) case comparison (referred to as 'case studies') in the provinces of Limburg (multimodal), Fryslân (unimodal, same operator), and Groningen (unimodal, different operators) and a quantitative network analysis (referred to as 'network analysis') of the PT network in Roermond-Sittard (located in Limburg). The synthesis chapter ('implementation'), in which these two main analyses are combined for the case of the railway lines Leeuwarden-Zwolle and Groningen-Zwolle, has provided insight in the external factors. Hereafter, all the factors are described separately.

Table 7.1 | Average passenger TT in minutes for the different PT networks around Roermond-Sittard on working days.

	Objective TT			Perceived TT		
	NS / Veolia	Arriva	Δ	NS / Veolia	Arriva	Δ
All OD pairs	36.8	34.1	-2.7 -7.3%	74.0	66.9	-4.1 -9.6%
Actual demand	23.7	23.4	-0.3 -1.3%	39.2	38.2	-1.0 -2.6%

Strengths

Several benefits of multimodal concessions and internal coordination are obtained, compared to a situation with unimodal concessions and partnership or contractual coordination.

- **Feeder network**: the network analysis shows that average passenger TT can decrease when a feeder network and pulse timetable are introduced. As can be seen in table 7.1, dependent on the

use of smartcard data (actual demand) and TT coefficients (perceived TT) a reduction of up to -9.6% passenger TT can be obtained. In the particular case, the effect of the improved connections was higher than the introduction of the feeder network itself. For the operator, a feeder network is often more efficient to operate.

- **Integrated network and timetable design**: better connections can be achieved, because the operator can design the network and timetable simultaneously. Changes in the network can directly be translated in a timetable, as done in Limburg.
- **Integrated tickets and fares**: integrated fares and to some extent integrated tickets are a benefit of multimodal concessions for passengers as well. On average, passengers pay a lower fare in the case in the network analysis. Especially multimodal travellers pay less, because the boarding rate is not to be paid twice anymore. An exception to this is the category of passengers that changed from a direct bus line to a multimodal trip that is much longer. This group is faced with a higher fare in the new situation. From the interviews, it became clear that a feeder network and fare integration are dependent on each other and have a joint added value.
- **One source of information**: information to passengers can be integrated, which means that passengers can consult among others timetables and maps for train and bus at one location. Also, a regional branding can be developed. In the case studies, this is only fully achieved in the multimodal concession.
- **A clear point of contact for almost all PT**: virtually all PT related activities are the responsibility of one operator, which is transparent for both passengers and PTAs.
- **Operator has control over and oversees the whole PT chain**: smartcard data availability of and the control over both train and bus creates more solution space for the operator. For example, in the case of Limburg a station that did not fit in the train timetable is now served by bus.
- **Financial compensation train-bus:** the operator can use the train revenues to operate a relatively extensive bus network, which would not be possible in a separate bus concession.

Weaknesses

Although the number of strengths is relatively large, a multimodal concession is not the solution to all coordination problems. Coordination issues between stakeholders will always remain since borders will evermore persist. Besides that, some aspects of multimodal concessions are not a solution to all passengers.

- **Feeder network causes more interchanges:** when buses feed the trains, additional transfers are needed for formerly bus passengers to reach their destination. The direct bus connections to cities are lost in that case.
- **Feeder network not always suitable**: in both Fryslân and Groningen, it is mentioned that the main cities in the region are polycentric and therefore ask for more connections going directly into the city, instead of only trains to the main station(s). Other reasons why feeder networks are not always suitable, mentioned in the interviews, are unsuitable geographical structures and overcrowded trains.
- **High investment risks / less potential operators**: a multimodal concession requires substantial investments that cannot be done by all operators. Ultimately, that might lead to decreased competition in the PT sector. In the implementation chapter, it became clear that concerning the network the whole region would preferably be tendered once. However, that would ask a too large investment for the operator.
- **More coordination between ICs and regional trains needed**: the accommodation of regional trains at a new operator requires increased coordination between the two train operators and their authorities. In Limburg, arrangements between the two train operators are made to offer an integrated system to passengers.

Opportunities

In current society, there are opportunities to implement a multimodal concession. Some of the opportunities are demands for attention in the current (negative) situation. Others are focused on positive consequences of implementation of a multimodal concession.

- **Political attention**: politics is essential for the introduction of a multimodal concession. Politicians must be aware of the inefficiencies in some networks and must be shown best practice (multimodal concessions) in other regions.
- **Pressurised PT budgets**: in case ridership in rural areas decreases, PT budgets must be heightened. A feeder network and pulse timetable can help to reduce the expenses of PTAs.
- **Directly competing train and bus operators**: when a bus network is obviously designed to pick-up train passengers instead of feeding, the attention of policymakers can be awakened to change plans. This also happened in Limburg, where the former contract even stimulated competition between train and bus.
- **Subsidiarity**: PTAs can get more influence on the railway lines in their area (subsidiarity: coordination of railway lines can be dealt with on a lower administrative and political level). Multimodal concessions allow regional governments to manage their full regional PT networks. A related advantage is that money used for improvements on the railway lines flows back into the region by the regional revenues.
- **Several potential areas in the Netherlands**: there are a lot of potential regions suitable for introducing a multimodal concession and feeder network in the Netherlands.

Threats

Although the benefits and opportunities of an integrated system seem to outweigh the drawbacks in most cases, there are not so many examples of multimodal concessions available, at least in the Netherlands. That is because of the threats.

- **Complex organisational structures**: sometimes complex current or required organisational structures hold the introduction of a multimodal concession and integration in general. A typical example is the case of Groningen, where two different PTAs tendering either train or bus seems to have a different (financial) interest.
- **Limited public attention**: the current situation is often not seen as a(n) (urgent) problem that must be solved. Instead, it is often seen as the normal situation, which embarrasses the look for solutions.
- **Current interests**: a lot of extra stakeholders and interests play a role in regional PT, especially when a railway line is decentralised. Operators of directly awarded contracts and labour unions can be seen as the most prominent opponents, as shown by the reaction on the new railway plan.
- **Duration on-going concessions**: the duration and size of current concessions make it difficult to directly switch to a multimodal concession because they must be aligned with each other. In the implementation case, this is one of the most significant factors that hold the introduction of a multimodal concession.
- **Operator change on the track takes time**: developments on the track, such as operator changes, take some years before implementation. Political decision-making, CT, and lead-time are important reasons for that.
- **Cumbersome process infrastructural changes**: in case infrastructure must be prepared for higher frequencies, which is often the case when a railway serves as a backbone of the feeder network, infrastructural changes must be done. These processes are time-consuming and complicated.

Vehicle management is the fifth aspect of operational integration. Though this aspect seems to be difficult to arrange in all kinds of concessions, the case studies show. The primary cause is the current procedure, in which TC train and bus communicate about delays on a too voluntary basis and in a too complicated way. In all cases, this aspect is on the agenda.

Wrapping up, an integrated PT system as described before is in most cases desirable for all stakeholders. A multimodal concession is not the only option to reach integration. Two organisational structures seem to be the most suitable. The case studies show that partnership coordination can be non-committal for operators and therefore is not always effective. A situation in which the PTA has the development function and push for integration by contractual coordination, then, is the only alternative for a multimodal concession. Such a situation often occurs in a unimodal gross-cost contract and is comparable to a 'verkehrsverbund'. In the Netherlands, this form is not found in practice. It creates a lot of responsibilities for the PTA that are currently part of the operator functions. A fundamental discussion about operator and governmental tasks in PT can be held. Operators might be better capable to adjust operations on market demands. Anyway, implementation in the Netherlands seems to be complicated at the moment. More research is needed to get better insight into the trade-off between these two coordination systems.

Figure 7.1 | SWOT analysis of a multimodal concession

	Positive	Negative
Internal	**Strengths** • Feeder network (shorter TTs and better interchanges) • Integrated network and timetable design • Integrated tickets and fares • One source of information • A clear point of contact for almost all PT • Operator has control and oversees the whole PT chain • Financial compensation train-bus	**Weaknesses** • Feeder network causes more interchanges • Feeder network not always suitable • High investment risks / less potential operators • More coordination between ICs and regional trains needed
External	**Opportunities** • Political attention • Pressurised PT budgets • Directly competing train and bus operators • Subsidiarity • Several potential areas in the Netherlands	**Threats** • Complex organisational structures • Limited public attention • Current interest (e.g. operators of directly awarded contracts and labour unions) • Duration on-going concessions • Operator change on the track takes much time • Cumbersome process infrastructural changes

7.2 Recommendations

The effect of multimodal concessions on integration has been researched in this study. However, specific topics can be explored even better, or current situations can be changed to achieve more integration. Therefore, some recommendations are mentioned hereafter.

Research

A topic that directly at the beginning of the report is left aside is physical integration. Well-designed interchanges are vital for the reduction of transfer resistance. Physical integration can help to reduce that. Extra research in a western European context is desirable for that reason. Another research recommendation, more in line with this study, is the topic of the Verkehrsverbund. This study suggests that this is a promising coordination form. There already is some literature about that, but a new study could focus on the implementation of that model in a Dutch context and a comparison with multimodal concessions. A special focus on the functioning of a PTA as tactical planner is recommended. Thirdly, on the topic of quantitatively determining the pros and cons of a feeder network, a more thorough analysis is desirable. More cases could be analysed, preferably with before and after data, to strengthen the results. Next, the impact of multimodal concessions on personnel management and vehicle management in terms of rolling stock planning can be elaborated more. Sometimes, employees are allowed to work as both train and bus driver. For planning, these aspects can facilitate the planning during holidays. A new study could focus on these aspects. Finally, in a lot of multimodal concessions two railway operators operate next to each other on the same track. One operates the ICs and the next one the regional trains. New research can look at the interaction between the operators and the effects on passenger service, especially in case of disruption.

Policy

From a policy point of view, also a set of recommendations is drawn up. Foremost, and logically resulting from the conclusions, is the recommendation to work on integration. Operational integration has proved to be an improvement of the PT system. It is therefore necessary to reflect on the current coordination systems used from an integration point of view. That can be done by focussing on the inefficiencies in the current systems and also by looking at successful integrated concessions. In the Netherlands, Limburg can be taken as an example. On a longer term, the coordination form or division of tasks can be changed. Also, decentralisation of railway lines can be considered as a step towards a multimodal concession or better regional train-bus alignment. Before that time, parallel bus lines can be prohibited by the PTA. On a shorter term there are often possibilities as well. Applying some form of partnership coordination can be used relatively easy, next to another coordination mechanism. Some expressions of integration are in the interest of all stakeholders and can therefore be achieved in current coordination systems. Especially real-time alignment of vehicles at transfer points (vehicle management) is an example of this.

Another policy recommendation concerns smartcard data availability. It was mentioned by several respondents that the fear to share data among operators and PTAs makes it difficult to oversee the whole PT chain in case of unimodal concessions. In fact, the current situation withholds operators to think beyond one modality. This problem is solved in a multimodal concession, because one operator has all data, but it is recommended to let PTAs demand data open to all operators and governments in unimodal concessions as well. In the plan requirements for new concessions, it can simply be added. This data can be the start of a conversation between PTA, train operator, and bus operator to see smart solutions. Interests can still play a role, but then exchange of ideas is possible to improve the PT system.

Finally, the province of Fryslân is recommended to add some demands about integration in the new bus concession starting in 2022. As a multimodal concession is not feasible at the moment, a stronger position of the province is desirable to reach a higher level of network and fare integration.

In the awarding procedure, the province could give points to plan concerning train-bus integration or not assign points to parallel bus lines. On the topic of fare integration, requirements about fares for transferring passengers can be added. A too soft approach will probably not lead to better integration on these topics.

7.3 Discussion

To end this study, some discussing remarks are made. The three main research methods of this thesis, case studies, interviews, and data analysis all have their strengths, but also shortcomings. A combination of methods is used to diminish the limitations. However, it remains of importance to know the restrictions to be able to better interpret the value of the results. Below, the different research methods are discussed separately. After that, some content-based discussion points are added.

Methodological

Case studies are a suitable method to see the practice of a certain topic. Though, each case study comes with context-specific factors. For example, the population density in Fryslân is different from Limburg. That has quite some consequences on the network implemented. Sometimes, other choices can be made in a denser populated area. Also, the concurrence on the railway lines affect the network. Because the contexts are different, comparison requires accurate study. It is tried to capture these effects in the generalisation at the end of Chapter 4, but it remains possible that factors are overseen. Another limitation of case studies is the selection of cases, which can determine the outcomes to a certain extent. However, the selection of cases in this study was mainly driven by scarcity. In the Netherlands, only one case with a gross-cost contract was available. Also the multimodal concessions were limited. The case of Limburg was the biggest concession, operated by Arriva, most recently changed, and therefore most suitable. However, secondary sources mainly confirmed the validity of the outcomes for the other concessions.

Conducting interviews was used to get better insight in what is going on in the cases. This method, however, also has its flaws that must be mentioned. Again, selectivity is a point of attention. More specifically, who is interviewed and what questions are asked have large influence on the outcome. Therefore, more than one interviewees are asked and they also from the perspective of both operator and PTA. Most of the times the answers of the different respondents match, especially concerning the facts. Opinions sometimes differed and that makes the conduction of several interviews valuable. In particular in the case of Groningen, the four interviews give a broad perspective on the actual situation. Also, the role of the interviewer is important. The interviewer bias can result in directed answers. A fixed interview guide is used to avoid this. However, specific topics the interviewees come up with are valuable as well. So, here a trade-off between the two aspects is made. Also, written documents are used to merge the two sources of information.

Data analysis is a general research method, in this research applied in the form of network analysis using smartcard data. This smartcard data represented the OD and was based on an average of working days or sundays in one month. The particular month was November, in which demand usually is higher than in the spring or summer. It can be questioned whether this influences the outcomes. However, the TT reduction was realised in both situations, for all OD pairs and using smartcard data. This indicates a limited effect on the outcomes in other periods of time.

Subject matter

Besides methodological points of discussion, other subject matter points can be mentioned as well. A first point concerns the relatively slow roll out of multimodal concessions in the Netherlands. Most policy makers have heard of the (theoretical) advantages of multimodal concessions. Already in the 90s, the first experiences with a multimodal concession were done in the concession 'Achterhoek'. Still, the network has undergone some minor changes only. That stability seems to be an indicator of the success. A lot of people spoken agreed on the success of that concession, but are holding back when it comes to organisational changes in their region. Repeatedly, inhibitions for the implementation are mentioned. It seems that little initiative is shown at the government side to really make progress on this topic. This might have to do with (lobbying of) other stakeholders. Next to all formal threats, it is also important to have supporters and go-getters at the province to arrange organisational change.

Next, it is noticed that multimodal concessions usually are larger, because railway lines usually cannot be demarcated into small concessions. However, it seems that smaller concessions also have their pros. Informal interaction between train and bus drivers can, for example, positively influence vehicle management. Once was mentioned that in the concession Achterhoek train drivers proactively call the TC bus when they are delayed. From an economic point of view, there is no interest of train drivers to do that. That probably has to do with the fact that the concession is relatively small and staff knows each other. It depends on the particular region, but it is maybe on of the strengths of the Achterhoek as well.

Furthermore, a mentioned disadvantage of feeder networks and pulse timetables is the relatively long dwell time at transfer points. In fact, this is considered as loose time. However, this time can be used for driver breaks. In the future some a new benefit can be obtained: opportunity charging of buses. In time e-buses become available for regional bus operation, this seems to perfectly fits in the timetable.

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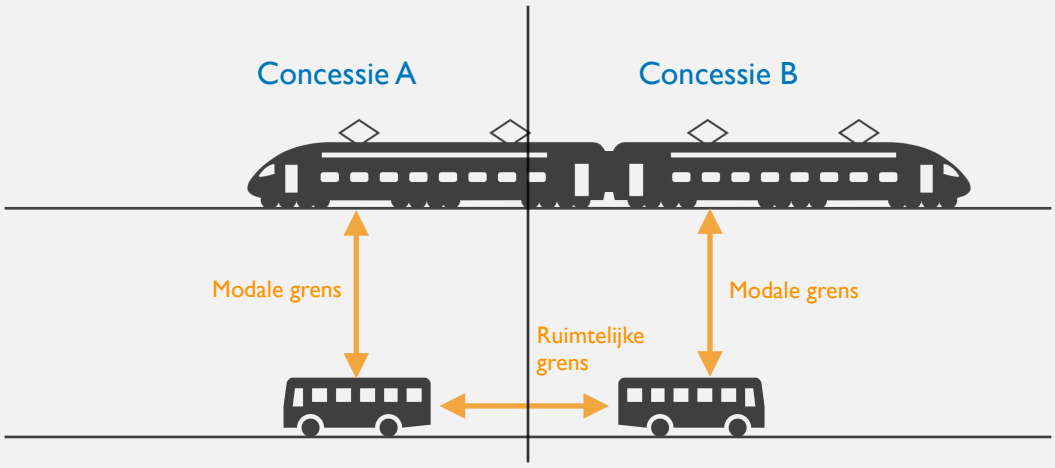
A. Managementsamenvatting

In heel Europa is het aanbesteden van openbaar vervoer (ov) gereguleerd sinds 2000. De Wet personenvervoer 2000 organiseerde in Nederland de reorganisatie van het Nederlandse regionale ov. (Wet Personenenvervoer 2000, 2001). Hoewel het aanbesteden van concessies op de meeste plaatsen heeft geleid tot meer klantgerichtheid en efficiëntere exploitatie (Beck, 2011; Mouwen & Rietveld, 2013), zijn ook enkele externaliteiten opgemerkt. De drang naar defragmentatie veroorzaakte namelijk (meer) ongewenste grenzen bij de randen van de concessies, zowel ruimtelijk als tussen verschillende modaliteiten (zie figuur S.1). Dergelijke grenzen uiten zich bijvoorbeeld in tariefverschillen en slechte aansluitingen. Er zullen altijd grenzen zijn in een ov-systeem waar verschillende vervoerders zijn, maar sommige kunnen wel worden weggenomen en andere beperkt. Een vaak voorgestelde oplossing om te modale grenzen te doen verdwijnen is het aanbesteden van multimodale concessies. In een dergelijke concessie verwerft de vervoerder het recht om openbaar vervoer in een gebied uit te voeren met zowel stoptreinen als bussen. In theorie zouden daardoor de grenzen tussen die modaliteiten moeten worden weggenomen en zou een geïntegreerd ov-systeem voor passagiers ontstaan. Voor vervoerders is efficiëntere exploitatie mogelijk, omdat er geen concurrentie meer bestaat tussen trein en bus. Een ov-autoriteit heeft slechts met één vervoerder meer te doen, wat vaak eenvoudiger is dan in de huidige situatie. Enkele verwachte nadelen van multimodale concessies kunnen echter ook worden genoemd. Multimodale concessies zijn bijvoorbeeld vaak groter en alleen grotere vervoerders zijn in staat daarop in te schrijven. In theorie lijken multimodale concessies potentie te hebben, maar de exacte voor- en nadelen zijn nog onduidelijk. Daarom is de hoofdvraag van dit onderzoek: *Wat zijn de voor- en nadelen van het aanbesteden van regionale multimodale openbaarvervoerconcessies voor reizigers, autoriteiten en vervoerders in plaats van regionale unimodale concessies?* Daarbij ligt de nadruk op regionale treinen en bussen als modaliteiten in een niet-stedelijke context.



Figuur S.1 | Visualisatie van ruimtelijke (horizontale) en modale (verticale) grenzen in ov-concessies.

Literatuur

Het doel van het invoeren van een multimodale concessie is het creëren van een geïntegreerd ov-systeem. Een multimodale concessie is echter maar één van de manieren om dat te bereiken. In de literatuur zijn enkele studies gewijd aan de betekenis en operationalisering van het concept (intermodale) integratie. Volgens Saliara (2014) ervaren passagiers door intermodale integratie het ov-systeem als één geheel en de aangeboden diensten als 'naadloos' met een minimaal aantal onderbrekingen in de reis, ongeacht het aantal vervoersmiddelen of vervoerders. Zoals weergegeven in tabel S.1 kan intermodale integratie worden onderverdeeld in drie niveaus: organisatorische,

operationele en fysieke integratie (Saliara, 2014). Een volledig geïntegreerd systeem is geïntegreerd op al die drie niveaus. Organisatorische integratie is een vereiste voor de andere twee niveaus en gaat over het maken van afspraken tussen belanghebbenden, ov-autoriteiten en vervoerder(s). De daadwerkelijke uitvoering van een geïntegreerd systeem hoort bij operationele integratie. Onderdeel van operationele integratie is een geïntegreerd netwerk (visgraatmodel), een pulsdienstregeling, geïntegreerde informatievoorziening, geïntegreerde tarieven en kaarten en geïntegreerd voertuigbeheer. Op fysiek niveau moeten voorzieningen goed zijn ontworpen om geïntegreerde diensten te kunnen aanbieden. Dit aspect valt echter buiten de reikwijdte van dit onderzoek. In de rest van dit onderzoek ligt de focus op verschillende manier om een multimodal netwerk te coördineren om operationele integratie te bereiken en de voordelen van een visgraatnwerk voor reizigers. Deze kennis is gecombineerd en toegepast op een actuele casus bij 'implementatie'.

Tabel S.1 | Drie niveau van integratie in het ov, aangepast van Saliara (2014).

Organisationele integratie	Operationele integratie	Fysieke integratie
Het bestaan van een of meerdere onafhankelijke autoriteiten De ov-autoriteit heeft de verantwoordelijkheid om ov in een bepaald gebied te reguleren	**Netwerkindeling** Visgraatmodel waarbij bussen zijn aangetakt op de spoorlijn	**Bereikbaarheid van faciliteiten** Alle gebruikers kunnen faciliteiten makkelijk bereiken
Afspraken tussen vervoerders Vervoerders overleggen onderling	**Dienstregeling** Pulsdienstregeling met overstappunten voor stoptreinen en bussen	**Locatie van faciliteiten** Overstappunten op geschikte plekken in het netwerk
	Informatie Alle ov-gerelateerde informatie is beschikbaar op één plek	**Stationsontwerp** Geen fysieke barrières om over te stappen
	Tarieven & kaarten Tarieven en kaarten zijn geldig in alle voertuigen in het systeem	**Controle van voertuigbewegingen** Geen conflicten tussen voetganger en voertuigbewegingen
	Voertuigbeheer Overstappen worden gegarandeerd bij vertraging	

Coördinatie

De interactie tussen ov-autoriteit, vervoerder en passagiers bepaalt de manier waarop ov wordt aangeboden en gebruikt. Voor het ov-aanbod is vooral de interactie tussen autoriteit en vervoerder van belang. Er zijn verschillende manieren mogelijk waarop dat kan worden georganiseerd. Strategische planning is meestal de verantwoordelijkheid van de ov-autoriteit of van een politieke raad. Op het laagste (operationele) niveau is het de verantwoordelijkheid van de vervoerder om te zorgen voor kaartverkoop, informatie, personeel en voertuigbeheer. De verschillen zitten met name op tactisch niveau: netwerkindeling, dienstregeling, tarief- en kaartbepaling en voertuigtype. De manier waarop dit is georganiseerd heeft een grote invloed op de manier waarop integratie wordt bereikt. Gebruikmakend van de drie concepten van economische organisatie, namelijk markt, hiërarchie en netwerk (Powell, 1990), zijn drie mogelijke manieren voor het coördineren van een multimodaal netwerk gedefinieerd.

- **Contractuele coördinatie**: coördinatie wordt bereikt door een contract dat expliciet vermeldt wat de vervoerder moet doen, ook op het gebied van integratie. Dit type coördinatie kan worden gebruikt in unimodale concessies waarbij de ov-autoriteit opbrengstverantwoordelijk is. De autoriteit heeft een ontwikkelingsfunctie en kan integratie van de vervoerders eisen.

- **Informele coördinatie**: overleg is het sleutelwoord voor de deze vorm van coördinatie. Wanneer de vervoerder opbrengstverantwoordelijk is, heeft een autoriteit niet de absolute macht om integratie af te dwingen. De manier om toch integratie te bereiken is het opzetten van samenwerkingsverbanden tussen de autoriteit en vervoerder(s). Integratie wordt bereikt door informeel contact.
- **Interne coördinatie**: wanneer één vervoerder verantwoordelijk is voor verschillende modaliteiten, kan integratie intern binnen de vervoerder worden bereikt. Er is hierbij geen rol voor de autoriteit. Dit kan alleen worden gedaan in een multimodale concessie waarbij de vervoerder opbrengstverantwoordelijk is.

Om te testen in hoeverre de drie coördinatievormen in de praktijk functioneren op het gebied van integratie is gebruikgemaakt van een casusonderzoek. Er zijn drie Nederlandse gebieden geselecteerd waar een andere vorm van coördinatie wordt gebruikt. In alle gevallen zijn de regionale treinen aanbesteed. Interviews zijn gehouden om een duidelijk overzicht te krijgen van wat er gaande is. Aan de geïnterviewden is gevraagd hoe netwerk, dienstregeling, informatie, kaarten/ tarieven en voertuigbeheer op elkaar zijn afgestemd. Ook zijn de bestekken van de verschillende concessies geraadpleegd voor de formele interactie. Merk op dat kaarten (ov-chipkaart) en informatie (reisinformatie-apps) in Nederland al in hoge mate op nationaal niveau zijn geïntegreerd.

- **Groningen** (contractuele coördinatie): de provincie Groningen is een casus die wordt gekenmerkt door een afzonderlijk nettokostencontract voor trein en een brutokostencontract voor bus. De provincie zelf is de ov-autoriteit voor de spoorconcessie. Het beheer van de busconcessie is gedelegeerd aan het OV-bureau, die speciaal voor dit doel is opgericht. Het OV-bureau heeft een geïntegreerde busconcessie aanbesteed voor twee provincies (Groningen en Drenthe). Hoewel het OV-bureau formeel gezien deel uitmaakt van de provincie Groningen, blijken er soms belangenconflicten te zijn rond het thema integratie. Het belang van het OV-bureau om zoveel mogelijk passagiers te vervoeren is niet altijd verenigbaar met samenwerking op het gebied van trein-busintegratie. Concreet vertaalt zich dit in een netwerk dat op sommige plaatsen is geïntegreerd (waarschijnlijk als daar financieel belang bij is) en tarieven, informatie en voertuigbeheer die nauwelijks zijn geïntegreerd. Het gemeenschappelijk belang op het gebied van dienstregelingsintegratie zorgt wel voor vruchtbare samenwerking.
- **Fryslân** (informele coördinatie): kenmerk van de tweede casus is twee unimodale concessies voor regionale treinen en bussen, maar dezelfde vervoerder. De ov-autoriteit, de provincie Fryslân, coördineert beide nettokostencontracten. Dat leidt ertoe dat de vervoerder zich vooral richt op wat in beide contracten afzonderlijk wordt geëist. Integratie is daar geen kernpunt in. Twee aparte afdelingen binnen de vervoerder concentreren zich op hun eigen deel in de ov-keten en slechts enkele integratiepunten krijgen aandacht. Dienstregelingen zijn op elkaar afgestemd, informatie deels, maar netwerk, tarieven en voertuigbeheer nauwelijks.
- **Limburg** (interne coördinatie): in de provincie Limburg is een volledige multimodale concessie aanbesteed. De vervoerder exploiteert zowel regionale treinen als bussen onder een nettokostencontract van de provincie. Netwerk en dienstregeling worden gelijktijdig ontworpen voor trein en bus. Ook informatie en tarieven zijn geïntegreerd. Geïntegreerd voertuigbeheer is echter niet geregeld.

In de interviews zijn verschillende oorzaken genoemd voor niet-geïntegreerde aspecten in de casussen. Volgens de geïnterviewden wordt in sommige gevallen het visgraatmodel niet toegepast vanwege ongeschikte geografische structuren, grote passagiersstromen naar een belangrijke bestemming waar kortsluiten de voorkeur heeft of overvolle treinen. De mate waarin tarieven worden geïntegreerd, is afhankelijk van bestaande businesscases en afspraken (moeilijk te veranderen in het geval van derving voor de vervoerder), een gebrek aan verwachte meerwaarde voor passagiers (afhankelijk van de afstand) en onzekerheid rond een mogelijke vervoerderswissel aan het einde van de concessie. Een belangrijke bevinding is het feit dat een geïntegreerd netwerk en tariefstructuur meestal afhankelijk zijn van elkaar. Belangrijk voor informatie-integratie is een

gedeelde visie op marketing bij de trein- en busvervoerder. Voertuigbeheer is in alle gevallen nauwelijks op elkaar afgestemd. Dat heeft vooral te maken met een te ingewikkelde procedure waarbij de verkeersleiding trein de verkeersleiding bus proactief moet bellen. Dit is echter een onderwerp dat waarschijnlijk binnenkort wel aandacht krijgt.

(Financiële) belangen blijken een grote rol te spelen bij het streven naar integratie. Conflicterende belangen tussen ov-autoriteiten (Groningen) en de druk bij vervoerders om aanbestedingen te winnen (sterke focus op aparte contracten, Fryslân) houden operationele integratie tegen. Daarom lijkt het erop dat slechts twee organisatiestructuren echt geschikt zijn voor integratie. In een multimodale concessie is er een stimulans voor de vervoeder zelf om integratie te regelen. De vervoerder kan de volledige ov-keten controleren, heeft alle mogelijke data en zal daarom het systeem integreren. De andere optie is een Verkehrsverbund-model. Hierin heeft de ov-autoriteit de integratiefunctie. Door brutokostencontracten aan te besteden zijn de vervoerders hier vooral uitvoerend bezig.

Netwerkanalyse

Naast de aanbodzijde wordt ook de vraagzijde beïnvloed door de introductie van een geïntegreerd ov-systeem. Er wordt vaak aangenomen dat een visgraatnetwerk, pulsdienstregeling en tariefintegratie gunstig zijn voor passagiers. In een casusonderzoek (een deel van Limburg) is deze hypothese getest. Beide netwerken (voor en na) zijn met behulp van ov-chipkaartdata en dienstregelingen met elkaar vergeleken. De huidige ov-chipkaartdata is zowel toegepast op het voormalige als het huidige netwerk, wat de vergelijking eenvoudiger maakt, maar geen rekening houdt met veranderingen in reispatronen. Specifieke reistijdaspecten (voortransport, tijd in het voertuig, overstaptijd en overstapweerstand) zijn verzwaard om de waardering van verschillende reiscomponenten door passagiers te modelleren. De specifieke casus is Roermond-Sittard, waar tot een paar jaar geleden een verschillende trein- en busvervoerder actief waren. Momenteel loopt er een multimodale concessie. Het netwerk is veranderd in een visgraatnetwerk met een pulsdienstregeling en geïntegreerde tarieven. Uit de analyse volgt dat de gemiddelde reistijden, niet en wel gegeneraliseerd, zijn gedaald met een bereik van -0,3% tot -12,2% (zie tabel S.2). Dit is het geval voor zowel het gemiddelde van alle HB-verbindingen als daadwerkelijke vraag (op basis van ov-chipkaartdata). Het aantal multimodale passagiers is echter klein. De verbeterde overstappen trein-bus en bus-bus meer invloed op deze uitkomsten dan het netwerk zelf. Het grootste nadeel van dit netwerk is het verdwijnen van enkele directe buslijnen. Deze reizigers worden het meest benadeeld door het nieuwe netwerk. Er worden echter ook enkele nieuwe directe lijnen aangeboden.

▶ **Tabel S.2** | Gemiddelde passagiersreistijden in minuten voor de verschillende ov-netwerk op werkdagen.

	Objectieve reistijd			**Ervaren reistijd**		
	NS / Veolia	**Arriva**	**Verschil**	**NS / Veolia**	**Arriva**	**Verschil**
Alle HB-verbindingen	36.8	34.1	-2.7 -7.3%	74.0	66.9	-4.1 -9.6%
Daadwerkelijke vraag	23.7	23.4	-0.3 -1.3%	39.2	38.2	-1.0 -2.6%

Door middel van de geïntegreerde (slechts één keer instaptarief betalen) en niet-geïntegreerde tarieven is ook een financiële vergelijking gemaakt voor reizigers die het volle tarief betalen. Zoals

verwacht betalen passagiers gemiddeld minder dan voorheen. Er zijn echter twee uitzonderingen. Ten eerste is de nieuwe tariefstructuur voor treinen goedkoper voor ritten <7 kilometer, maar duurder daarboven. Dit is een politieke keuze van de ov-autoriteit, maar kan de prijs voor treinreizigers negatief beïnvloeden. Daarnaast moeten sommige passagiers overstappen van een unimodale naar een multimodale reis. Hoewel de reisduur mogelijk korter is, reizen sommigen van hen een langere afstand en betalen ze daardoor meer. Dit is echter een zeer beperkte groep reizigers. Er kan worden geconcludeerd dat de meeste passagiers beter af zijn in de nieuwe situatie, zowel qua reistijd als qua prijs. Dat is opvallend, want een multimodale concessie is ook efficiënter voor een vervoerder.

Implementatie

Veel sterke en zwakke punten van multimodale concessies zelf zijn al genoemd. Om inzicht te krijgen in de externe factoren die een rol spelen bij de implementatie, is een geschikte casus uit het huidige politieke debat gekozen voor nader onderzoek. De regionale treindiensten Leeuwarden-Meppel (-Zwolle) en Groningen-Zwolle zijn aangewezen voor decentralisatie door het Nederlandse kabinet (Bureau woordvoering kabinetsformatie, 2017). Al in 2011 heeft Federatie Mobiliteitsbedrijven Nederland een plan voorgesteld om deze spoorlijnen toe te voegen aan een multimodale concessie. Dit plan is beoordeeld door Janse de Jonge (2012), inclusief een aantal netwerkverbeteringen. Een update van dit document toont aan dat op het huidige busnetwerk een besparing van € 3.000.000 per jaar kan worden behaald, voornamelijk door enkele parallelle buslijnen te schrappen. Het openen van vier nieuwe stations kan helpen om de benadeelde reizigers te bedienen en kan ook nieuwe passagiers in het ov krijgen.

Vervolgens is de vraag hoe betere integratie kan worden bereikt vanuit het perspectief van coördinatie. Er zijn vijf alternatieven voorgesteld en beoordeeld, variërend van geen enkele organisatorische verandering tot een volledige multimodale concessie in drie provincies (Groningen, Fryslân en Drenthe). De mening en argumenten van alle relevante belanghebbenden op het nieuwe spoorplan van FMN zijn bestudeerd om meer inzicht te krijgen in de externe factoren en om een betere beoordeling van de alternatieven te maken. Het lijkt erop dat bestaande belangen bij vervoerders van onderhands gegunde concessies en vakbonden een belangrijke rol spelen. Andere gevonden factoren zijn beperkte publieke aandacht, looptijd en grootte van huidige concessiegrenzen en ingewikkelde coördinatiesystemen. Na het afwegen van alle argumenten lijken de meest veelbelovende alternatieven tussen de twee uitersten in te liggen. Ten eerste kunnen twee multimodale concessies rondom beide spoorlijnen worden ingevoerd. Het tweede alternatief is het toevoegen van de spoorlijnen aan de huidige regionale treinconcessie in het noorden. De busconcessies blijven dan hetzelfde, maar meer focus op integratie is nodig. De eerste optie zal vrijwel zeker leiden tot een beter geïntegreerd systeem, maar vereist behoorlijk wat organisatorische inspanning en is alleen haalbaar als de huidige concessies zijn afgelopen. Het tweede alternatief lijkt haalbaar op dit moment, maar vereist veel aandacht van de ov-autoriteit tijdens de concessies. De ov-autoriteit moet meer leiding nemen over de integratiethema's. Vanuit integratieoogpunt lijkt een uitgebreide noordelijke spoorconcessie op dit moment het beste coördinatiesysteem.

Conclusie

Er is geconcludeerd dat een geïntegreerd ov-systeem per saldo veel voordelen biedt voor passagiers, zoals een beter netwerk, tarieven en duidelijke informatievoorziening. Dit kan worden geregeld in een multimodale concessie. Een gunstig aspect van een multimodale concessie voor de vervoerder is de mogelijkheid om de hele ov-keten te controleren en in staat zijn om financieel te compenseren tussen trein en bus. De baten voor de ov-autoriteit is iets minder duidelijk, maar een eenvoudigere manier van coördinatie en financiële voordelen zijn belangrijke aspecten. Enkele nadelen kunnen ook worden genoemd, zoals meer overstappen, verlies van directe buslijnen en gevallen waarin het visgraatmodel niet geschikt is. Ook ontstaat er een coördinatievraagstuk tussen intercity's en stoptreinen. Meestal wegen de voordelen voor de meeste passagiers echter zwaarder dan de nadelen. Dat betekent echter

niet dat overal multimodale concessies moeten worden ingevoerd. Een organisatie waarin de ov-autoriteit leidender is, kan ook helpen om een geïntegreerd netwerk op te zetten. Soms komt implementatie niet van de grond. Dat kan te maken hebben met de huidige belangen, een gebrek aan publieke aandacht, huidige concessies en mogelijke implementatieproblemen. Alle aspecten zijn samengevat in een SWOT-analyse, zoals afgebeeld in figuur S.2.

De beleidsaanbevelingen hebben betrekking op de focus op integratie. Zowel multimodale concessies als een 'Verkehrsverbund'-achtig model lijken integratie te kunnen verbeteren, echter vraagt dat een betwistbare positie voor de ov-autoriteit. Niet in alle gevallen is het mogelijk om direct een van deze coördinatiesystemen in te voeren, maar op korte termijn kunnen ook verbeteringen worden aangebracht wanneer ze in het gezamenlijk belang zijn. De tweede beleidsaanbeveling betreft de beschikbaarheid van (ov-chipkaart)data, die eigenlijk aan alle belanghebbenden zou moet worden verstrekt. Dat kan een beter overzicht geven van wat er gaande is en hoe integratie kan worden bereikt. Een specifieke aanbeveling voor de provincie Fryslân gaat meer focus op integratie in de nieuwe busconcessie die in 2022 start. Vanuit wetenschappelijk oogpunt worden fysieke integratie, implementatie van een Verkehrsverbund in een Nederlandse context en een diepgaandere data-analyse van een visgraatnetwerk als aanbeveling genoemd.

Figuur S.2 | SWOT-analyse van een multimodale concessie

	Positief	Negatief
Intern	**Sterktes** • Visgraatmodel (kortere reistijd en betere overstappen) • Geïntegreerd netwerk- en dienstregelingsontwerp • Geïntegreerde kaarten en tarieven • Eén informatiebron • Duidelijk aanspreekpunt voor vrijwel al het ov • Vervoerder heeft controle en overzicht over de hele ov-keten • Financiële compensatie tussen trein en bus	**Zwaktes** • Visgraatmodel zorgt voor meer overstappen • Visgraatmodel niet altijd geschikt • Hoge investeringsrisico's / minder geschikte vervoerders • Meer coördinate tussen intercity's and stoptreinen nodig
Extern	**Kansen** • Politieke aandacht • Onder druk staande ov-budgetten • Direct concurrende trein- en busvervoerders • Subsidiariteit • Verschillende potentiële gebieden in Nederland	**Bedreigingen** • Complexe organisatiestructuren • Beperkte publieke aandacht • Huidige belangen (zoals vervoerders van onderhands gegunde concessies en vakbonden) • Duur van lopende concessies • Vervoerderswissel op het spoor kost veel tijd • Ingewikkeld proces infrastructuuraanpassingen

B. Interview Reports

Overview of the interviewees

Actor	Department	Limburg	Fryslân	Groningen
Operator	Regional business development	Arjan Wiering (Arriva)	Yvonne Dubben (Arriva)	Yvonne Dubben (Arriva) Michel van der Mark (Qbuzz)
	Traffic Control	Angelo Coenen (Arriva - train) Rob Bergsma (Arriva - bus)		
PTA		Sabine Kern & Lennard van Damme (province)	Wim Brethouwer (province)	Jorne Bonte (OV-bureau) Herman Sinnema (province)

The interviews are conducted in Dutch. An untranslated report of each of them is depicted below. Note that the interview with Sabine Kern and Lennard van Damme was conducted primarily for another purpose. Consequently, the questions asked are different from the other interviews.

B1 Standaardvragen

Doel: inzicht krijgen in de manier waarop bus en trein worden afgestemd tussen vervoerder en ov-autoriteit op verschillende niveaus van operationele integratie. Hypothese: multimodale concessie functioneert beter.

Afstemming
Op welke manier worden bus en trein op elkaar afgestemd?
- Netwerk & dienstregeling
- Kaarten & tarieven.
- Informatievoorziening.
- Bijsturing.

Daarbij van belang zijn alle interacties tussen vervoerder en overheid (van informeel tot formeel), zoals:
- Wettelijke eisen.
- Bestek / contract.
- Concessie-overleg.
- Communicatie tussen vervoerders onderling.

Prestaties
Wat gaat goed in de afstemming tussen bus en trein? Waarom gaat dat goed?
Wat kan beter? Waarom kan dat beter?

B2 Arjan Wiering

Ontwikkelmanager regio Limburg bij Arriva
Donderdag 26 juli 2018
Heerlen
Casus Limburg

Hoe komt een bieding, in dit geval Limburg, tot stand?
In de voorstudie wordt vaak al duidelijk of een tender interessant is. Op heel veel streekconcessies zit erg weinig marge. Dan kan er een strategisch belang zijn om wel in te schrijven, omdat er schaalvergroting mogelijk is of efficiëntiewinst te boeken is. In ieder geval was Limburg een interessante concessie. Daarom werd er een bieding voorbereid. Dat wordt gedaan door het tenderteam. Dat heeft een kern, bestaande uit een aantal vervoerkundigen, vervoerplanners, een controller. De specialisten die ook nodig zijn worden daarvoor ingevlogen. Zo komt er iemand met een commerciële achtergrond bij, iemand vanuit de veiligheidshoek, iemand voor de service, etcetera. Dat team wordt dus steeds groter. De kern is 7/8 mensen en dat wordt uiteindelijk 30-35 mensen. Die mensen hebben allemaal input. Een paar mensen uit de kern worden aangesteld om de stukken de schrijven. Dat zijn stukken over allerlei plannen, van milieu tot implementatie.

Bij de implementatie werd vervolgens gekeken wat er nog verandert moet worden. Ten opzichte van het plan waren er in Limburg alleen op het gebied van de dienstregeling al meer dan 140 wijzigingen. Dat geldt ook voor tarieven, NextBike, enzovoort. De bieding is geschreven in 2014 en gebaseerd op data van 2013. Daarom is er in de implementatieperiode nog heel veel veranderd in het aanbod. In 2015 en 2016 zijn er ook nog dingen gebeurd die leidden tot aanpassingen in het systeem. Zo was er bijvoorbeeld ingeschreven met een treintype dat niet meer te krijgen was, maar ook het netwerk heeft aanpassingen gehad en de tariefstellingen zijn anders geworden.

De bieding is tot stand gekomen vanuit de overtuiging dat met name op het treinproduct een interessant aanbod te doen was. Dat had te maken met de reizigersaantallen. De Maaslijn is de drukste decentrale spoorlijn van Nederland. Dat zorgt al snel voor een goede kostendekkingsgraad. Het busproduct kan daarmee gefinancierd worden. Het contract in zijn geheel is gezond, maar onderdelen daaruit zijn minder gezond. Op zich is dat niet anders dan welk ov-contract dan ook. In Limburg is het busdeel minder gezond en het treindeel heel gezond. Dat is vergelijkbaar met de concessie Achterhoek-Rivierenland.

Op welke manier worden trein en bus op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?
Conceptueel is alles gezamenlijk aangevlogen. Het visgraatmodel is het uitgangspunt. Dat is in Limburg in het verleden al uitgerold en daar is wat evolutie overheen gegaan. Door de eisen die toen werden gesteld is daar toen een soort spaghettidienstregeling uitgekomen. Alle lijnen lopen kriskras door elkaar en kronkelen door elkaar heen. In de uitgangspunten van het Limburgnet, van tevoren gedefinieerd door de provincie samen met Inno-V, wordt al uitgegaan van strakke lijnen, snelle verbindingen, hoogwaardig openbaar vervoer en meer maatwerk. Daar heeft Arriva een eigen sausje aan gegeven. De vraag is wat gedicteerd is en wat Arriva zelf heeft bedacht. Zeker in een eerste jaar moet ingevuld worden wat er moet gebeuren volgens het bestek. In sommige tenders is het zo dat de oude dienstregeling eerst moet worden overgenomen en dat doorontwikkeling pas later gebeurt. Limburg heeft ervoor gekozen de shocktherapie direct te doen. In het eerste jaar veranderde alles al. Wat betreft de trein is er vrij duidelijk wat er is en hoe er gereden moet worden. De lijnen liggen er. Het busvervoer was in het Limburgnet in tweeën gesplitst. Er waren zoekgebieden en het regulier pakket. Bij de zoekgebieden werd in feite een budget gegeven en een aantal witte vlekken op de kaart waarvoor een oplossing moest worden bedacht door de vervoerder. In de tenderfase zijn er wat voorstellen gedaan en in de implementatiefase zijn er nog wel wat

dingen verandert. In Maastricht was een buitenwijk als zoekgebied gedefinieerd. Uiteindelijk is die wijk met een paar kleine wijzigingen in het stadsnet opgenomen. Op andere plekken zijn lijntaxi's, ov-shuttles of buurtbussen ingezet. Het reguliere pakket is in de volledige breedte uitgerold. Daar zijn wat normen voor gesteld door de provincie, maar omdat het een 'ademende concessie' is kan wanneer sprake is van veranderend gebruik de vervoerder dingen aanpassen. De vervoerder heeft die vrijheid zelf. De vraag is dan of de betreffende kilometers beter kunnen worden ingezet. Er wordt tegen de 30 miljoen kilometer per jaar gereden. Een kilometer in de avonduren op de prairie van Noord-Limburg is minder interessant dan een kilometer in de spits van Maastricht, voor zowel Arriva als de klant. Bij de bieding is dus eerst gekeken naar de hoofdlijnen, de HOV-lijnen. Daaromheen wordt gekeken naar verbindingen die nodig zijn om de dwarsverbindingen te kunnen bieden. Daarop wordt vervolgens gefeederd. Tenslotte worden de witte vlekken ingevuld.

Bij de huidige concessie zijn er twee treinlijnen bijgekomen ten opzichte van de vorige concessie. Die kwamen over van NS. Dat veranderde het netwerk al. Op de Maaslijn is gekozen voor een andere oplossing dan Veolia met een veel bredere dienstverlening. In het busnetwerk is heel veel verstrakt en geschrapt aan hoedjes en onrendabele lijnen. Er is heel veel op de kop gegaan. Veolia had al in een deel van de concessie zowel bus als trein. In die gebieden waren de mensen al gewend dat bus en trein op elkaar werden afgestemd. Bij de nieuwe concessie is, met name op het deel van de nieuwe lijnen, het netwerk flink aangepast.

Kritisch bekeken is het de vraag of er in een multimodale concessie meer wordt afgestemd dan in andere concessies. Vervoerkundigen kijken altijd naar wat er op het hoofdrailnet gebeurd. Dat is ook belangrijk. Er rijden in Limburg meer mensen de provincie uit dan dat ze van het regionale spoor gebruik maken. Er wordt altijd rekening gehouden met de massa. In die zin wordt er altijd wel afgestemd. Netwerktechnisch gezien zijn er veel dingen veranderd, maar die waren anders waarschijnlijk ook wel gebeurd. Waarom zou een bus rijden die nergens op aansluit? Aansluitingen zijn van belang om mensen überhaupt het systeem in te krijgen. Vervolgens is het belang van de vervoerder om te zorgen dat de reiziger zoveel mogelijk kilometers bij jou maakt. Als er geen goede busverbinding is rijdt de reiziger in de auto naar een P+R en maakt alleen gebruik van de trein.

Toch zijn er wel voordelen te behalen als één vervoerder zowel bus als trein in beheer heeft. Arriva kan als één partij praten. Er wordt veel gesproken met provincie en gemeenten. Als er wordt gepraat over een station(somgeving) kan het gaan over looproutes, het busstation, aansluitingen, tarieven, klantenservice, informatie in dezelfde stijl, etcetera. Eén vervoerder heeft daar veel meer over te zeggen. De voordelen van een multimodale concessie op dit gebied zijn met name dat de keten als geheel beïnvloed kan worden. Een vervoerder kijkt beter naar optimalisaties dan wanneer hij geïsoleerd werkt. Er is geen belang om een parallele buslijn te rijden. Er wordt doelmatiger omgegaan met de financiering die er is. Er wordt geprobeerd om zoveel mogelijk reizigers in de HOV-lijnen te krijgen. Er kan beter gestuurd worden op wat er op knooppunten nodig is. Sittard is het grootste treinknooppunt in Limburg. Als daar mensen uit de IC gaan en met stoptrienen en bussen de provincie in rijden, is dat winst voor regionale vervoerder. Dat wordt dus gefaciliteerd. Goede parkeerplaatsen, duidelijke informatie, en dergelijke spelen daarin een rol. Een vervoerder die alleen treinen rijdt probeert reizigers zolang mogelijk in de trein te houden. Eén vervoerder voor beide modaliteiten doet dus iets met de mindset.

Het afstemmen van de dienstregeling is een complex proces. Tot nu toe gaat het echter goed in de samenwerking met NS. Wel heeft bijvoorbeeld PHS veel impact op de treinenloop in Limburg. Uiteindelijk zijn die lijnen van NS dominant. ProRail geeft de capaciteit en zij besluiten wat er komt. Arriva past de plannen daarop aan. Dat afstemmingsproces loopt goed. Druk bereden spoor is wel een probleem. Dat heeft te maken met enkelspoor, goederenvervoer, etcetera. Wat verder een oplossing vraagt is de nieuwe trein naar Aken. De aansluitingen in Aken zijn heel belangrijk voor die trein, maar ook in Heerlen en Maastricht moeten overstappen mogelijk zijn. Dat is een

internationale trein en die gaat in principe voor. Dat is voor NS schakelen, omdat de aansluitingen rondom die trein geregeld moeten worden. Een gevolg voor Arriva is dat één station niet meer bediend kan worden, omdat het niet paste met de aansluitingen. Dat kan wel een multimodale oplossing worden bedacht. Station De Kissel kan dus worden bediend met de bus.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
Het uitgangspunt is betalen per kilometer. Dat is voor de bus heel logisch, op het spoor niet altijd. Bij NS wordt met tariefeenheden gewerkt en loopt de korting op naarmate de reis langer is. Bij Arriva zijn korte ritten goedkoper. Dat is wat betreft vol tarief. Verder worden er nog regionale producten op de ov-chipkaart aangeboden. Bij de trein is dat vaak een vorm van een traject vrij abonnement. Bij bus gaat dat via zones. Eigenlijk zijn dat sterabonnementen. De kortingspercentages van beide producten zijn rond de 15%. Dan is er nog het trein-bus combinatieticket. Dat product kan voor elke mogelijke rit in Limburg gekocht worden en biedt 40% korting op het goedkoopste product. Ook toeristische kaartjes worden aangeboden. Verder zijn er nog busproducten, zoals een dagkaart. In sommige gebieden zijn ook alleen maar bussen en dan hoeft geen onnodig duur kaartje te worden aangeschaft. Waar mogelijk wordt een combinatieticket aangeboden, maar af en toe worden er ook kaartjes voor één modaliteit uitgegeven. De trein is toch een soort premiumproduct in het ov, in tegenstelling tot bus.

Het is lastig in te schatten hoeveel mensen een gecombineerd ticket aanschaffen. Wel is duidelijk dat er veel wordt overgestapt. De barrière daarvoor is ook afgenomen, omdat er geen overstaptarief wordt betaald. Dat maakt het voordeliger om een bus-treinrit te maken. De prijs is daar een factor in, maar het is de vraag in hoeverre dat invloed heeft. De gemiddelde busrit in Limburg is 8 kilometer en trein 15 kilometer in Zuid-Limburg en 27 kilometer in Noord-Limburg. Op zulke afstanden zijn de tarieven een stuk aantrekkelijker geworden. Op een lange rit is het verschil klein. De tarieven waren al onderdeel van de bieding. Een deel is verplicht en een deel is aangeboden. Daarmee kan een vervoerder zich onderscheiden.

Als het goed is heeft de vervoerder hetzelfde belang als de opdrachtgever. Het uit zich wellicht in andere KPI's. Het belang is dat er een zo goed mogelijk systeem is tegen beheersbare kosten. Het moet voldoen aan de politieke besluitvorming. Dat geldt ook voor de vervoerder. Dat blijkt ook uit veel gesprekken. De verschillen zitten met name in de concrete uitwerking. Daarom worden maatregelen vaak uitgewisseld. Uiteindelijk staat het reizigersbelang voorop. Het wordt pas vervelend als de opdrachtgever onrendabele lijnen wil. Tot nu toe gaat dat in samenwerking met de provincie goed.

In hoeverre is de informatievoorziening en communicatie naar reizigers van trein en bus op elkaar afgestemd?
In principe is alles geïntegreerd. Alle reisinformatie staat in een app. De huisstijl voor bus en trein is hetzelfde. Alle acties die worden gedaan zijn altijd multimodaal. Alle uitingen zijn hetzelfde, namelijk voor de multimodale reiziger. Dat werkt wel goed. Sommige evenementen spitsen zich wel toe op bepaalde modaliteiten, zoals Pinkpop en de dodenherdenking bij Margraten.

Intern zijn bus en trein nog wel verschillende dingen. Dat is bijvoorbeeld merkbaar bij rapporteren. Dat gaat in de bus via Albatros en in de trein via NS of ProRail. Er wordt wel geprobeerd heel veel samen te werken, maar er is een aantal technische zaken daadwerkelijk anders. Daar zijn specialist en voor nodig. In het ontwikkelbureau zitten wel alle vervoerplanners, zowel bus als trein. De aansturing is hetzelfde. Dat is niet in elke concessie zo. Ze worden ook allemaal multimodaal opgeleid. Het voordeel daarvan is dat ze elkaar kunnen ondersteunen, want ze hebben ook verschillende piekmomenten in het jaar. Als er echt (spoor)technische zaken zijn, komen andere mensen helpen. Dat zou eigenlijk nog beter moeten. In het algemeen gaat het in de regio best aardig. Op vestigingsniveau is het wel vaak zo dat teammanagers zich specialiseren in bus of trein.

Er zijn geen multimodale vestigingen, maar dat ligt ook aan de massa. Machinisten en buschauffeur zijn ook hele andere mensen. Er zijn maar weinig mensen die het qua karakter allebei goed kunnen. Er zijn andere vaardigheden voor nodig.

In welke mate worden trein-busaansluitingen gegarandeerd bij vertraging?
Dat gaat nog niet goed genoeg. Op sommige stations is het heel simpel. Dan kan de buschauffeur zien of de trein er is, zoals Meerssen. In het dienstregelingsboekje staan ook alle (gegarandeerde) aansluitingen en die hebben de buschauffeurs. Dat zijn de kleine stations en daar zijn de aansluitingen het belangrijkst. In een grote stad rijden bussen vaak genoeg. Idealiter zou de treininformatie ook bij de chauffeur gepubliceerd wordt, maar zover is het nog niet. Als de chauffeur een iPad zou hebben kan daarop staan waar alle omliggende voertuigen zijn. Technisch gezien is dat nog niet mogelijk. Dat is wel onhandig, want de reiziger weet het vaak wel.

Wat gaat goed in de afstemming tussen trein en bus?
Het netwerk en de dienstregeling bouwen gaat goed. Ook de afstemming met reizigersdata en het bouwen van het tariefstelsel is geen probleem. Er wordt goed rekening gehouden met elkaar. Factoren die daar een belangrijke rol in spelen zijn de beschikbaarheid van data en begrip voor het systeem - kennis van de materie. Met die data weet je wat er precies op een station gebeurt en is het makkelijker om een goed plan te maken. Er zijn meer oplossingen mogelijk. Dat helpt heel erg. Soms kan de dienstregeling van de trein zelfs een beetje wijzigen. Verder speelt cultuur een rol. Er is niemand in Limburg die een trein eng vindt. Daardoor wordt er ook beter gekeken naar overstappen. Ook de communicatie is gemakkelijker. Bijvoorbeeld bij de Maaslijn wordt gebruikgemaakt van instaphulpen. Die communiceren makkelijker met een buschauffeur dan wanneer daar een andere vervoerder zou rijden.

Wat kan beter in de afstemming tussen trein en bus?
De situational awareness. In de achterhoek was lang geleden een groene lamp op sommige busstations. Dan konden buschauffeurs zien aan de lampkleur zien of de trein al vertrokken was. Dat systeem is er niet meer, maar er is nog niks beters bedacht. Dat kan dus beter. In de trein wordt vaak omgeroepen dat aansluitende treinen vertraagd zijn. Dat zou eigenlijk met de buslijnen ook moeten. Niet perse voor stadslijnen, maar met name op kleine stations kan dat heel handig zijn voor reizigers. Er wordt wel statische reisinformatie gepubliceerd in de trein, maar dat is nog niet dynamisch. Het zou ook kunnen dat de buschauffeur het dan zegt in de bus tegen reizigers als een bus vertraagd is. Hetzelfde geldt voor kaartjes kopen. Op het moment moeten trein- en buskaartjes apart worden gekocht, ook als e-ticket. Dat zou geïntegreerd moeten zijn. Eigenlijk zou dat voor heel het ov zo moeten zijn, onafhankelijk van de vervoerders. Er zou een e-ticket voor alle reizen moeten zijn. Dan wordt het voor de reiziger veel transparanter. Dat is waarschijnlijk de enige manier om verwende autogebruikers in het ov te krijgen.

B3 Yvonne Dubben

Ontwikkelmanager regio Noord bij Arriva
Donderdag 12 juli 2018
Groningen
Casus Fryslân & Groningen

Fryslân

Op welke manier worden bus en trein op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?

Er vindt afstemming plaats tussen de vervoerontwikkelaar van bus en van trein, zodat de knopen en overstappen goed georganiseerd zijn. Er is dus intern overleg over. In bestekken wordt expliciet afstemming geëist, bijvoorbeeld minimaal 1 keer per jaar overleg hierover. De vervoerontwikkelaar heeft, in het proces om te komen tot een vervoerplan, de verantwoordelijkheid dat deze afstemming ook plaatsvindt. De doorlooptijden om tot een dienstregeling te komen zijn voor bus en trein verschillend. Trein is leidend daarin en de planning daarvoor begint eerder. Ergens in het proces van het maken van het vervoerplan zal de vervoerontwikkelaar bus bij de vervoerontwikkelaar trein aankloppen om te vragen naar de plannen voor een bepaalde plek.

In Noord-Nederland is voornamelijk enkelspoor. Dat betekent dat er weinig mogelijk is wat betreft de dienstregeling van de trein. De dienstregeling kan misschien eens een minuut schuiven, maar het zal nooit helemaal anders worden. Het is wel contractueel vastgelegd dat er overstappen gecreëerd moeten worden tussen de Arriva-treinen en tussen Arriva- en NS-treinen. Dat proces gaat vooraf aan de busplanning.

De belangrijkste bestemming in Friesland is Leeuwarden. Dat is een belangrijk gegeven. Voor de rest zit het busnetwerk vast aan het wegennet. Er is weinig sprake van parallelliteit tussen bus en trein. Hier en daar rijden bussen parallel aan het spoor, maar dat zijn voornamelijk stopbussen die langs elk dorp gaan. De trein is dan de HOV-verbinding die snel en direct is. In die zin bijten de modaliteiten elkaar niet. Die bus kan dus niet zomaar worden opgeheven zonder dat het hele vervoernetwerk in beschouwing wordt genomen, omdat er dan heel veel dorpen worden gedupeerd.

Ondertussen is wel de opdracht samen met de provincie Friesland opgepakt, vanuit de politieke motie ‘Blanco gebieden’, om de kaart van Friesland op het gebied van mobiliteit opnieuw in te tekenen. Dat is breder dan alleen openbaar vervoer. Het start met het intekenen van de hoofdassen: trein en HOV. Vanuit de vervoerbehoefte vanuit de bewoners en bezoekers van de provincie wordt dan opnieuw gekeken hoe de rest van het netwerk kan worden ingericht. Dan kan het zijn dat er opnieuw gekeken wordt naar stations om daar slimme hubs van te maken als dat nu niet zo is. De opdracht van de motie laat dus ruimte om op geheel nieuwe wijze naar de mobiliteit in de ‘blanco gebieden’ te kijken. Een uitkomst zou, bij wijze van spreken, kunnen zijn dat vraagafhankelijk vervoer wordt opgeheven en dat met de elektrische fiets een afstand van 5 kilometer tot een HOV-halte als redelijk wordt gezien. Richting het eind van het jaar wordt dat duidelijk. De opdracht is een volledige samenwerking en komt voort uit het ingediende verlengingsvoorstel voor de concessie. De buscontracten zouden eigenlijk aflopen in 2020. Daar is een aanbod voor gedaan. Een onderdeel daarvan was een pilot met het strekken en versnellen van lijnen. Dat is gedaan omdat er wordt geworsteld met de vraag wat er moet worden gedaan met de bereikbaarheid van het platteland. In de volgende concessie is het geld beperkt, de provincie wil verduurzamen en het platteland moet bereikbaar worden gehouden. Dat vraagstuk schuurt op bepaalde plekken. Daarom wordt er in de verlenging van de concessie een aantal pilots opgestart die de input gaan vormen voor het volgende bestek. De uitvraag kan daardoor verbeteren. Er zijn drie pilotgebieden aangewezen.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
Sinds afgelopen januari is er een regionaal dal-voordeelproduct om met korting in heel het noorden te kunnen reizen. Het was een treinproduct, maar dat is breder getrokken. Daarmee is er een provinciegrens, een concessiegrens en een vervoerdersgrens overschreden. Dat is vrij uniek en op dit moment het enige geïntegreerde product.

De vraag is wel hoe belangrijk tariefintegratie voor de klant is. Op basis van data is onderzoek gedaan om het aantal overstappers in beeld te krijgen. Daaruit blijkt dat het aantal overstappers beperkt is. Het is de vraag waar dat door komt. In ieder geval is er op dit moment geen aanleiding om het hele tarievenhuis opnieuw in te delen. De tarieven van trein zijn anders dan die van bus. Daarnaast is er ook ooit ingeschreven door Arriva op een bepaald tarief met een bepaalde business case. Bij het goedkoper aanbieden van vervoer zal ergens gecompenseerd moeten worden. Daarom is het de vraag of de stap van volledige tariefintegratie genomen zal worden. Er is wel gesproken over het afschaffen van het opstaptarief in een multimodale reis. Ook daarbij lijkt het vooral een theoretische exercitie waarbij de reiziger het niet als een schot ervaart tussen beide modaliteiten. Eigenlijk is reizen op saldo al een geïntegreerd product. Dit betekent echter niet dat er samen met andere vervoerders regelmatig gekeken wordt naar verbeteringen voor de reiziger, ook wat tarieven betreft.

In alle coalitieakkoorden in de drie noordelijke provincies staat dat er een trajectabonnement Noord-Nederland moet worden ontwikkeld. Dat ligt sinds de start van de coalitie op de plank, er is nog geen invulling voor deze opdracht gekomen en in maart zijn de verkiezingen alweer. Tot nu toe is de roep om integratie een latente behoefte die onvoldoende onderbouwd is. Ook hier is het punt dat het tarievenhuis moet veranderen en daar wellicht een prijskaartje aan hangt. De opbrengsten moeten namelijk op peil blijven. Daarnaast is de behoefte niet dusdanig groot dat er tot nu toe aan vervoerders gevraagd is om een trajectkaart Noord-Nederland te ontwikkelen en in te voeren. Dat was wel het geval bij de busconcessies in Friesland. Toen Arriva beide busconcessies in beheer kreeg, snapte de reiziger niet meer waarom er verschillende abonnementen waren. Voor de chauffeurs gold hetzelfde. Daarom is daar wel tariefintegratie gekomen.

In hoeverre is de informatievoorziening en communicatie naar reizigers van trein en bus op elkaar afgestemd?
De betreffende informatie komt uit verschillende bronnen (ProRail en NDOV open data), maar is op veel gebieden wel geïntegreerd. Reisinformatie is geïntegreerd in de reisplanner. Ook in de bussen wordt aansluitinformatie gegeven over de treinen. Dat gaat in de treinen ook komen in de nieuwe concessie, want dat is technisch nog niet mogelijk op dit moment. In het busboekje zitten ook alle bussen en treinen, net zoals de lijnennetkaarten. Op die manier wordt het geïntegreerd. De opdrachtgever stelt op dit gebied vooral eisen aan informatie over de aansluitingen.

Wat is de rol van de opdrachtgever in de integratievraagstukken?
De provincie is vooral bezig met concessiebeheer. Daarbij gaat het met name om prestatie-indicatoren zoals rituitval en punctualiteit. We streven naar een samenwerking waarbij het totaalproduct naar een hoger plan getild kan worden. Er wordt wel gewerkt aan een concessiemanagementsysteem om te kijken hoe daar stappen in te zetten zijn. Er moet gepraat worden over de visie: moet het een geïntegreerd product zijn. Wat wil de klant?

Groningen

Op welke manier worden trein en bus op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?
De laatste jaren is het concept Qlink geïntroduceerd. Dat zijn langeafstandslijnen in de vorm van regulier ov die gestrekt zijn en daardoor aantrekkelijker zijn geworden. Links en rechts rijden die lijnen nog wel parallel aan het spoor. Er is geen parallelliteit bij gekomen, maar het is wel meer een concurrent geworden van de trein. Reizigers maken de keuze waar ze moeten zijn in Groningen en bepalen op basis daarvan of ze met de trein of de bus reizen. Daar hebben we wel 'last' van als treinvervoerder, ware het niet dat de grenzen van de capaciteit op het spoor op dit moment wel bereikt zijn.

Aan de andere kant is een HOV-lijn naar Veendam wel opgeheven toen daar een trein ging rijden. In die zin wordt er wel slim gekeken naar de afstemming tussen bus en trein. Dat gaat vaak in samenwerking met het OV-bureau (dat is het directe aanspreekpunt, Qbuzz voert alleen maar uit), maar ook dat is niet in processen vastgelegd. Dat is elkaar telkens zoeken en wordt gedaan vanuit een gezamenlijk belang. Iedereen ziet dat de reiziger niks heeft met concessiegrenzen, maar een reisbehoefte van A naar B heeft. Daarom is men een paar jaar geleden bij elkaar gaan zitten, inclusief NS, om te kijken waar de verbeterpunten zitten in de integratie. Daaruit bleek dat het vooral te maken heeft met communicatie.

De interactie tussen het OV-bureau en de provincie is, voor wat betreft uitvoeringskwaliteit, klein. Het OV-bureau heeft een eigen bestuur. Daarnaast ligt de opbrengstverantwoordelijkheid voor de bus bij het OV-bureau en voor de trein bij de vervoerder. Het buscontract van het OV-bureau gaat er met name over om het zo goedkoop mogelijk en zo kwalitatief goed mogelijk uitvoeren van wat geëist wordt. Dat is zo ontstaan omdat de vervoerder hun ontwikkelrol minder goed uitvoerden. Omdat de scope van het OV-bureau de duur van een contract overstijgt, is er ook meer ruimte om te ontwikkelen.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
In de jaren '80 werd voor het eerst parallelliteit opgeheven in Groningen. Mensen werden verplicht met de trein te gaan reizen. Dat stuitte op best wat weerstand, want de trein is duurder dan de bus. Daarom werden de sterabonnementen geïntroduceerd op de treinen. Zo werd het mogelijk om met het bustarief op de trein te reizen. In januari is het dalvoordeeltarief geïntroduceerd (zie hierboven). Ook in de communicatie wordt daar gezamenlijk mee naar buiten getreden. Het zijn kleine dingen, maar grote stappen in het vinden van elkaar. Daarnaast is er in Groningen het Sterabonnement Noord-Nederland, een regionaal product waarmee zowel in de bussen van Qbuzz als in de treinen van Arriva kan worden gereisd.

In hoeverre is de informatievoorziening en communicatie naar reizigers van bus en trein op elkaar afgestemd?
De marketingcommunicatie van bus en trein is soms gescheiden. Daar zijn nog wel voordelen mee te behalen. Er zijn wel eens pogingen gedaan om samen op te trekken. In de zomer zijn allerlei aparte acties. Dat is op een gezamenlijke landingspagina gezet. Dat bleek toch lastig, omdat de doorverwijzingen toch weer naar de aparte vervoerders gaan. Het is nu wel makkelijker om elkaar te vinden. Als het OV-bureau een krant uitgeeft wordt er gevraagd of er treininformatie in moet en andersom. Overigens is in de landelijke reisinformatie van bus en trein natuurlijk wel samen.

Algemeen

Wat gaat goed in de afstemming tussen trein en bus?
Op dienstregelingsniveau gaat het goed, in beide concessies, bijvoorbeeld op het gebied van aansluitingen. Vervoerontwikkelaars zijn professionals zijn die elkaar eenvoudig weten te vinden in het ontwerpproces van vervoerplannen en dienstregelingen.

Wat kan er beter in de afstemming tussen trein en bus?
De gezamenlijke netwerkontwikkeling kan beter. Iedereen heeft data, maar niemand heeft het totaaloverzicht. Pas als alle data beschikbaar is, is er goed te zien wat er gebeurt in het ov. Met die kennis zou het netwerk kunnen verbeteren en eigenlijk zou dan heel Noord-Nederland als geheel gezien moeten worden.

Op dit moment verrassen de plannen van het OV-bureau om buslijnen te veranderen wel eens, bijvoorbeeld als bussen worden aangetakt op de trein. Dit wil nog wel eens gaan schuren vanuit financieel oogpunt (inkomstenverlies), ook op tariefniveau. Er zitten voor- en nadelen aan een dergelijk OV-bureau met opbrengstverantwoordelijkheid. Vanuit het perspectief van Arriva is de opbrengstverantwoordelijkheid bij de vervoerder het beste. Aan de andere kant heeft de organisatie van het OV-bureau ook voordelen. Er is ruimte voor investeringen die anders niet gedaan zouden kunnen worden. De scope is niet de contractlengte, maar langer. Dat geeft meer draagvlak voor investeringen.

B4 Michel van der Mark

Commercieel manager bij Qbuzz
Woensdag 26 september 2018
Groningen
Casus Groningen

Wat is de verhouding tussen het OV-bureau en Qbuzz?
Formeel gezien is er sprake van een kostencontract. Qbuzz wordt betaald per dienstregelingsuur. Alle opbrengsten van Qbuzz worden een op een overgedragen aan het OV-bureau, inclusief de opbrengsten van de ov-studentenkaart. Marketing en communicatie is ook de verantwoordelijkheid van het OV-bureau. Qbuzz heeft de know-how en expertise en denkt mee. Dat gaat op een goede manier, maar als het erop aankomt beslist het OV-bureau namens de politiek.

Op welke manier worden trein en bus op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?
Er is een doorlopend afstemmingsoverleg tussen de vervoerkundigen van het OV-bureau en de vervoerkundigen van Qbuzz voor de busdienstregeling. De vervoerkundigen van het OV-bureau bedenken de hoofdlijnen, maar maken niet de exacte dienstregeling. Het gaat dan over frequenties en aansluitingen. Het 'in Hastus kloppen' doet Qbuzz. Dan zijn er wel eens dingen die mooi waren op papier, maar in Hastus een andere uitwerking hebben. De afstemming is dus doorlopend nodig om een werkbare dienstregeling te krijgen, van plan of aanpassing tot de daadwerkelijke doorrekening. De dienstregelingstabellen die de reiziger te zien krijgt worden gemaakt door Qbuzz. Er zijn geen strikte eisen vanuit het OV-bureau, meer algemene frequenties en dergelijke. Het proces gaat voornamelijk in overleg. Er zijn wel politieke wensen, maar als het niet kan kan het niet. Als het OV-bureau iets perse op een bepaalde manier zou willen, zou het proces ook niet lopen. Voor aansluitingen is een eis soms logisch, maar de tussenliggende rijtijden en punctualiteit beïnvloeden ook de dienstregeling. Er wordt ook gekeken op basis van data. In de praktijk wordt er in goed overleg samengewerkt en heeft Qbuzz ook ideeën die worden gedeeld.

NS is leidend als het gaat om de aansluitingen. De rest moet dan volgen. Arriva sluit daar op aan met de noordelijke treindienstregeling en dat spoor is in de basis dus leidend voor bus. Er is wel wat parallelliteit in het gebied, maar niet overdreven veel. De aansluitingen zijn daardoor des te belangrijker. Zodra er bekend wordt wat de treintijden zijn wordt de busdienstregeling daarop aangepast. Waar mogelijk wordt erover gepraat of het slimmer of anders kan, maar trein blijft wel leidend. ProRail en de capaciteit op het spoor spelen ook een belangrijke rol. Bussen zijn flexibeler dan treinen en het dienstregelingsproces is korter wat betreft doorlooptijd. Logischerwijs is dat volgend, maar dat gaat bijna op een natuurlijke manier. De treindienstregeling is lang van tevoren bekend. Dan wordt er gekeken naar wat logisch is wat betreft aansluitingen. Het is een continue samenwerking en het gaat om het resultaat voor de klant. Dat betekent niet dat er steeds contact is met Arriva, want dat proces loopt wel. Er gebeuren nooit echt schokkende dingen in de treindienstregeling. Het gaat over minuten. Wederzijds informeren is daarbij wel belangrijk. Omdat er contact goed is, is er snel een overleg gepland als dat nodig is. Als het niet nodig is, is daar ook geen behoefte aan.

Wat betreft de parallelle buslijnen is er wel contact met Arriva, maar vooral met het OV-bureau. Er is geen driehoeksrelatie op dit niveau, maar de verhoudingen zijn goed. Instapcijfers en capaciteit van treinen bepalen voornamelijk de lijnvoering. Treinen zitten vaak bomvol in de spits. Liever wordt er niet parallel gereden, omdat er dan een capaciteitsprobleem is. Er is meer afstemming tussen de partijen over het stimuleren van de daluren bij reizigers. Vol is vol geldt in de spits en dan is er al aanvullend vervoer per bus, betaald door de provincie en Arriva. In de daluren is nog ruimte en door samenwerking wordt geprobeerd reizigers buiten de spits te laten reizen.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
De doelstelling is om met alle concessies in het noorden, ZOWAD, NZWF, GD en de noordelijke lijnen, te werken aan een tarievenhuis dat iedereen snapt. Arriva is druk om de twee busconcessies in Friesland te integreren. In Groningen is het sterabonnement geldig op de treinen en bussen. Dat is er in Friesland niet meer. Er vindt voortdurend afstemming plaats en er is ook gezamenlijke productontwikkeling. Dalvoordeel Noord-Nederland is een gezamenlijk product, geldig in trein en bus. Dat was een grote wens van de overheden. Er wordt geprobeerd af te stemmen, maar de verschillende soorten concessies maken het lastig om een gezamenlijk product te ontwikkelen. Een oorzaak is bijvoorbeeld dat de waarde van een treinreis vaak hoger is. Er zijn ook proposities in Friesland die niet zin GD passen. De ambitie is er wel om steeds meer naar elkaar toe te komen en een eenduidig tarief te creëren. Echter, de overheid heeft destijds besloten om de tarieven ook de decentraliseren. Dat heeft gezorgd voor een heel palet aan producten. Er zijn allerlei initiatieven om dat steeds compacter te maken, maar dat is lastig met drie overheden en concessies die andere kenmerken hebben. Het sterabonnement is nu weg in Friesland, maar in GD is het nog steeds. Er is nog geen vervangend product ontwikkeld. De opbrengsten van het sterabonnement worden ook verdeeld met Arriva.

Voor de reizigers is het belangrijk dat het tarievenhuis eenvoudiger wordt. De reiziger snapt niets van concessiegrenzen. Wel tussen trein en bus, maar niet bus-bus. Bussen van Arriva rijden Assen binnen, maar de tarieven zijn anders. Met name dergelijke concessieoverschrijdende buslijnen zijn ingewikkeld. Trein-busintegratie is wat dat betreft overzichtelijker. Aan de andere kant heeft Arriva weer eigen abonnementen voor het hele traject. Er is in ieder geval doorlopend overleg over en er zijn politieke doelstellingen. Over die doelstellingen wordt veel overlegd, omdat ze niet volkomen helder zijn. Buiten die politieke doelstellingen om vindt het meeste overleg plaats tussen vervoerders. Dat is ook de rolverdeling.

Door alle verschillende concessies is het ook lastig om afspraken te maken over reguliere tarieven, zoals het opstaptarief in een multimodale reis. Daarom worden de landelijke afspraken gevolgd. Het kilometertarief is in elk gebied verschillend. Dat is ook het gevolg van opbrengst-verantwoordelijkheid, opdrachtgever, nieuwe concessies en tariefafspraken. Er zit een goede gedachte achter, maar is niet overal hetzelfde. Op dit moment zijn er geen gesprekken over het afschaffen van het opstaptarief. Het is geen onderwerp dat hoog op de agenda staat op dit moment. Er zijn wel veel reizigers dit met trein en bus rijden. Bijvoorbeeld richting Zernike vanuit Zuidhorn is een trein-busverbinding.

In hoeverre is de informatievoorziening en communicatie naar reizigers van trein en bus op elkaar afgestemd?
Qbuzz voorziet reizigers van alle reisinformatie, zoals informatie op de website, richting apps, haltevertrekstaten en posters. Reizigersinformatie die ontwikkeld wordt samen met het OV-bureau, zoals de informatie op de schermen in de bus, wordt gepubliceerd door Qbuzz. De OV-krant wordt uitgegeven en betaald door het OV-bureau, maar in samenwerking met Qbuzz. In het algemeen snapt de reiziger niet wat het OV-bureau is, dus er is voor gekozen om Qbuzz prominent aanwezig te laten zijn en niet een eigen merknaam te lanceren, zoals in Utrecht.

Specifieke promotieacties, zoals dalvoordeel Noord-Nederland en de promotie van de persoonlijk ov-chipkaart, worden afgestemd met Arriva. Dat is in het verleden ook al vaker gebeurd. Bij het aanspreken van publiek met meerdere concessie (bijvoorbeeld trein-bus) is het belangrijke om met één gezicht naar buiten treden. Dan wordt er afstand genomen van de eigen branding. Dat gebeurt al jaren, los van het winnen of verliezen van concessies. Het noorden clustert vaak als het om gezamenlijk dingen gaat. Soms is het lastig om gezamenlijke proposities van de grond te krijgen, maar de verkenningen lopen al jaren. Het dalvoordeelproduct is het beste voorbeeld. Daar is maar

een half jaar aan gewerkt. De volgende actie is een actie om de persoonlijke ov-chipkaart aan te bieden voor €2,50. Omdat zowel GD als Friesland daar apart mee bezig was, is het samen opgepakt.

Samenwerking trein-bus is een jaar of vier/vijf geleden begonnen met het opzetten van een integratiegroep vanuit het OV-bureau. Alle mensen die van belang waren vanuit de verschillende organisaties zaten daarin. Het is begonnen met het zoeken naar samenwerking op het gebied van tarieven, netwerk, paralleliteit, etcetera. In dat overleg schoven ook ProRail en NS aan. Dat is later overgegaan in de ov- en spoortafels, zowel regionaal als landelijk. In die landelijke tafel wordt de noordelijke lobby ingebracht. Los daarvan zijn er projecten, zoals spitsmijden. Er wordt heel veel overlegd als het gaat om het belang van de reiziger in het noorden. Die samenwerking was al intensief, maar wordt steeds concreter door specifieke en grotere acties.

Er wordt niet gewerkt aan een gezamenlijk app of website. Elke vervoerder heeft meerdere regio's. Het zou een specifieke vraag vanuit de opdrachtgevers moeten zijn en in alle bestekken moeten staan, maar die vraag is er niet geweest. Het zou ook lastig zijn om dit verder te integreren, omdat concessies komen en gaan. Daarom gebeurt het niet op die manier, maar wel op een andere manier: gezamenlijke campagnes, actiewebsites, verwijzingen naar elkaar, etcetera. Iedere vervoerder heeft een eigen website en verkoopt alleen de eigen en gezamenlijke producten. Dat is ook het meest logisch. Veel reizigers gebruiken ook apps als 9292, waarin informatie al is geïntegreerd.

In welke mate worden trein-busaansluitingen gegarandeerd bij vertraging?
Een bus wacht, maar kan niet oneindig wachten. Dat is maximaal 3-5 minuten. Soms zit er wat meer rek in. Dat is een gevoelig punt in aansluitingen, want er is geen directe actieve communicatie tussen de verkeersleidingen van Arriva en Qbuzz. Dat zou ook heel ingewikkeld worden. Een aantal locaties heeft als voordeel dat het zichtlocaties zijn. De chauffeur ziet de trein daar komen. Als dat niet zo is, is het ingewikkelder. Qbuzz kan wel zien waar de treinen rijden en of ze te laat zijn. Dat is open data, maar wil niet zeggen dat er altijd gewacht kan worden. Als de vertraging meer dan 3-5 minuten is wordt het lastig om te wachten, want dan worden de punctualiteitsnormen en aansluitingen aan de andere kant niet meer gehaald. Te vroeg vertrekken mag niet, maar te laat ook niet. Binnen 0 en 180 seconden moet er vertrokken worden. Bij het wachten op een trein wordt dat niet gehaald, maar daar is een logische verklaring voor. Wachten mag niet leiden tot verslechterde punctualiteit onderweg, dus er is wel een spanningsveld. Een vertraagde bus heeft ook impact op reizigers bij de haltes onderweg. Voor bus is met name de aankomstpunctualiteit belangrijk, want dat gaat over trein-busaansluitingen. Er wordt dus wel rekening mee gehouden, maar niet oneindig.

Op niet-zichtlocaties weten chauffeurs niet of de trein vertraagd is. Een chauffeur kan natuurlijk wel passagiersstromen zien en snapt ook wel wat er gebeurt. In de schermen in de bussen worden de aansluitingen met de trein wel getoond. De chauffeur ziet dat helaas nog niet. Daar wordt wel aan gewerkt. Laatste treinen zijn wel kritisch en chauffeurs wachten daar vaak op. 's Avonds is het ook makkelijker om verloren tijd weer in te halen. Over het algemeen zijn er weinig klachten over. Het gaat dus goed, maar het kan altijd beter, met name het wederzijds informeren zonder verkeersleiding. De data is er, dus visualisatie zou kunnen helpen, met name aan de buskant. Het zou niet werken om dat via de verkeersleiding te doen. De verkeersleiding is erop gericht om het proces te laten lopen en er gebeurt meer dan op treinen aansluiten. Daarom worden de chauffeurs zelf wel blijvend geïnformeerd over het wachten op aansluitingen indien mogelijk. De verkeersleiding stuurt er alleen op als er een telefoontje komt, maar dat gebeurt zelden.

Soms zit er een fout in de dienstregeling en dat leidt dan structureel tot niet-gehaalde aansluitingen. Dan moet er worden ingegrepen in de dienstregeling. Als de treindienstregeling op het laatste moment wordt gewijzigd, is de busdienstregeling al klaar en kan niet zomaar gewijzigd worden. Als dat niet parallel loopt of het informeren naar elkaar loopt niet helemaal goed, duurt het vaak twee tot drie maanden om het te repareren. Dat heeft te maken met doorlooptijd van de dienstregeling.

De diensten voor de chauffeurs moeten bijvoorbeeld goedgekeurd worden, de reisinformatie moet klaargemaakt worden en een logische datum moet worden gekozen. Dat kost veel tijd. Soms is een andere interventie nog mogelijk tussendoor.

Wat gaat goed in de afstemming tussen trein en bus?
Er gaat een heleboel goed. Vanuit Qbuzz is het niet bekend dat er (structurele) problemen zijn. Dat heeft er mee te maken dat iedereen elkaar kent. Als iemand echt iets wil weten wordt er wel gebeld. Het is een klein wereldje en het escaleert niet. De afstemming tussen OV-bureau, Arriva en Qbuzz is goed op het gebied van planning. Er wordt veel overlegd, dus het voelt niet als concurrentie. Alle informatie die mogelijk is om te delen wordt gedeeld in het grotere belang.

Als geheel is het noorden een voorbeeld van goede samenwerking, ondanks alle concessiewisselingen. Dat wordt echter niet vaak gezegd. Het gezamenlijke belang is groter dan het individuele belang. Dan gaat het over OV-bureau, Arriva en Qbuzz. Ook de ambtenarenlaag eronder werkt samen. Iedereen kent elkaar. Er zijn heel veel initiatieven om het noorden op de spoor- of buskaart te zetten, voornamelijk als gewicht tegen de randstad. Er zijn wel veel stappen gemaakt. Het heeft er ook mee te maken dat de overheden samenwerken. Dat helpt om de goede prioriteiten te stellen. Toen de ov- en spoortafel startte is het noorden altijd gezien als het voorbeeld.

NS doet ook mee aan de overleggen, maar niet altijd aan de samenwerking die daaruit volgt, zoals het dal-voordeelproduct. Het zit niet in de genen van NS om op trajecten acties te doen. Dat ligt uit de comfort zone. Ze worden altijd betrokken, maar als het erop aankomt is het vaak ingewikkeld: technisch danwel communicatief. Partijen als Arriva en Qbuzz zijn veel slagvaardiger, omdat ze kleiner zijn en ook regionale belangen hebben. NS heeft een landelijk belang. Als zij beginnen aan een speciale propositie in het noorden, zullen andere gebieden waarschijnlijk willen volgen. Het is echter wel heel wenselijk dat ze mee zouden doen, want het niet meedoen van NS wordt als een van de grootste nadelen van het dal-voordeelproduct genoemd.

Wat kan beter in de afstemming tussen trein en bus?
Dat is lastig te zeggen, omdat er al veel overlegd wordt. De noordelijke tariefintegratie kan nog wel beter. Het ideaalbeeld is een begrijpbaar product voor de reiziger dat voor de noordelijke provincies allemaal gelijk is. In ieder geval geen kerstboom aan producten op een ov-chipkaart. Het is echter complex om dat te realiseren door de verschillende contracten en belangen. Aan de andere kant is er weinig concessie-overschrijdend verkeer. Dan is de vraag of het niet voor de bühne is. In de marketing is het heel goed, maar het is de vraag hoeveel mensen ervan profiteren.

In hoeverre zou een multimodale concessie in het noorden beter zijn dan nu?
Er zou voornamelijk winst te behalen zijn voor de vervoerder. Een multimodale concessie kan slimmer worden aangestuurd. Dat geeft ook aan dat er een concurrentievoordeel is voor vervoerders die zowel trein als bus rijden. Er kan een beter product worden neergezet. Aan de andere kant zorgt het ook voor grote concessies. Dat gaat gepaard met veel geld en complexiteit in beheer. Daarom is er in Friesland voor gekozen om niet multimodaal aan te besteden. Er is van alles voor te zeggen. Uiteindelijk zal het voordeel voor de reiziger opleveren, maar blijven andere concessiegrenzen een rol spelen. Wat betreft tarieven blijft de afhankelijkheid van de politiek. Een vervoerder kan alleen een voorstel indienen.

B5 Rob Bergsma

Manager verkeersleiding bus bij Arriva
Woensdag 11 juli 2018
Heerenveen

Wat is de rol van de verkeersleiding bus met betrekking tot overstappen bij vertraging?

Buschauffeurs kunnen zonder tussenkomst van de verkeersleiding met elkaar communiceren via radioverkeer. Dat is beperkt tot een aantal kilometers, afhankelijk van de bebouwing. Als een passagier vraagt om een aansluiting belt de ene chauffeur de ander en vraagt om even te stoppen. De passagier moet daar zelf om vragen, want dat gebeurt niet pro-actief door de chauffeur. Het is altijd hopen dat de andere chauffeur het bericht hoort. Omdat dat een onzekere factor is, wordt op plekken met veel overstappen of overstappers toch vaak de verkeersleiding gebeld. De verkeersleiding weet precies welke overstappen er zijn en ook de realtime-gegevens van de oproepende bus zijn bekend. In de toekomst wordt dat ook mogelijk voor de vertrekkende bus. De verkeersleiding neemt vervolgens contact op met de tweede chauffeur om te zorgen dat die blijft wachten. Het is echter altijd een afweging of de aansluiting gehaald wordt of niet, want er zitten meer mensen in de bus die misschien wel een andere aansluiting willen halen. De maximale wachttijd is 3 minuten. Overigens wachten chauffeurs bij gegarandeerde aansluitingen vaak per definitie al.

Overstappen bus-bus tussen verschillende vervoerders kunnen ook geregeld worden via radioverkeer. Dan moet de chauffeur het kanaal opzoeken van de concullega. Dan is het hopen dat de andere chauffeur het hoort, waarbij de kans kleiner is dat het goed gaat dan bij dezelfde vervoerder. In het geval van meerdere vervoerders geval gaat het daarom meestal via de verkeersleiding. Dan belt de buschauffeur de verkeersleiding, die weer belt met de verkeersleiding van de andere vervoerder, die op zijn beurt weer contact opneemt met de betreffende chauffeur.

Hoe worden, bijvoorbeeld in de multimodale concessie Limburg, trein-bus-aansluitingen geregeld?

Een bus-treinoverstap gaat eigenlijk op dezelfde manier als een overstap naar een concullega. De verkeersleiding bus neemt dan contact op met verkeersleiding trein om de trein even vast te houden. Er zijn echter plekken waar dat niet kan, bijvoorbeeld omdat de slagbomen dichtgaan bij kleinere stations. De machinist kan dan niet eens wachten, want hij krijgt een groen sein. Dan zou de treinverkeersleiding met ProRail moeten bellen, maar dat is niet realistisch. In andere gevallen lukt een minuut wachten misschien nog een keer. In de praktijk gebeurt het echter bijna niet. Een enkele keer gebeurt het 's avonds of op zondag.

Andersom is gemakkelijker en dat gebeurt ook nog wel eens. Dan belt de treinverkeersleiding naar de busverkeersleiding en wordt de betreffende bus gebeld, die dan vervolgens een paar minuten wacht op de trein. De laatste bus wacht nog wel eens wat langer of er wordt vervangend vervoer geregeld. De vraag om een bus te laten wachten komt tegenwoordig ook wel eens binnen via de webcare, die het binnenkrijgt via Twitter. Ook daarop wordt door de verkeersleiding bus de buschauffeur gebeld om te wachten

In hoeverre zitten er verschillen tussen de prestaties in de verschillende concessies op dit gebied?

Er zijn hierover niet direct gegevens voorhanden. Voor zover in te schatten zit het verschil met name op het vlak van de dienstregeling, wat dan waarschijnlijk beter gaat wanneer bus en trein bij één vervoerder zijn. Dienstregelingen worden tegenwoordig strak in elkaar gezet. Alle lucht is eruit. Er hoeft niet veel te gebeuren voor een bus vertraagd is. Daadoor gebeurt het al snel dat een

aansluitende rit ook vertraagd is of vervalt om weer op tijd te komen. Voor de opvang van die ritten zijn geen mensen en materieel beschikbaar. Bepaalde trajecten zijn daar extra gevoelig voor. Buschauffeurs weten dat. Dat wordt gerapporteerd en soms ook opgelost bij een dienstregelingswijziging.

Als de aansluitingen goed in de dienstregeling zitten hangt het af van de omstandigheden of die aansluitingen ook worden gehaald. De verschillen tussen de concessies op dit vlak zijn waarschijnlijk klein. Ook hier is misschien iets meer mogelijk wanneer bus en trein bij dezelfde vervoerder ondergebracht zijn.

Wat wordt er gedaan met klachten over niet-gehaalde overstappen?
Niet-gehaalde overstappen worden geregistreerd voor het geval de passagier gaat klagen. Er wordt echter zelf niks mee gedaan, want een volgende keer is de situatie weer anders.

Wat wordt er gedaan om de aansluitingen bij vertraging te verbeteren?
Er worden vooral technische verbeteringen doorgevoerd, maar die liggen niet perse op het bijsturingsvlak. Aan passagiers wordt bijvoorbeeld informatie gegeven over aansluitingen via schermen in de bus, waarbij wordt aangegeven waar de voertuigen precies zijn. Dat kan helpen om passagiers gerust te stellen. Ook chauffeurs kunnen die informatie krijgen. Verder zouden de gegarandeerde aansluitingen eigenlijk geautomatiseerd moeten worden in de system. Waar de bussen zijn is precies bekend. Aansluitende bussen zouden dan automatisch een melding krijgen dat ze moeten wachten. Het is echter wel van belang om te weten dat er mensen in zitten. De chauffeur zou dat dan moeten bevestigen.

Hoe zou de communicatie tussen de verkeersleiding trein en bus kunnen verbeteren?
Het zou een optie zijn om de verkeersleiding trein en bus bij elkaar te zetten. Dan zou verkeersleiding trein, bus, webcare en klantenservice bij elkaar op een afdeling moeten zitten. Een soort van commandocentrum van heel Nederland. Bij extreme dingen, zoals stremmingen op het spoor, zijn de lijntjes dan korter. Maar het is eigenlijk overdreven om dat alleen voor de aansluitingen te doen. Het is maar een klein onderdeel van het werk. Het belangrijkste is dat de verkeersleiding het aanspreekpunt voor chauffeurs is bij calamiteiten, incidenten en veiligheidsproblemen, daar waar de dienstregeling in gevaar komt. Daarnaast is het een totale organisatiewijziging en er moeten dan afspraken gemaakt worden met opdrachtgevers en provincies die daar heel anders in staan. Limburg wilde eigenlijk ook dat de verkeersleiding bus daar kwam, maar we hebben het toch hier gekregen. Ook het OV-bureau Groningen-Drenthe wil de busverkeersleiding op het eigen grondgebied hebben. In de nieuwe concessie moet de verkeersleiding blijven in het gebouw waar het nu zit en de mensen die daar zitten mogen alleen de bussen in die concessie doen. Dat laatste is overigens goed, want het werkt niet om verkeersleiders elders in het land samen te laten werken met de verkeersleiders in Heerenveen. In Zuid-Holland hebben is daar ervaring mee opgedaan. In het bestek stond dat daar een aparte verkeersleiding ingericht meest worden. Dat is gebeurd, ondanks dat we het eigenlijk niet wilden. Die verkeersleiders werkten samen met het team in Heerenveen en samen deelden ze het werk voor heel Nederland. Dat vergt afstemming onderling en ging iedere keer mis. Nog steeds zitten er twee verkeersleiders in Leiden, maar de afstemmingsproblemen zijn verminderd nu er in verhouding meer mensen in Heerenveen zitten en minder in Leiden. Voor Arriva is het een voordeel om het centraal te regelen, want dan kan de bezetting kleiner worden. Daarnaast is het niet overal tegelijk druk en kunnen de mensen zo optimaal mogelijk worden ingezet op deze manier. Ook is dat handiger rond concessiegrenzen waar communicatie op grensoverschrijdende lijnen nodig is.

B6 Angelo Coenen

Manager verkeersleiding trein
Maandag 16 juli 2018
Heerenveen

Wat zijn de taken van de verkeersleiding trein?
De belangrijkste taken van de verkeersleiding zijn de bijsturing van personeel en materieel. Daarnaast wordt het onderhoud van de treinen en het aantal kilometers dat een trein aflegt bijgehouden. Eigenlijk alles wat afwijkt van de reguliere planning wordt bijgestuurd door de verkeersleiding, als het gaat om materieel en personeel. Het verschil met de verkeersleiding bus is dat zij vaak taken uitzetten bij de vestigingen in de regio om de problemen op te lossen, terwijl dat bij de verkeersleiding trein zelf wordt opgelost. ProRail is de infrabeheerder van het spoor en daarom moet elke beweging die afwijkt van de planning opnieuw worden aangevraagd bij ProRail.

Hoe is de verkeersleiding trein georganiseerd?
Er zijn drie afdelingen door het land heen, in Leeuwarden, Zutphen en Maastricht. De verkeersleiders in Maastricht zitten bij ProRail op de zaal. Daar is de communicatie heel snel. In Zutphen en Leeuwarden zitten ze op het regiokantoor. Alle vestigingen bedienen een deel van Nederland.

Hoe vaak gebeurt het dat een trein wacht op een andere (vertraagde) trein?
Eigenlijk niet zo heel veel. Het komt heel zelden voor dat er op gestuurd kan worden. Het Nederlandse spoornetwerk zit zo compact in elkaar dat er heel weinig tijd is om te wachten. Een nieuw pad krijgen bij vertraging is dus lastig. Zeker op plekken met samenloop (bijvoorbeeld ten zuiden van Roermond) is dat het geval. Dan kan het zomaar zijn dat er niet gereden kan worden of pas een kwartier/halfuur later, dus dat wordt zelden gedaan. Er is wel een laatste treingarantie. Bij de laatste trein is er de plicht voor zowel Arriva als NS om op elkaar te wachten. Dat loopt dan via ProRail. De treindienstleider bepaalt of het sein wordt herroepen en de decentrale verkeersleider bepaald over nieuwe paden.

Overdag gebeurt het wel eens dat er wordt gewacht, maar dan is de vertraging dusdanig klein dat wachten mogelijk is. Op het moment dat het sein op groen gaat is er nog een marge om te kunnen rijden, afhankelijk van het station, het baanvak, het pad en het tijdstip. Dat proces gaat altijd via ProRail. Het maakt dus niet uit van welke vervoerder de treinen zijn. Op de trajecten waar Arriva nu rijdt is het echter vrijwel niet mogelijk. Soms is er wat ruimte op plekken waar Arriva alleen rijdt, maar als het al kan speelt ook nog de vraag of het het waard is voor de groep passagiers die er baadt bij heeft. Het vraagt namelijk nog uren van bijsturing om daarna de dienstregeling weer te kunnen hervatten. Dat geeft ook problemen voor heel veel andere reizigers.

Hoe worden, bijvoorbeeld in de multimodale concessie Limburg, trein-busaansluitingen geregeld?
Bij vertraging van een trein wordt er eigenlijk niets gedaan. De verkeersleiding bus wordt niet automatisch geïnformeerd als een trein van Arriva vertraagd is, zodat de bussen op de trein kunnen wachten. Daar is geen tijd voor, omdat het werk van de treinverkeersleiders erg arbeidsintensief is. Het verschil tussen de verkeersleiding bus en trein is dat de verkeersleiding bus voornamelijk meldingen doorstuurt, terwijl er bij de verkeersleiding trein altijd iets met meldingen gedaan moet worden. Er wordt meer gepland, materieel en personeel wordt aan elkaar gekoppeld en als er een grotere vertraging is betekent dat dat zij druk aan het werk zijn. Er zijn veel meer fluctuaties wat betreft drukte.

Op het moment dat er een grote verstoring is waardoor er niet gereden kan worden, worden er sms'jes en appjes gestuurd naar verschillende afdelingen, waaronder de verkeersleiding bus. Als dat gelezen wordt, dat is natuurlijk altijd de vraag, dan zijn ze op de hoogte. Soms is er dan ook nog direct contact. Dat is echter in het geval dat er meer dan een halfuur geen treinverkeer mogelijk is. In het geval van verschillende vervoerders is er bij calamiteiten ook wel eens contact met de verkeersleiding bus van een ander bedrijf. In Groningen is wel eens contact met de verkeersleiding van QBuzz. Dan kunnen de buschauffeurs op de hoogte worden gesteld van problemen op het spoor. Daar houdt het contact echter ook op.

Los van de vraag of een aansluiting mogelijk is, speelt ook de mentaliteit een rol in de afstemming tussen bus en trein. Trein en bus zijn eigenlijk twee eilanden, zelfs binnen hetzelfde bedrijf. Iedereen regelt zijn eigen zaken. Er is wel eens over gesproken om de verkeersleiding trein van Leeuwarden naar Heerenveen te verplaatsen in de nieuwe concessie noordelijke treindiensten. Er is toen toch besloten om naar Groningen te gaan en daar - net zoals in Maastricht - samen met ProRail te gaan zitten.

Hoe zouden trein-busaansluitingen verbeterd kunnen worden?
Los van welke vervoerder een bepaalde lijn rijdt, heeft de reiziger het recht op reisinformatie en aansluitingen. Op het moment dat aansluitingen gegarandeerd kunnen worden, afgezien van de vraag of de paden beschikbaar zijn, is er een vervoersplicht. Het beste zou zijn om dat automatisch via een pushbericht te doen. Op het moment dat een trein vertraagd binnenkomt zou de chauffeur op een tablet, telefoon, o.i.d. dan een bericht krijgen om op de trein te wachten.

Concreet wordt er op dit moment gewerkt aan betere reisinformatie. De nieuwe apparatuur die in de treinen in het noorden komt gaat daarbij helpen. Er komt nieuwe hardware in de treinen en een nieuw back-officesysteem. Dat systeem gaat vertraging doorgeven aan de reizigers, maar is nog steeds reactief. Het systeem communiceert nog niet automatisch naar de bus toe, want de bussen zijn nog uitgerust met een ander systeem. Op het moment dat hetzelfde systeem zou worden gebruikt, zou de buschauffeur een waarschuwing kunnen krijgen in geval van vertraging van de trein. In multimodale concessies zou dat dan kunnen worden geregeld, maar op plekken waar Arriva alleen de bus of trein rijdt is het dan nog niet mogelijk. Dan zou bijvoorbeeld Qbuzz dezelfde hardware moeten gaan aanschaffen. Daar ligt een taak voor de opdrachtgever. Die zou een werkgroep en geld beschikbaar kunnen stellen om dat te regelen. Het probleem zit er ook in dat bedrijven geen data delen, omdat dat concurrentiegevoelige informatie is.

Er komt ook nog iets anders bij kijken, namelijk de eisen van de opdrachtgever. Op dit moment wordt er in veel concessies afgerekend op te vroeg of te laat wegrijden met een bepaalde marge. Als de bus te lang wacht op de trein gaat dat geld kosten, terwijl de buschauffeur er niets aan kan doen dat de trein vertraagd is. Er vindt geen afrekening plaats op basis van reizigersvertraging. De vraag is wat belangrijker is en hoe het causaal verband (wanneer is het in het belang van de reiziger om te wachten) achteraf kan worden getrokken. Ook in Limburg wordt Arriva afgerekend op punctualiteit en inzetbaarheid. Aangezien Arriva heeft aangeboden om de bus-trein aansluitingen te verbeteren, zou het logisch zijn om daar ook met de opdrachtgever over te praten. Het gaat echter alleen werken als er bij zowel de verkeersleiding trein als bus mensen worden ingezet die alleen maar bezig zijn met de aansluitgarantie.

In de achterhoek geven machinisten vaak zelf al door dat ze te laat zijn. Dan wordt de verkeersleiding trein gevraagd om contact op te nemen met de verkeersleiding bus om door te geven dat de trein te laat is. Door ervaring weten de buschauffeurs daar vaak ook wanneer ze kunnen wachten. Het is echter een klein gebied en men probeert elkaar te helpen. Een machinist die heen en weer pendelt weet precies waar de aansluitingen krap zijn. Hoe groter het gebied wordt, hoe minder de betrokkenheid richting de reiziger wordt, omdat het personeel de reiziger niet meer kent.

Het probleem van dit systeem is echter dat het niet wenselijk is dat elke machinist gaat bellen, omdat dat voor heel veel telefoontjes zorgt. Op bepaalde knopen in Limburg zou het eventueel een oplossing kunnen zijn.

Hoe zou de communicatie tussen de verkeersleiding trein en bus kunnen verbeteren?
De werkzaamheden zijn zo verschillend dat het niet wenselijk is dat ze bij elkaar op zaal zitten. Dat heeft ermee te maken dat de mensen bij trein zich heel goed moeten kunnen afsluiten, terwijl het bij de verkeersleiding bus vaak druk is. In 2003/2004 is het geprobeerd, maar dat is misgegaan. Hierna heeft men het niet meer geprobeerd. Snel schakelen kan alleen maar als je fysiek bij elkaar zit of je technische hulpmiddelen zo zijn ingericht dat iedereen hetzelfde ziet en dezelfde oplossing krijgt voorgeschoteld. In Maastricht is de communicatie enorm verbeterd door het inhuizen van de verkeersleiding bij de post ProRail, vooral in tijd. Het is merkbaar dat het opstarten van de treindienst, na een calamiteit, daar aanmerkelijk sneller gaat. Het kan zomaar een halfuur schelen. Het komt voor dat de teamleider van ProRail, de decentrale verkeersleider, de treindienstleider en de verkeersleider van Arriva daar even kort samen overleggen. Dat helpt heel veel, want daarna staan alle neuzen dezelfde kant op. Een samenwerking bus-trein zou daar bijvoorbeeld ook baat bij kunnen hebben.

Eisen in een bestek en de opdrachtgever, dwingen ons echter tot een decentrale verkeersleiding waardoor het soms onmogelijk wordt om fysiek bij elkaar te zitten. Ook in de concessie Groningen-Drenthe was een eis dat er een verkeersleiding bus in Groningen kwam te zitten. Datzelfde geldt voor Limburg, waar ook voor bus een aparte post werd geeist. In eerste instantie zou daar ook iemand speciaal zijn voor bus-trein aansluitingen. Dat is er niet van gekomen. Voor de afwegingen tussen centraliseren en decentraliseren van de verkeersleiding zijn meerdere voor- en nadelen te noemen. Argumenten voor decentralisatie zijn het contact met de regio, kennis hebben van de regio en het feit dat dezelfde mensen altijd dezelfde baanvakken bedienen. Bij centralisatie zijn minder ftes nodig doordat er bijvoorbeeld meer baanvakken op één tafel bijgestuurd kunnen worden. Daardoor kan werk gedeeld worden en komt er meer begrip voor elkaars werk.

B7 Lennard van Damme & Sabine Kern

Hoofd afdeling vervoer en milieu / concessiemanager
Woensdag 6 juni 2018
Maastricht
Casus Limburg

Proces voor decentralisatie

Welke partij was initiatiefnemer voor de decentralisatie en wat heeft dit voor de rest van het proces betekend?
Het Nieuwe Spoorplan van FMN heeft de provincie Limburg geïnspireerd in de mogelijkheden die decentralisatie van stoptreinen biedt, bijvoorbeeld op het gebied van integratie van bus- en treinvervoer in een eigen regionet. Dat rapport was ook de aanleiding om het proces van decentralisatie in te gaan en de stoptreinen in eigen beheer te nemen.

Wat voor stappenplan heeft de provincie Limburg gevolgd in het proces om te komen tot gedecentraliseerde treindiensten? Wat ging hierin goed? Wat zou provincie Limburg anders doen?
Na het uitkomen van Het Nieuwe Spoorplan heeft de provincie initiatief genomen om de stoptreinen te decentraliseren. Ondertussen werd het plan van FMN door Janse de Jonge geëvalueerd, in opdracht van de minister. De uitslag van de evaluatie was wisselend per lijn en daarom werd beslist om een pilot te starten op een aantal positief beoordeelde trajecten. Dat was het geval voor de lijnen in Limburg en daarom werd besloten om daar te starten. De provincie is tevreden met het feit dat de pilot gestart is en daarom ook met het stappenplan dat gevolgd is.

Welke lessen trekt de provincie Limburg over de interacties met IenW, NS en ProRail over deze periode?
Het is belangrijk om consequent het reizigersbelang in het oog te houden. Er spelen een hoop andere processen en belangen een rol, maar het was in het belang van de reizigers om de decentralisatie door te zetten.

Welke lessen trekt de provincie Limburg over de interactie met de zittende/ toekomstige vervoerder (concessiehouder) over deze periode?
De provincie moet de verbindende schakel tussen de vervoerders zijn. Een rol als buffer tussen de verschillende, landelijke en regionale, vervoerders is nodig om een gelijk speelveld te creëren. De interactie met de regionale vervoerder heeft ervoor gezorgd dat het HRN in de provincie ook verbeterde. Een betrouwbaardere en frequentere dienstregeling heeft namelijk ook positieve gevolgen voor het HRN. Tevens kwam er meer focus te liggen op grensoverschrijdende (trein)verbindingen.

Wat zijn concrete aanbevelingen van de provincie Limburg aan medeoverheden over het proces in de periode voor de decentralisatie?
Het nemen van initiatief is belangrijk, ook als andere actoren niet direct positief zijn. Daarom is het ook belangrijk dat er bestuurlijk draagvlak en visie binnen de provincie is over de manier waarop dat het beste kan worden aangepakt.

Proces na decentralisatie

Welke lessen trekt de provincie Limburg over de interacties met IenW, NS en ProRail over deze periode?

Het is belangrijk om te realiseren wat de belangen en posities van de verschillende actoren zijn. Bij sommige actoren is dat duidelijk, maar soms kunnen de rollen vermengd zijn. Door dat in het achterhoofd te houden wordt het makkelijker om zelf een positie in te nemen.

Welke lessen trekt de provincie Limburg over de interactie met de vervoerder (concessiehouder) over deze periode?
In de periode ter voorbereiding op de aanbesteding van de treinen was er voornamelijk interactie met NS. Er is geprobeerd om data van NS te verkrijgen over de aantal reizigers op de verschillende trajecten om zo een gelijk speelveld te creëren voor alle mogelijk nieuwe concessiehouders. Dat bleek echter moeilijk, omdat de belangen groot zijn. Het is een belangrijke les om daar goede afspraken over de maken.

Wat zijn concrete aanbevelingen van de provincie Limburg aan medeoverheden over het proces in de periode na de decentralisatie?
Er moeten goede afspraken worden gemaakt over aspecten die raken aan samenloop. Het doel is om het gehele ov-systeem zoveel mogelijk te integreren, want dat is het best voor de reiziger. Dat vraagt om beter samenspel tussen de vervoerders. Op dit moment zijn het landelijke NS-tarief en het Provinciale tarief op dezelfde relaties niet gelijk. Als echter overgestapt wordt op een aansluitende bus is het regionale Limburg tarief aantrekkelijker. Een gelijke prijs voor gelijke relatie moet nog gerealiseerd worden. NS en Arriva hebben overeenstemming bereikt over samenwerking onderling tussen service- en controlepersoneel. Dit komt de sociale veiligheid ten goede. Alle verkooppunten in Limburg zijn gecombineerde punten van Arriva en NS.

Inhoud

Hoe is het decentralisatieconvenant inhoudelijk tot stand gekomen?
I&W heeft een voorstel gedaan voor het decentralisatieconvenant. Vervolgens is er over de voorwaarden van dat convenant onderhandeld met I&W. Daar is uiteindelijk een convenant uit gekomen waarmee de decentralisatie een feit werd.

We hebben het convenant gezien voor de laatste decentralisaties voor Limburg. In hoeverre zou de provincie Limburg dit convenant weer toepassen (vorm en aandachtspunten)?
Dat is op dit moment niet aan de orde. Alle stoptreinen in de provincie zijn nu gedecentraliseerd. Omdat dat gelukt is, is het belangrijkste doel bereikt.

Waar moeten overheden op letten?
Het is van belang om goed te onderhandelen met I&W over de voorwaarden van decentralisatie. Dat geeft de provincie uiteindelijk een betere positie wanneer de decentrale spoorlijnen worden overgenomen.s

Effecten decentralisatie

Kan de provincie Limburg aangeven wat de decentralisatie van treindiensten voor de provincie heeft gebracht?
Het is lastig om op dit moment te zeggen wat de precieze effecten voor de reiziger zijn, omdat er nog (meer) objectieve resultaten moeten komen over de prestaties. Toch zijn er in het algemeen wel positieve punten te noemen. In ieder geval is het openbaar vervoer nu beter geïntegreerd dan voorheen en het lijnennet van de bus is beter afgestemd op die van de trein. Dat is in het belang van de reiziger. Daarnaast is er tariefintegratie gekomen voor bus en stoptrein, wat ervoor zorgt dat reizigers binnen de provincie eenvoudiger en goedkoper multimodaal kunnen reizen. Tenslotte heeft de kwaliteitsverbetering ook effect op het HRN van NS, zoals reeds genoemd.

Kan de provincie Limburg aangeven wat de decentralisatie van treindiensten de provincie Limburg heeft gekost?
Inhoudelijk gezien zijn er weinig kosten gemaakt. Kleine kernen kunnen soms nadeel ondervinden van de huidige organisatie, alleen heeft dat niet direct te maken met de decentralisatie. De kosten zitten met name in de eigen inzet van de provincie om alles voor elkaar te krijgen. De periode van decentralisatie is voor de provincie zelf erg intensief geweest.

B8 Wim Brethouwer

Beleidsmedewerker openbaar vervoer bij provincie Fryslân
Donderdag 23 augustus
Leeuwarden
Casus Fryslân

Hoe is de huidige concessie-indeling in Fryslân ontstaan?
In 1999 was Fryslân een van de eersten die bezig was met een multimodale concessie. Syntus was net eerder in de Achterhoek. NoordNed reed in Noord- en West-Fryslân zowel bus als trein en is het nodige gaan ontwikkelen voor een betere afstemming daartussen. Zo zijn ze bezig geweest met een integraal tariefsysteem voor trein en bus. Toch kwam de integratie niet helemaal uit de verf, zoals was verwacht. De concessie aan NoordNed was onderhands gegund. Toen aanbesteden verplicht werd bleek het handig om de noordelijke spoorlijnen samen met Groningen aan te besteden. De spoorlijn Leeuwarden-Groningen houdt immers niet op bij de grens. Daarnaast speelden schaalvoordelen een rol. Het werd moeilijk om dan trein en bus ook nog samen aan te besteden. Daardoor werd de multimodale concessie weer losgelaten. De treinconcessie werd aan Arriva gegund en die had ook een deel van het busvervoer al in handen. Arriva had ook ideeën over multimodaliteit, waarvan sommige beter uit de verf kwamen dan andere. Op een gegeven moment was het idee dat de trein naar Harlingen 's avonds niet meer hoefde te rijden, omdat er ook een bus reed. De bestaande buslijn moest die reizigers dan overnemen. Dat was voor de provincie wel bespreekbaar, maar dan moet er een snelle busverbinding zijn en dat was niet het geval. Dat was een stap te ver.

Er werd lange tijd op aangestuurd om in 2020 weer een multimodale concessie aan te besteden, maar toen kwam dezelfde afweging weer. De omvang en complexiteit leidden toch tot de keuze om trein en bus tocht weer apart te doen. Wat wel gebeurd is dat de busconcessies steeds groter worden. Naar alle waarschijnlijkheid is ook in Fryslân vanaf 2022 één busconcessie. De concessie zou aflopen in 2020, maar is met twee jaar verlengd, omdat de provincie op dit moment nog niet duidelijk voor ogen heeft wat zij wil uitvragen. In de tijd tot december 2022 kunnen nog een aantal experimenten worden gedaan.

In hoeverre is het een voordeel dat Arriva zowel trein als bus rijdt in Fryslân?
Het is een voordeel, maar er wordt nog niet optimaal gebruik van gemaakt. Er is wel geprobeerd om flexibel personeel, zowel werkzaam als buschauffeur als machinist, in te voeren. Dat bleek erg lastig. Het valt, in het algemeen, vaak tegen voor vervoerders om met iets heel nieuws te komen. Vaak richten ze zich op wat de opdrachtgever heeft uitgevraagd. Dat is op zich logisch, want vervoerders willen natuurlijk aanbestedingen winnen. Verder zijn de marges smal. Dat zorgt ervoor dat er weinig capaciteit is om nieuwe dingen te ontwikkelen. Er wordt veel gefocust op efficiency en financiën. Dat vertaalt zich in efficiënte omlopen. Dat gebeurt ook vaak bij dienstregelingsvoorstellen en dat kan wel eens ten koste gaan van de vernieuwing en flexibiliteit.

In principe is er vanuit de provincie aparte aansturing van de bus- en treinconcessie. Er wordt wel eens integraal gekeken, maar doordat het verschillende werelden zijn is dat beperkt. Arriva heeft het qua aansturing intern ook gescheiden.

Op welke manier worden trein en bus op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?
Het visgraatmodel is al heel lang bekend in Nederland, voornamelijk na het succes van Syntus in de Achterhoek. Daarom is er ook in Fryslân gekeken naar de mogelijkheden daarvan. Daaruit bleek dat er eigenlijk weinig mogelijkheden zijn om dat uit te werken. Het levert vaak weinig winst op. Dat heeft onder andere te maken met de geografische structuur. Er zijn weinig mogelijkheden om dwars

op het spoor te rijden. Alle vervoersstromen zijn op Leeuwarden gericht. Daarnaast zijn de afstanden te kort om een overstap lonend te maken. Omdat trein en bus ook een eigen tariefsysteem hebben maakt dat een gecombineerde reis vaak duur. Dat is ook een belemmering. Tot slot kent Fryslân veel water. Dat zorgt ervoor dat niet elke verbinding direct gemaakt kan worden. Het netwerk dat er op dit moment is lijkt daarom nog veel op het netwerk ten tijde van NoordNed. Er zijn wat wijzigingen gekomen, onder andere door nieuwe wegen, maar het is sindsdien niet ingrijpend veranderd. Als er een andere vervoerder zou komen heeft dat waarschijnlijk ook weinig invloed op het netwerk. In het programma van eisen staat vrij duidelijk beschreven waar een vervoerder aan moet voldoen. Connexxion heeft ook een tijd bussen gereden in een deel van Fryslân. Zij hebben toen ook niet een heel ander lijnennet ingevoerd.

De provincie is kritisch op buslijnen die parallel lopen aan de treinlijnen. In principe zijn die lijnen er niet, tenzij er een goede reden voor is. Vaak bediend een dergelijke buslijn dorpen onderweg waar de trein niet stopt of staat er een school. Bijvoorbeeld in Heerenveen staat een school aan de noordkant. Het is makkelijker als de bus dan direct naar die school rijdt. Ook tussen Leeuwarden en Franeker is dat zo. Het staat niet zwart op wit in het contract waar wel en niet gereden mag worden, maar in goed overleg met de vervoerder komen we er altijd uit als er discussie is over dergelijke lijnen. Arriva is afhankelijk van de opdrachtgever, dus een goede verstandhouding is belangrijk. Echt grote strijdpunten zijn er ook niet.

Op dit moment rijdt de Opstapper op plekken waar geen openbaar vervoer is. De Opstapper brengt mensen na reservering naar een knooppunt. Er zit een gestage groei in het aantal gebruikers. Op sommige plaatsen wordt er regelmatig gebruik van gemaakt, op andere plaatsen nauwelijks. Het idee hierachter lijkt wel wat op het visgraatmodel met het verschil dat sommige dorpen op verschillende knooppunten georiënteerd zijn. Daarom is ervoor gekozen om voor sommige dorpen meerdere verbindingen aan te bieden met de Opstapper. Het is de vraag of de Opstapper op langere termijn financieel houdbaar is. Die vraag is er ook voor rustige buslijnen.

Het netwerk is op dit moment op zich goed, maar er is wel een aantal plekken waar het aantal reizigers toe zou mogen nemen. Er wordt gekeken naar alternatieven voor rustige buslijnen. Dat kan betekenen dat het busnetwerk wat wordt aangepast, want de treininfrastructuur ligt vast. De busconcessies voor Arriva zijn verlengd en dat biedt de mogelijkheid om wat te experimenteren. Zo worden er een paar buslijnen gestrekt. Op dit moment zijn er twee buslijnen in een aantal plaatsen gestrekt en volgend jaar komen daar nog een paar bij. Een ander experiment heeft te maken met een andere opzet van het vervoer in het landelijk gebied. De provinciale staten hebben een motie aangenomen om die gebieden als ‘blanco gebieden’ te zien, waarbij de hoofdstructuur gehandhaafd blijft en het gebied daarbinnen opnieuw wordt ingericht. Er wordt dan naar een oplossing gezocht door met de bevolking en andere betrokkenen in gesprek te gaan. Dat is nu in voorbereiding. Voor elk gebied is een adviesbureau ingehuurd met een andere invalshoek. Er wordt in ieder geval breder gekeken dan alleen openbaar vervoer. Arriva is gevraagd om ook zelf met een plan te komen om dat ernaast te leggen.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
Er is op dit moment geen afstemming. NoordNed is ooit bezig geweest met een eigen tariefsysteem, maar om een of andere reden is dat niet van de grond gekomen.

Op plekken waar Arriva bus en trein rijdt is dergelijke afstemming wel makkelijker dan plekken waar NS de sprinters rijdt. Het is met NS lastig om daar afspraken over te maken. Arriva kan bijvoorbeeld zelf de tarieven aanpassen. Doordat het aantal overstappers van bus op trein beperkt is, is dat waarschijnlijk niet geregeld.

In hoeverre is de informatievoorziening en communicatie naar reizigers van trein en bus op elkaar afgestemd?
In principe is de informatie voor reizigers gescheiden. Zowel bus als trein hebben een eigen systeem. Voor kleinere knooppunten zou het handig kunnen zijn om gezamenlijke informatievoorziening te creëren, maar het is op dit moment niet een heel belangrijk punt. Het netwerk is wel duidelijk. Het aantal overstappers van trein op bus is beperkt. De trein is veel populairder dan de bus.

In welke mate worden trein-busaansluitingen gegarandeerd bij vertraging?
Dat is in beperkte mate geregeld. In het contract is gevraagd aan de busvervoerder om met een wachttijdenregeling te komen van een paar minuten. Bij de laatste verbinding is de wachttijd wat langer. Een trein wacht in principe niet op een vertraagde bus. Het is niet een onderwerp dat vaak terugkomt in de concessie-overleggen. Dat heeft ook te maken met de hoge punctualiteit van de trein. Het gaat vaker over aansluitingen tussen regionale en landelijke treinen.

Arriva heeft beperkte mogelijkheden om ov-chipkaartgegevens concessieoverstijgend te gebruiken. In principe is dat in verband met privacywetgeving verboden. Als dat wel mogelijk zou zijn zou het mogelijk zijn om te weten hoeveel overstappers er zijn. Het lijkt erop dat het aantal vrij beperkt is. Met die kennis zou het mogelijk zijn om meer inzicht te krijgen in welke aansluitingen belangrijk zijn.

Wat gaat goed in de afstemming tussen trein en bus?
De keuzes die gemaakt worden in de dienstregeling, waarin de trein leidend is en er goed wordt gekeken naar aansluitingen. Dat heeft te maken met het feit dat zowel de provincie als de vervoerder het belangrijk vindt om goede aansluitingen te hebben.

Wat kan beter in de afstemming tussen trein en bus?
Als er één concessie zou zijn, zou het personeel het ov-systeem ook als geheel gaat zien. Trein en bus zijn wat dat betreft nu nog wel echt gescheiden.

Wat zijn volgens u de belangrijkste voor- en nadelen van het decentraliseren van de lijnen Zwolle-Groningen en Zwolle-Leeuwarden?
Het gaat erom of het voor de reiziger voordelen oplevert. Het is niet decentraliseren om het decentraliseren. Betere afstemming tussen trein en bus, overstappen, communicatie, betere bediening zijn daarin belangrijke punten. Tussen Leeuwarden en Heerenveen zou de aansluiting op de trein beter kunnen als er tariefintegratie is. Op dit moment rijden veel bussen zelf door naar Leeuwarden. Het visgraatmodel zou daar nog beter toegepast kunnen worden.

Mogelijke nadelen zijn dat er verschillende treinvervoerders zijn. Dat zorgt voor extra communicatie onderling, maar ook extra paaltjes om in te checken. De provincie is ook vaarwegbeheerder, dus de bruggen op het traject bepalen in belangrijke mate de dienstregeling al. Daar zit weinig ruimte in. Al met al blijft het een afweging tussen de aansluiting op het landelijke net of het regionale net.

B9 Jorne Bonte

Projectleider dienstregeling bij OV-bureau Groningen-Drenthe
Donderdag 19 juli 2018
Assen
Casus Groningen

Wat is de verhouding tussen het OV-bureau en de provincie?
Het OV-bureau Groningen-Drenthe is een gemeenschappelijke regeling van de provincies Groningen en Drenthe en de gemeente Groningen. Fleur Gräper is voorzitter van het dagelijks bestuur van het OV-bureau en tevens de gedeputeerde van Groningen en daarmee de concessieverlener van spoor. Er is dus een directe verbinding tussen de provincie en het OV-bureau.

Hoe komt de dienstregeling tot stand?
Het OV-bureau is daarin leidend, maar het gaat in samenwerking met de vervoerder. Uiteindelijk hakt het OV-bureau de knopen door. De dienstregeling op hoofdlijn wordt bijvoorbeeld goedgekeurd door het OV-bureau. Dat is net gebeurd voor 2019. Dat gaat natuurlijk in overleg met de vervoerder en vele andere partijen als gemeenten, provincies, Rijkswaterstaat, aanpalende vervoerders, consumentenorganisaties e.d.

In het najaar keurt het dagelijks bestuur van het OV-bureau de uitgangspunten voor de nieuwe dienstregeling goed. Daarin staat onder andere het financiële kader, wat inhoudelijk belangrijk is en hoe het proces eruit gaat zien. Samen met de vervoerder(s) en de gemeenten gaat het OV-bureau daar verder invulling aan geven. Uiteindelijk schrijft het OV-bureau de ontwerphoofdlijnen dienstregeling. Daarover wordt nadrukkelijk met de vervoerder overlegt, omdat uiteindelijk in de details duidelijk wordt of uiteindelijk iets wel of niet kan. Ook het OV-bureau heeft geen belang bij een zeer inefficiënte dienstregeling. Dat zorgt alleen maar voor slecht ingezette bussen, slechte aansluitingen, etc. Ook de input van de chauffeurs, reizigers, consumentenorganisaties en gemeenten is daarin belangrijk. Eind april kan het bestuur dan de ontwerphoofdlijnen goedkeuren. Dan wordt er zoveel mogelijk geïnformeerd richting alle partijen om feedback te krijgen. Er wordt een bijeenkomst geregeld met alle wethouders verkeer en vervoer uit het gebied. Al die input die daaruit komt wordt gebruikt om de definitieve hoofdlijnen goed te keuren, weer in samenspraak met alle betrokken partijen. Per verbinding / lijn wordt dan beschreven wat er aan de hand is en wat er aangedaan gaat worden. Meestal wordt dat door het bestuur eind juni / begin juli goedgekeurd. Op basis van die hoofdlijnen wordt de dienstregeling tot in detail uitgewerkt.

Het basisnetwerk is vastgelegd in de omgevingsvisie. Daar staan verbindingen in die voor tien jaar zijn vastgelegd. De exacte route is niet vastgelegd, maar wel een minimale (vaste) frequentie. Daar worden dus geen ritten geschrapt als daarmee de basisbediening minder zou worden. Verder zijn de hubs vastgelegd, waar bussen op elkaar aansluiten en waar in ieder geval fiets- en autoparkeerplekken zijn. Dat zijn de overstappunten. Ook de HOV-lijnen zijn vastgelegd, maar dan voor 20 jaar. De definitie van HOV is ook vastgelegd daarin. Bij die lijnen is het maken van aansluitingen vaak minder moeilijk vanwege veel hogere frequenties. De uitdaging zit meer in de knopen waar bussen minder vaak rijden.

Op welke manier worden trein en bus op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?
In het proces van de dienstregeling, als voor het spoor enigszins bekend is welke kant het opgaat (januari / februari), is er een overleg met zowel NS /Arriva als de busvervoerders. Dan wordt de nieuwe dienstregeling besproken en worden zaken op elkaar afgestemd, bijvoorbeeld als het ergens misgaat. Soms komen er ook later nog dingen doorheen. Zo is de uurdienst naar Veendam en Winschoten 's avonds en op zondag omgedraaid. Qbuzz heeft behoorlijk veel werk gehad aan de

aansluitingen. Uiteindelijk bleek dat het kon en op veel plekken zelfs betere aansluitingen opleverde. Die terugkoppeling is toen gegeven. Op basis daarvan is door de provincie de knoop doorgehakt dat het kon. Van tevoren is er dus afstemming over de aansluitingen. Als die afstemming er niet zou zijn zou het enorm vervelende consequenties kunnen hebben voor reizigers. Het is in het belang van alle partijen om daar goed over te overleggen. Met name in de daluren kan iedereen wel reizigers gebruiken, zeker in Oost-Groningen. Dan moeten de aansluitingen goed zijn. In de spits zitten treinen en bussen wel vol.

De lijnvoering sec gebeurt voornamelijk samen met de busvervoerder, als is daar ook wel afstemming met de treinvervoerder. Zo zijn op nadrukkelijk verzoek van de provincie en de treinvervoerder de Qliner-ritten geschrapt toen de trein naar Veendam ging rijden. Tegelijkertijd zijn de scholierenlijnen blijven rijden omdat het in de spits ontzettend druk is. Ook rijdt Qbuzz op verzoek van provincie en /of Arriva nog een paar extra ritten in de spits richting Zernike vanuit Winsum en Winschoten. Iedereen heeft elkaar nodig en daarom is afstemming ook belangrijk. Een reiziger reist van A naar B en wil zo min mogelijk te maken hebben met gedoe tussen vervoerders en concessies.

Qlink is ontwikkeld in samenwerking tussen het OV-bureau en Qbuzz, maar de rechten liggen bij het OV-bureau. De uitrol van Qlink is niet uitdrukkelijk besproken met Arriva. Er is wel afstemming geweest over de aansluitingen, maar niet over frequenties en dergelijke. Dat wordt wel besproken, maar Arriva heeft daar geen zeggenschap over.

In de Achterhoek is ooit het visgraatmodel uitgerold. Dat was voor het netwerk toen heel goed: hogere frequenties, meer betrouwbaarheid en aantrekkelijker voor reizigers. De dubbelingen in het netwerk gingen eruit. Dat is in Groningen-Drenthe ook zoveel mogelijk gedaan: geen dubbelingen waar dat niet nodig is. Tegelijkertijd is het openbaar vervoer in het gebied ook doorgegroeid, met name richting de stad Groningen. Daarom zijn er aanvullend op de trein extra vervoermogelijkheden nodig. De stad is best groot en de trein heeft maar een beperkt aantal stations. Andere belangrijke bestemming voor reizigers in het gebied kunnen daarom beter bediend worden met de bus. Bijvoorbeeld in Winsum is de trein de snelste en beste verbinding richting het hoofdstation. Lijn 65 uit het gebied rijdt daar ook. Scholieren richting Groningen-Zuid stappen daar veel over op de trein, maar reizigers richting Kardinge blijven bijvoorbeeld in de bus. Daarmee vullen bus en trein elkaar op dergelijke verbindingen mooi aan. Datzelfde geldt voor Delfzijl-Appingedam-Groningen. Richting Lewenborg is de bus gewoon sneller. Op dergelijke verbindingen blijft het aantal reizigers in zowel bus als trein groeien. Dat zijn veelal reizigers die uit de auto gaan. Met alleen spoor of alleen bus zou je die niet allemaal het openbaar vervoer in krijgen, maar met elkaar wordt het hele ov-systeem naar een hoger niveau getild.

Op veel plekken, met name op het platteland, werkt het visgraatmodel goed. Vanuit Vlagtwedde gaat bijvoorbeeld een bus naar Winschoten in plaats van naar Groningen. Vanaf Winschoten kan snel worden overgestapt op de trein naar Groningen. Waar dat goed gecombineerd kan worden qua capaciteit is dat doorgevoerd. Belangrijk in de Achterhoek was ook dat in bijvoorbeeld Vorden een bus en trein niet op dezelfde plek in het dorp stopten, maar dat wel zijn gaan doen bij de invoering van het visgraatmodel. Dat is ook in Groningen en Drenthe doorgevoerd om de aansluitingen te verbeteren. Waar het handiger is om met de bus apart te blijven rijden gebeurt dat ook om het totale vervoerssysteem voor de reizigers mooier te maken, met name richting de stad. Daar zijn de vervoersstromen vaak groot en met diverse bestemmingen. Zowel bus en trein hebben daar vaak capaciteitsproblemen.

Op directieniveau vindt er ook regelmatig overleg plaats over bus-trein integratie op hoofdlijnen. Dat gaat erover hoe de organisatie als geheel de integratie kan verbeteren. Welke richting gaat we

op? Met elkaar vinden we dat samenwerken belangrijk is en dat hoeft niet perse in dezelfde concessie.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
De ov-chipkaart speelt daar een belangrijke rol in. Het is makkelijk om in- en uit te checken bij bus en trein. Er is één betaalbewijs voor beide systemen. In het contract voor het regionaal spoorvervoer Groningen is ook opgenomen dat het sterabonnement geldig is. Dat wordt ook gebruikt in de bus. Daarmee is 1 abonnement voor beide systemen beschikbaar. Met name scholieren maken daar gebruik van. Juist in Groningen is dat van belang, omdat er best veel spoor is waarop met de bus gefeederd wordt. Het tarief van het sterabonnement onderling afgestemd. Afgelopen jaar is er ook een kortingsabonnement geïntroduceerd van al het openbaar vervoer in het noorden, behalve de trein van NS.

De rest van de reisproducten is gescheiden. Dat gaat dan met name over de papieren kaartjes. In de bus maakt ongeveer 10% van de reizigers daar gebruik van. Er kan worden gekeken naar de integratie daarvan, maar dat wordt lastig. Dan moeten de tarieven en opbrengsten worden afgestemd en het is maar een beperkt deel van de reizigers waar dat dan voor wordt gedaan. Het digitaliseren van de papieren kaartjes gaat behoorlijk in de papieren lopen. Het is nu belangrijker om het basissysteem goed op orde te hebben.

In hoeverre is de informatievoorziening en communicatie naar reizigers van trein en bus op elkaar afgestemd?
Alle data van de reisinformatie is openbaar. Alle partijen kunnen daarbij, zoals 9292. Google Maps is een ander voorbeeld. De reisplanner op de site van Arriva of Qbuzz geeft ook beide modaliteiten. De dienstregelingstabellen zijn wel apart. Verder staat in de OV-krant, die huis-aan-huis wordt verspreid, ook de informatie over het spoorvervoer. Ook NS en Arriva kunnen daar informatie in kwijt.

In welke mate worden trein-busaansluitingen gegarandeerd bij vertraging?
Er is veel overleg over grote geplande spoorstremmingen met alle partijen om de werkzaamheden te bespreken, de consequenties en hoe de overlast kan worden beperkt. Zo rijden bij een stremming tussen Assen en Groningen de stopbussen naar P+R Haren, zodat reizigers daar met reguliere bussen naar Haren kunnen. Dat is een veel snellere verbinding dan wanneer de NS-bus al die stations moet aandoen. In enkele gevallen rijdt bijvoorbeeld Arriva wel naar station Europapark en reizen NS-reizigers ook met hen mee. Dat soort afstemming vindt plaats.

Een aandachtspunt is nog de ongeplande stremmingen. Daarvoor is wel de afspraak gemaakt dat als NS of Arriva niet voldoende bussen hebben, dat ook Qbuzz wordt gebeld. In de spits is dat lastig, maar in de daluren zijn daar wel mogelijkheden.

In het bestek zijn ook eisen opgeteld voor de wachttijd van een bus bij een vertraagde trein. Een belangrijk punt daarbij is de communicatie naar de chauffeur. De chauffeur weet niet altijd hoeveel de trein later is en anders moet hij contact opnemen met de verkeersleiding. De reiziger weet meer dan de chauffeur soms. Het wachten bij vertraging is nog wel een aandachtspunt. Wat er vaak gebeurt is dat de Arrivatreinen aan willen sluiten op de NS-treinen (i.v.m. meerdere reizigers die overstappen die hier mee gebaat zijn) en daar vaak wachten als het kan. Dan lijkt het bijvoorbeeld in Delfzijl niet altijd helemaal goed te gaan met de aansluiting op de bus. Er wordt door het OV-bureau niet gemeten hoe vaak het goed gaat.

Wat gaat goed in de afstemming tussen trein en bus?
In het gezamenlijk belang van de reizigers wordt er gekeken naar wat er samen gedaan kan worden om reizigers in het totale openbaar vervoersysteem van o.a. bus en trein zo goed mogelijk te

faciliteren en ontzorgen. Bijvoorbeeld op het gebied van overstappen. Ook op het niveau van communicatie gaat het steeds beter. Dat gaat over de verschillende modaliteiten en concessies heen. Het gezamenlijk belang staat voorop. Dat wordt ook op bestuurlijk- en directieniveau uitgesproken en uitgedragen. Het is belangrijk dat het bestuur en de directie dat ook vindt en uitstraalt. Het wordt zo uitgedragen dat samenwerking belangrijk is.

Wat kan beter in de afstemming tussen trein en bus?
Het belangrijkste is om gezamenlijk te kijken naar het belang van de reiziger en daarover met alle partijen goed mee af stemmen. Dat gaat vaak beter met Arriva dan met NS. Er wordt wel samengewerkt met NS, maar NS doet wel vaak haar eigen ding. Zo is het bijvoorbeeld erg jammer dat NS niet meedoet met het regionale kortingsproduct.

Verder zijn de ongeplande spoorstremmingen nog een aandachtspunt. Het zorgt voor enorm veel overlast als een trein niet rijdt en dat zou minder moeten zijn. De bus is in die zin veel betrouwbaarder. Er valt zelden een bus uit en de impact bij een stremming is veel kleiner.

B10 Herman Sinnema

Concessiebeheerder trein bij provincie Groningen
Woensdag 22 augustus 2018
Utrecht
Casus Groningen

Wat is de verhouding tussen de provincie Groningen en het OV-bureau?
De provincie is één van de drie 'moeders' van het OV-bureau. Het OV-bureau heeft ambtelijke voorbereidende vergaderingen, bestuurlijke vergaderingen en ook een bestuurlijke voorzitter. De bestuurlijke voorzitter is nu de gedeputeerde van de provincie Groningen. In principe hebben die drie partijen, provincie Groningen, provincie Drenthe en de gemeente Groningen, het voor het zeggen. Ook zijn die drie partijen politiek verantwoordelijk voor het OV-bureau. Op die manier is er politieke controle. Dat betekent dus bijvoorbeeld dat dienstregelings- en tariefvoorstellen langs alle provincies moeten.

Het OV-bureau is ontstaan vanuit de gedachte dat als een vervoerder opbrengstverantwoordelijk is er aan het begin van de concessie heel veel gebeurt, maar richting het einde niet meer. Daar zijn qua materieel natuurlijk wel overnameregelingen voor, maar de gedachte was dat de overheid de ontwikkeling van het netwerk beter zelf kan doen. En ook dat de overheid dan meer profiteert van de geplande investeringen in infrastructuur, omdat er minder dienstregelingsuren nodig zijn. Er is van alles voor en tegen te zeggen, maar bij de trein is Arriva opbrengstverantwoordelijk en heeft de ontwikkelfunctie en bij de bus heeft de overheid dat.

Voor de samenhang tussen bus en trein zou het beter zijn om beide organisaties te integreren, maar nu is er juist gekozen voor de samenhang tussen het busvervoer in Groningen en Drenthe, bijvoorbeeld bij Stadskanaal en Emmen. Als de trein daarbij zou komen, waarbij de concessie loopt van Friesland tot Duitsland, zouden ook de busconcessies in Friesland erbij moeten en wordt de concessie veel te groot. Er is geen bedrijf dat dat kan financieren. Dat is nu ook al de uitdaging, gegeven de 70 treinen van de noordelijke treinconcessie: een enorm te financieren bedrag.

De consequentie is dat er schotten tussen de trein- en busconcessies zitten. Wanneer het gaat over de afstemming tussen trein en bus moet er met heel veel praten uit gekomen worden. Ook is er een gezamenlijke ontwikkelagenda. Waar zou moeten gelden dat het reizigersbelang voorop staat, heeft toch elke partij eigen doelstellingen voor wat betreft de opbrengsten. Zo heeft ook het OV-bureau een eigen begroting. In het verleden zijn daar ook wel eens tekorten geweest. Voor het OV-bureau is het wel beheersbaarder als er wat hekken rondom de concessie staan.

Op welke manier worden trein en bus op elkaar afgestemd op het gebied van netwerkontwerp en dienstregeling?
Dat gaat voor een deel buiten de opdrachtgevers om. In het contract staat wat Arriva mag doen wat betreft dienstregelingswijzigingen en zij voelen het ook in de portemonnee wanneer dat niet goed gaat. Er staat in het contract welke aansluitingen er moeten zijn en welke frequenties. Voor een heel groot deel ligt het daarmee ook wel vast. Bij de belangrijkste overleggen zijn de opdrachtgevers wel aanwezig, bijvoorbeeld bij het hoofdlijnenoverleg voor de dienstregeling. Het is vaak wel fijn om daar als opdrachtgever bij te zijn en mee te denken en mee te kijken. Maar Arriva heeft ook overleggen met NS, het OV-bureau, etcetera. Daar zit de opdrachtgever vaak niet bij.

In Groningen is het netwerk al redelijk opgeruimd. Bussen gaan bijvoorbeeld naar Winschoten of Veendam en vanaf daar rijdt de trein verder. De parallelliteit is er voor een groot deel al wel uit. Tot op zekere hoogte is er een visgraatmodel. Er zijn nog wel enkele lijnen die parallel rijden. Dat zijn

voor een deel bussen die doorrijden naar de Grote Markt. Dat is voor sommige reizigers een stuk sneller, waardoor is besloten die lijnen te handhaven.

Er zou meer overleg kunnen plaatsvinden tussen provincie en OV-bureau om te kijken of er ideeën zijn waar iedereen er beter van wordt, uiteraard inclusief de reiziger.

In principe is het OV-bureau zelfstandig, maar als er dingen niet goed gaan komt dat ook bij de provincie terecht. Uiteindelijk is de provincie politiek verantwoordelijk.

Hoe worden trein en bus op elkaar afgestemd wat betreft kaarten en tarieven?
Het tariefassortiment heeft overlap, maar is niet hetzelfde voor bus en trein. Daar worden wel stappen in gezet. Arriva had een eigen dal-kortingsproduct en het OV-bureau ook. De voorwaarden waren verschillend. Nu is er een noordelijk dal-kortingsproduct voor Friesland, Groningen en Drenthe. Dat is een goede eerste stap. De sterabonnementen zijn er ook nog steeds voor Groningen en Drenthe. Die zijn ook geldig in Arriva-treinen. Voor de rest zitten er wel verschillen tussen bus- en treinproducten. Het is de vraag hoe het was gegaan als het één organisatie was geweest of vervoerkundigen bij elkaar waren gaan zitten. Veel dingen waren dan waarschijnlijk hetzelfde, maar er waren vast wel wat dingen gevonden die beter konden.

Het is lastig om te weten hoeveel reizigers benadeeld worden door het huidige tarievensysteem. Onderzoek daarnaar begint met een ov-chipkaartonderzoek. Daar komt uit van waar naar waar reizigers reizen. Het gaat dan om een analyse over de concessies heen. Dat kunnen losse vervoerders niet zien. Uit dat onderzoek blijkt dan of er reizigers zijn die erg duur uit zijn, doordat ze bijvoorbeeld twee abonnementen moeten kopen.

Wat heel erg verschilt per opdrachtgever hoe het regionale netwerk functioneert. Eigenlijk is dat een keuze die gemaakt moet worden. In Groningen is er altijd veel aandacht voor de aansluiting van het regionale spoornetwerk op het landelijke net. Overal zijn de NS-abonnementen geldig. Dat is niet een afspraak tussen opdrachtgevers, maar tussen vervoerders onderling. De regionale vervoerders met NS hebben dat samen geregeld. Het was geen afspraak in het NOVB, waar ook de staatssecretaris bij zit. Soms leidt dat wel tot keuzes. In heel veel gebieden is er geen opstaptarief meer tussen bus en trein, zoals in Limburg. Dat is eigenlijk overal behalve in het noorden, maar dat is een keuze die gemaakt is. De afweging om vooral regionaal de tariefsystemen te integreren of juist de integratie met het landelijke spoorsysteem te zoeken blijkt ook uit het volgende. Om enkelvoudig in- en uitchecken in de treinketen te bereiken, moet de keuze gemaakt worden of bij iedereen of bij niemand het opstaptarief eraf gaat bij de in-check op een station. Gecombineerde bus-treinabonnementen maken het ook ingewikkeld. Het regionaal maatwerk bieden kan ervoor zorgen dat landelijke systeemintegratie wordt bemoeilijkt. Beide werelden samen kan niet. Regionale producten op je kaart kunnen er voor zorgen dat je bij een doorgaande reis regio-NS geen lange afstandskorting meer krijgt.

In hoeverre is de informatievoorziening en communicatie naar reizigers van trein en bus op elkaar afgestemd?
Er vindt bij het nieuwe dal-kortingsproduct samenwerking plaats tussen Arriva en het OV-bureau op het gebied van communicatie. Voor de rest is de communicatie nog veel gescheiden. Gevonden voorwerpen worden bijvoorbeeld per vervoerder bewaard, dus dan is het logisch dat de reiziger verschillende aanspreekpunten heeft. Toch gaat er al wel wat beter. Er is een bezem gehaald door de kaarten en de producten die niet veel werden verkocht zijn verdwenen. Voor de trein is het heel overzichtelijk, omdat het een landelijk assortiment is met aanvullend regionale producten. Die landelijke en regionale producten bijten elkaar niet. Hierdoor verkleinen we de kans dat reizigers langeafstandskorting mislopen.

Het OV-bureau geeft een OV-krant uit en vraagt Arriva of daar ook iets in moet over de treinen. Daar is echter wel een verschil in visie. Een OV-krant is politiek heel leuk, want het openbaar vervoer wordt gepromoot. Het punt is dat mensen die geen klant zijn er waarschijnlijk niet in kijken. Iemand heeft wel eens gezegd: 'het is alsof je als man een folder met Zeeman-ondergoed van vrouwen voor je neus krijgt'. Dat is een beetje de visie van Arriva. Daardoor komt de samenwerking soms wat minder snel op gang.

Verkooppunten zijn veelal niet samen. NS heeft, nu de eenmalige ov-chipkaart bestaat, het monopolie om die te verkopen. Het loket in Veendam verkocht vroeger ook losse treinkaartjes, maar sinds de eenmalige ov-chipkaart er is kan dat alleen nog bij het NS-automaat. Het loket is er dus alleen nog voor informatie en busproducten. Op dit moment gaan de NS-automaten weg en komen er Arriva-automaten voor terug. Die automaten bieden de mogelijkheid om regionale producten te verkopen. Op station Groningen hebben Arriva, NS en Qbuzz een apart loket. De Store van Arriva is langer open en verkoopt internationale vervoerbewijzen, in tegenstelling tot het loket van NS. Als station Groningen wordt verbouwd is het wel logisch dat dat anders wordt. Het is namelijk wel veel duidelijker als het samen is. In Friesland is er een gezamenlijk loket van NS en Arriva, maar NS bepaalt wanneer het loket sluit. Arriva moet zich daar op aanpassen. Het is de vraag hoe erg dat is, maar het geeft wel aan dat de flexibiliteit vermindert. Dat is ook de definitie en consequentie van samenwerking.

In welke mate worden trein-busaansluitingen gegarandeerd bij vertraging?
Er wordt niet standaard gewacht, want het is niet bekend of er reizigers zijn die een bus willen nemen. De reiziger moet dan eigenlijk op een station bij de machinist aankloppen en vragen of de machinist de verkeersleiding kan bellen. Een andere optie is om zelf Qbuzz te bellen. Soms kan de buschauffeur ook zien of de trein er al is, maar ook hij weet niet of er reizigers in de trein zitten voor de bus. Bussen wachten dus niet automatisch. De trein laten wachten loopt heel snel uit op een sneeuwbaleffect, dus dat gebeurt eigenlijk niet.

Wat gaat goed in de afstemming tussen trein en bus?
De dienstregeling sluit goed aan, er wordt een sterabonnement geboden, dat gaat goed. Een ander voorbeeld is dat het in het najaar heel druk is in de trein. Als de treinen overliepen liet Arriva wel eens een bus rijden. Die bussen waren echter een stuk trager dan de trein. Toen is er gekeken naar andere oplossingen. In Winschoten stappen in de drukste trein in één keer 180 mensen in. Toen is er in samenwerking met het OV-bureau een bus opgezet die direct naar Zernike rijdt. Dat wordt ook omgeroepen in de trein. Dat scheelt 40 mensen in de drukste trein van de dag. In het contract met Arriva staat dat de vervoerder er alles aan moet doen om te zorgen dat mensen mee kunnen in de trein. Daar valt dit onder. Het contract is strak op dat gebied. Er is een financiële overeenkomst tussen Arriva en het OV-bureau over die bus. Het feit dat de opbrengstverantwoordelijkheid bij Arriva ligt speelt ook een rol in de oplossingsgerichtheid op dit gebied.

Wat kan beter in de afstemming tussen trein en bus?
Op het gebied van marketing zou er nog wel wat kunnen gebeuren. De marketingvisie verschilt op het moment wel wat. Verder zou de communicatie onderling wel beter kunnen. Het gaat soms meer om elkaar informeren dan dat er echt samengewerkt wordt. Arriva volgt NS en het OV-bureau moet daar dan maar op inhaken. Voor een deel is het top-down op dit moment.

Hoe zouden de lijnen Groningen-Zwolle en Leeuwarden-Zwolle het best aanbesteed kunnen worden?
De regionale vervoerders hebben eigenlijk overal laten zien dat de kwaliteit, snelheid en frequentie omhoog kan. Er wordt over Limburg gezegd dat de afstemming tussen NS en Arriva goed gaat. Het officiële rapport is er nog niet. Het lastige aan Zwolle-Groningen is wel dat er dan drie opdrachtgevers zijn. Groningen is de belangrijkste bestemming, maar er loopt maar ongeveer 8

kilometer spoor door Groningen. Overheden moeten dan gaan samenwerken en dat is weleens lastig met verschillende besturen en belangen. Overijssel wil dan bijvoorbeeld een extra stations in Staphorst, terwijl dat niet perse in het belang is van de andere overheden. Dat is anders dan in Limburg.

Tussen Assen en Groningen kan misschien nog wel winst worden behaald met de hoeveelheid bussen die daartussen rijdt. Misschien kan het dal-kortingsproduct wel gaan gelden vanaf Beilen. Op de betreffende lijnen is wel minder het probleem wat er op de noordelijke lijnen speelde: lage frequenties, lage snelheden, etcetera. Dat soort voordelen zijn er minder tussen Zwolle en Groningen. De trein van NS rijdt al tot 22.00 uur 2x per uur. Efficiency kan daar dus niet worden gebruikt om langer door te rijden.

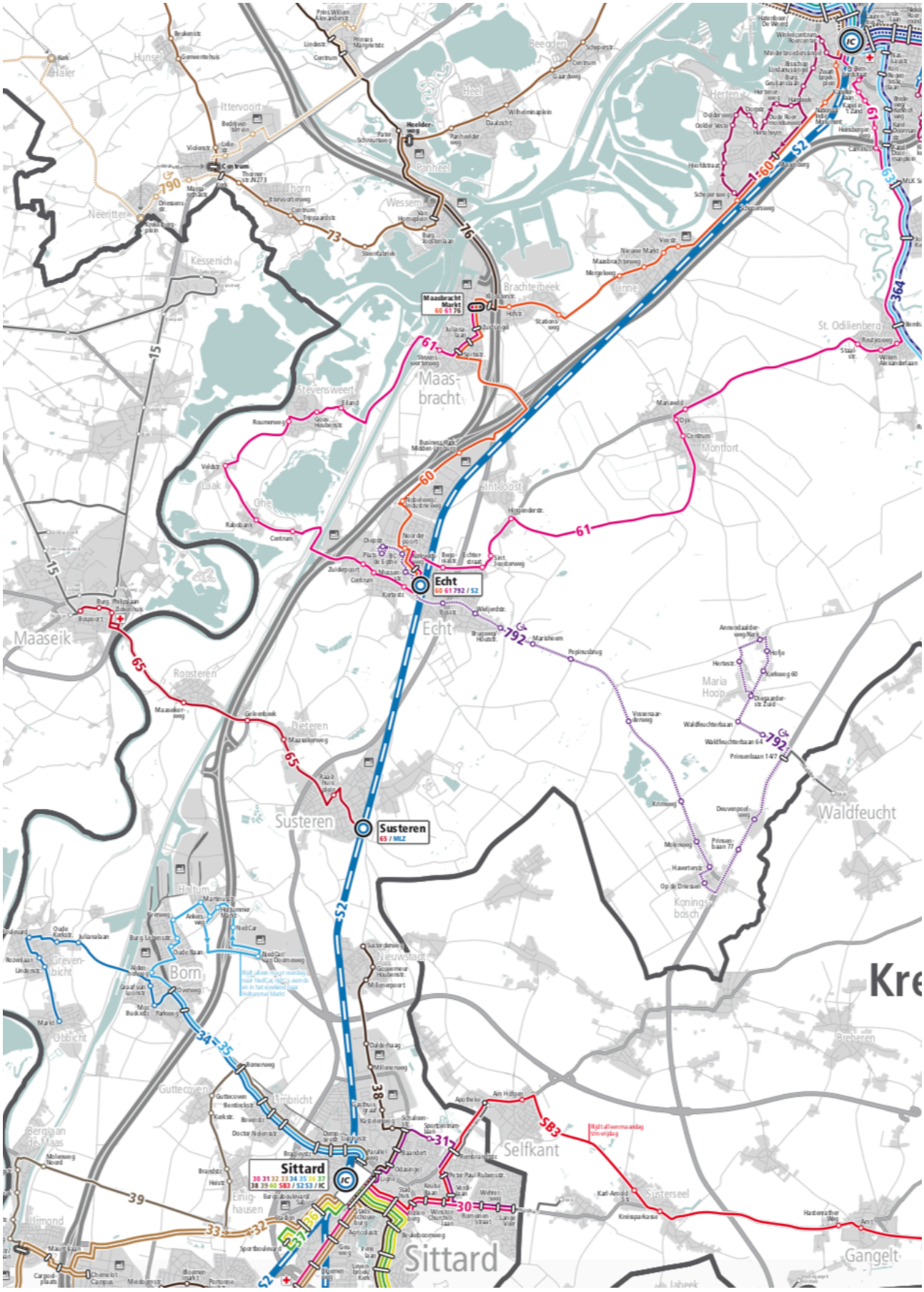
Een multimodale concessie zou kunnen, maar wordt waarschijnlijk vooral in de weg gezeten door de grootte. De concessie loopt dan van Friesland tot Duitsland. Dat is in theorie fantastisch, omdat alle schotten weggehaald worden, maar te groot voor vervoerders. Dus de voordelen zijn kleiner dan andere lijnen, maar ze zijn er zeker. Het officiële standpunt is dat als de reiziger er op vooruit gaat en de provincie er niet op achteruit is het een goed plan. In principe staat de provincie er positief tegenover met de ervaring op de noordelijke lijnen.

C. Network Maps

C1 Network Veolia

Note that this map depicts an older network (only small changes) than used in Chapter 5.

C2 Network Arriva



D. Network Assessment Results

Note that the outcomes in the tables are in the European decimal notation system.

D1 Travel Time Analysis

	Objective TT	**Perceived TT**
All OD pairs	Travel Time (TT)	Generalised Travel Time (GTT)
Actual demand	Weighted Travel Time (WTT)	Weighted Generalised Travel Time (WGTT)

Working Days

OD Arriva (including train connections)

Total: 5465.3
Average: 9.9
Minimum: 0.0
Maximum: 629.91

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot	Per
Dieteren - Dit		0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Echterbosch - Etb	0,0		0,0	0,0	0,0	0,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,5	0,0	0,0	1,455	0,0%
Echt, Kelvinweg - Ekw	0,0	0,0		0,0	0,1	9,7	0,0	0,0	0,6	0,0	4,0	7,7	0,0	1,3	0,0	0,2	0,1	19,0	0,0	0,2	0,1	2,7	0,0	0,2	45,86	0,8%
Echt, Noorderpoort - Enp	0,0	0,0	0,0		0,6	0,9	0,2	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,4	0,3	0,0	2,682	0,0%
Echt, Plats - Eps	0,0	0,2	0,0	0,1		0,2	1,0	0,0	3,4	0,0	0,1	0,0	1,5	0,0	0,0	0,0	0,2	0,0	0,0	0,2	0,0	0,0	0,0	0,0	6,955	0,1%
Echt, Station Arriva - Ec	0,0	7,6	25,5	0,0	1,2		1,5	1,2	12,4	10,7	7,0	55,5	6,9	25,0	0,0	1,5	2,4	487,4	0,2	4,7	1,0	408,9	11,0	12,4	1084	19,8%
Echt, Zuiderpoort - Ezp	0,0	0,0	0,3	0,0	0,0	0,8		0,0	0,2	1,3	0,2	0,6	0,0	0,0	0,0	0,0	0,0	0,7	0,0	0,1	0,0	0,1	3,0	0,1	7,5	0,1%
Hingen - Hin	0,0	0,0	0,0	0,0	0,0	0,6	0,0		0,0	0,1	0,0	0,0	0,0	0,4	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,1	0,0	1,727	0,0%
Koningsbosch - Knb	0,0	0,0	0,0	0,0	1,6	12,6	0,0	0,0		0,0	0,6	0,1	0,0	0,0	0,0	0,1	0,5	5,2	0,0	0,0	0,0	5,1	0,0	0,1	26,05	0,5%
Laak - Lak	0,0	0,0	0,0	0,0	0,0	13,9	1,2	0,0	0,0		0,0	2,3	0,0	0,4	0,0	0,4	0,0	7,8	0,0	0,0	0,0	4,9	0,3	0,5	31,68	0,6%
Linne - Lni	0,0	0,0	4,0	0,0	0,0	4,2	0,0	0,0	0,0	0,0		8,0	0,3	0,0	0,0	0,7	0,0	116,6	0,0	0,0	0,0	4,5	0,0	0,0	138,5	2,5%
Maasbracht - Mbt	0,0	0,0	6,8	0,0	0,0	51,1	2,1	0,0	0,0	1,4	8,3		0,1	0,5	0,0	1,8	0,4	182,5	0,2	0,0	0,0	38,8	1,5	1,2	296,7	5,4%
Maria Hoop - Mrh	0,0	0,0	0,0	0,0	0,8	7,0	0,0	0,0	0,0	0,0	0,0	0,0		0,0	0,0	0,0	0,2	2,3	0,0	2,1	0,0	3,1	0,0	0,0	15,55	0,3%
Montfort - Mft	0,0	0,0	0,0	1,0	0,0	16,0	0,2	0,4	0,0	0,2	0,0	0,3	0,0		0,0	0,2	0,0	4,1	0,3	0,0	1,0	10,5	0,5	0,3	35,14	0,6%
Nieuwstadt - Net	0,0	0,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0		0,0	0,0	0,1	0,0	0,0	0,1	67,1	0,0	0,0	67,95	1,2%
Pepinusbrug - Pep	0,0	0,0	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0		0,1	2,5	0,0	0,0	0,0	5,7	0,0	0,0	9,182	0,2%
Pey - Pej	0,0	0,0	0,0	0,0	0,4	1,1	0,0	0,0	0,3	0,0	0,0	0,1	0,1	0,0	0,0	0,0		2,3	0,0	0,0	0,0	1,6	0,0	0,0	5,864	0,1%
Roermond - Rm	0,4	0,1	12,0	3,6	0,0	460,7	1,4	1,6	4,7	6,1	110,5	162,5	3,2	37,6	0,2	2,4	0,0		2,9	5,9	27,4	564,5	7,0	190,6	1605	29,4%
Roosteren - Rst	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,0	3,9		0,0	0,0	4,3	0,0	9,3	17,91	0,3%
Sint Joost - Sjt	0,4	1,5	0,0	0,3	0,0	3,3	0,0	0,0	0,1	1,1	4,7	2,7	1,0	0,1	0,0	8,0	0,7	1,5	12,3		2,5	1,5	0,0	2,8	44,65	0,8%
Sint Odiliënberg - Sob	0,0	0,3	0,0	0,7	0,0	0,5	0,0	0,1	0,0	0,0	0,0	0,0	0,0	1,0	0,0	0,0	0,0	0,4	0,0	0,0		1,4	0,0	0,0	4,545	0,1%
Sittard - Std	0,4	0,5	0,0	0,0	0,0	466,3	0,0	0,1	6,0	3,4	6,0	37,4	2,2	9,6	68,5	1,9	0,0	629,9	2,9	1,4	1,5		2,4	219,4	1460	26,7 %
Stevensweert - Svt	0,0	0,0	0,5	0,0	0,0	11,8	3,3	0,0	0,0	0,1	0,0	2,0	0,0	0,4	0,0	0,0	0,0	23,0	0,0	0,0	0,0	3,2		0,0	44,36	0,8%
Susteren - Srn	1,3	1,0	0,0	0,0	0,0	15,7	0,0	0,0	0,5	0,1	6,0	0,9	6,0	0,0	0,0	37,4	0,9	195,9	15,9	2,2	2,6	225,5	0,0		511,9	9,4%
Total	2,545	11,95	49,09	5,773	3,955	1067	10,68	3,427	27,55	24,64	143,6	272,5	21,45	74,95	68,82	54,45	5,318	1667	34,68	16,59	36,32	1351	25,82	436,9	5465,3	
Percentage	0,0%	0,2%	0,9%	0,1%	0,1%	19,7%	0,2%	0,1%	0,5%	0,5%	2,7%	5,1%	0,4%	1,4%	1,3%	1,0%	0,1%	30,8%	0,6%	0,3%	0,7%	24,8%	0,5%	8,0%		

OD Veolia (only bus)

Total: 1155.07
Average: 11.67
Minimum: 0.0
Maximum: 176.28

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot	Per
Dieteren - Dit																						1,88		0,5	2,38	0,2%
Echterbosch - Etb						0,5			0,1								0,1								0,56	0,0%
Echt, Kelvinweg - Ekw																									0	0,0%
Echt, Noorderpoort - Enp																									0	0,0%
Echt, Plats - Eps																									0	0,0%
Echt, Station Arriva - Ec		0,9						0,2	9,4	7,5	1,8	23,7	3,7	13,3		3,0	12,7	10,7		1,8	2,06		13,6		104,2	9,0%
Echt, Zuiderpoort - Ezp																									0	0,0%
Hingen - Hin						0,3								0,1		0,1		0,19							0,61	0,1%
Koningsbosch - Knb						7,7							0,1				1,0								8,76	0,8%
Laak - Lak						6,0					0,2	1,5						5,6							13,26	1,1%
Linne - Lni						2,4				0,2		4,1						91,8					0,4		98,85	8,6%
Maasbracht - Mbt						27,4				1,5	4,9			0,9				176,3					2,9		213,8	18,5%
Maria Hoop - Mrh		0,1							0,3								4,7								5,15	0,4%
Montfort - Mft						13,4		0,1				0,51						22,44		0,1	1,1				37,59	3,3%
Nieuwstadt - Net																			0,1			38,7		7,9	46,66	4,0%
Pepinusbrug - Pep						3,6												0,18							3,78	0,3%
Pey - Pej		0,1				5,9			0,3				0,1	0,2		0,1		3,33							9,96	0,9%
Roermond - Rm						13,1		0,24		71,43	42,88	152,4		19,04		0,74	3,78			2	34,05		30,01		369,7	32,0%
Roosteren - Rst	0,1														0,2							8,69		5,7	14,62	1,3%
Sint Joost - Sjt						3,0								0,1				1,28			0,45				4,79	0,4%
Sint Odiliënberg - Sob						3,56		0,05						1,12			0,09	36,25		0,18					41,25	3,6%
Sittard - Std	2,22																		34,52					80,01	116,8	10,1%
Stevensweert - Svt						14,1				0,1	0,1	3,0							12,7						29,94	2,6%
Susteren - Srn	0,4														8,0				5,0			19,22			32,55	2,8%
Total	2,68	1,06	0	0	0	100,3	0	0,57	9,97	80,69	49,88	185,1	3,8	34,81	8,15	3,82	22,24	348	52,18	4,14	37,66	66,61	46,86	93,61		
Percentage	0,2%	0,1%	0,0%	0,0%	0,0%	8,7%	0,0%	0,0%	0,9%	7,0%	4,3%	16,0%	0,3%	3,0%	0,7%	0,3%	1,9%	30,1%	4,5%	0,4%	3,3%	5,9%	4,1%	8,1%		

TT Veolia

Average: 36.83
Minimum: 7
Maximum: 113

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		48	39	42	28	31	40	45	43	45	46	49	42	55	17	39	37	40	9	48	65	30	51	12	39,2
Echterbosch - Etb	51		34	58	25	21	56	61	40	61	49	44	8	69	50	34	32	35	34	62	79	38	67	32	45,2
Echt, Kelvinweg - Ekw	37	50		44	60	9	42	47	26	47	52	15	44	27	28	20	18	21	41	46	52	24	53	18	35,7
Echt, Noorderpoort - Enp	37	50	20		81	8	42	8	28	50	44	52	44	18	31	20	18	21	41	11	28	27	56	21	32,9
Echt, Plats - Eps	40	25	55	19		9	17	22	61	22	40	37	19	30	33	55	53	26	14	23	40	29	28	23	31,3
Echt, Station Arriva - Ec	28	21	9	7	9		9	10	15	14	28	19	15	18	19	9	7	14	18	11	28	15	20	9	15,3
Echt, Zuiderpoort - Ezp	42	85	55	19	46	9		22	61	10	33	25	79	30	33	55	53	26	46	23	40	29	16	23	37,4
Hingen - Hin	40	53	23	8	84	11	45		31	47	47	55	47	15	28	23	21	24	44	8	25	24	53	18	33,7
Koningsbosch - Knb	46	87	30	21	69	17	79	24		84	42	67	81	34	35	13	15	28	57	27	44	33	90	27	45,7
Laak - Lak	47	90	65	24	51	14	10	27	66		28	20	84	35	38	60	58	31	51	28	45	34	11	28	41,1
Linne - Lni	62	113	37	47	66	37	33	50	51	28		13	107	51	53	45	43	17	66	51	41	49	22	43	48,9
Maasbracht - Mbt	47	60	15	39	66	19	25	38	42	20	13		54	17	38	36	34	25	51	36	42	34	14	28	34,5
Maria Hoop - Mrh	48	11	31	55	22	18	53	58	37	58	46	68		66	47	31	29	35	31	59	57	35	64	29	43
Montfort - Mft	49	62	28	17	67	20	54	14	40	59	27	17	56		40	32	30	33	53	12	15	36	65	30	37,2
Nieuwstadt - Net	15	58	28	52	38	20	50	55	34	55	43	38	52	63		28	26	29	19	56	73	18	61	9	40
Pepinusbrug - Pep	38	79	22	13	61	9	43	16	13	46	34	32	73	26	27		7	22	42	19	36	25	54	19	32,9
Pey - Pej	36	77	20	11	59	7	41	14	15	48	32	30	71	24	25	7		20	40	17	34	23	52	17	31,3
Roermond - Rm	37	50	20	41	41	14	42	38	28	40	17	25	44	29	28	22	20		41	36	19	24	34	18	30,8
Roosteren - Rst	9	34	43	28	14	18	26	31	49	31	49	46	28	39	21	43	41	35		32	49	34	37	16	32,7
Sint Joost - Sjt	42	55	25	10	65	13	47	7	33	52	49	57	49	12	33	25	23	26	46		22	29	58	23	34,8
Sint Odiliënberg - Sob	59	72	42	27	77	30	64	24	50	69	33	41	66	15	46	42	40	19	63	22		46	75	40	46,2
Sittard - Std	29	53	23	47	44	15	45	50	29	50	38	33	47	58	19	23	21	24	33	51	68		56	11	37,7
Stevensweert - Svt	53	96	77	30	57	20	16	33	72	11	22	14	90	41	44	66	64	34	57	34	51	40		34	45,9
Susteren - Srn	11	47	17	41	34	9	39	44	23	44	32	27	41	52	10	17	15	18	15	45	62	11	50		30,6
Average	39,3	59,8	33	30,4	50,6	16,4	39,9	32,1	38,6	43,1	36,7	35,8	54	35,8	32,3	32,4	30,7	26,2	39,7	32,9	44,1	29,9	47,3	23	

TT Arriva

Average: 34.10
Minimum: 7
Maximum: 83

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		72	29	56	79	22	59	59	65	64	47	39	76	67	56	31	29	31	9	60	52	26	70	11	48,2
Echterbosch - Etb	74		42	39	32	26	42	42	12	47	60	52	9	50	62	20	23	44	78	43	60	39	53	33	42,7
Echt, Kelvinweg - Ekw	29	40		24	17	12	27	27	33	32	23	15	44	35	47	29	27	29	63	28	35	17	35	18	29,8
Echt, Noorderpoort - Enp	55	36	23		14	8	23	8	29	28	41	33	40	18	43	25	23	25	59	11	28	20	34	14	27,7
Echt, Plats - Eps	77	31	15	12		9	15	15	24	30	33	25	35	23	65	17	15	47	81	26	33	42	26	36	31,8
Echt, Station Arriva - Ec	20	21	10	7	9		9	10	14	14	28	20	25	18	38	10	8	14	24	11	28	15	20	9	16,6
Echt, Zuiderpoort - Ezp	53	37	24	21	14	8		24	30	10	42	25	41	34	44	26	24	26	57	27	44	18	16	12	28,6
Hingen - Hin	57	38	25	7	16	10	25		31	30	43	35	42	15	45	27	25	27	61	8	25	22	36	16	29
Koningsbosch - Knb	67	12	35	21	25	19	35	24		40	53	45	16	43	55	16	13	37	71	36	53	32	46	26	35,7
Laak - Lak	61	42	29	26	19	13	10	29	35		47	20	46	39	49	31	29	31	65	32	49	26	11	20	33
Linne - Lni	45	56	21	40	33	28	43	43	49	35		13	60	48	63	45	43	18	49	44	39	40	29	34	39,9
Maasbracht - Mbt	37	48	13	32	25	20	24	33	41	19	13		52	33	55	37	35	26	41	36	53	32	13	26	32,3
Maria Hoop - Mrh	77	8	45	42	35	29	45	45	15	50	63	55		53	65	23	26	47	81	46	63	42	56	36	45,5
Montfort - Mft	65	46	33	15	24	18	33	13	39	38	51	43	50		53	35	33	29	69	11	15	30	44	24	35,3
Nieuwstadt - Net	40	58	38	42	65	31	45	45	51	50	56	48	62	53		47	45	40	44	46	63	20	56	27	46,6
Pepinusbrug - Pep	59	19	27	24	17	11	27	27	12	32	45	37	23	35	47		8	29	33	28	45	24	38	18	28,9
Pey - Pej	56	21	24	21	14	8	24	24	14	29	42	34	25	32	44	7		26	30	25	42	21	35	15	26,7
Roermond - Rm	28	39	26	24	46	13	26	24	32	31	18	26	43	27	46	28	26		32	27	18	23	37	17	28,6
Roosteren - Rst	9	76	33	60	83	26	63	63	69	68	51	43	80	71	60	35	33	35		64	81	30	74	15	53,1
Sint Joost - Sjt	59	40	27	9	18	12	27	7	33	32	45	37	44	12	47	29	27	29	63		22	24	38	18	30,4
Sint Odiliënberg - Sob	74	55	42	24	33	27	42	22	48	47	60	45	59	14	62	44	42	19	78	20		39	53	33	42,7
Sittard - Std	23	34	21	18	41	14	21	21	27	26	39	31	38	29	20	23	21	23	27	22	39		32	10	26,1
Stevensweert - Svt	67	48	32	32	25	19	16	35	41	11	42	14	52	45	55	37	35	37	71	38	55	32		26	37,6
Susteren - Srn	11	29	16	13	36	9	16	16	22	21	34	26	33	24	34	18	16	18	15	17	34	11	27		21,6
Average	49,7	39,4	27,4	26,5	31,3	17	30,3	28,5	33,3	34,1	42,4	33,1	43,3	35,6	50,2	27,8	26,3	29,9	52,2	30,7	42,4	27,2	38,2	21,5	

Delta TT (absolute)

Average: -2.73
Minimum: -75.00
Maximum: +69.00

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		24	-10	14	51	-9	19	14	22	19	1	-10	34	12	39	-8	-8	-9	0	12	-13	-4	19	-1	208
Echterbosch - Etb	23		8	-19	7	5	-14	-19	-28	-14	11	8	1	-19	12	-14	-9	9	44	-19	-19	1	-14	1	-58
Echt, Kelvinweg - Ekw	-8	-10		-20	-43	3	-15	-20	7	-15	-29	0	0	8	19	9	9	8	22	-18	-17	-7	-18	0	-135
Echt, Noorderpoort - Enp	18	-14	3		-67	0	-19	0	1	-22	-3	-19	-4	0	12	5	5	4	18	0	0	-7	-22	-7	-118
Echt, Plats - Eps	37	6	-40	-7		0	-2	-7	-37	8	-7	-12	16	-7	32	-38	-38	21	67	3	-7	13	-2	13	12
Echt, Station Arriva - Ec	-8	0	1	0	0		0	0	-1	0	0	1	10	0	19	1	1	0	6	0	0	0	0	0	30
Echt, Zuiderpoort - Ezp	11	-48	-31	2	-32	-1		2	-31	0	9	0	-38	4	11	-29	-29	0	11	4	4	-11	0	-11	-203
Hingen - Hin	17	-15	2	-1	-68	-1	-20		0	-17	-4	-20	-5	0	17	4	4	3	17	0	0	-2	-17	-2	-108
Koningsbosch - Knb	21	-75	5	0	-44	2	-44	0		-44	11	-22	-65	9	20	3	-2	9	14	9	9	-1	-44	-1	-230
Laak - Lak	14	-48	-36	2	-32	-1	0	2	-31		19	0	-38	4	11	-29	-29	0	14	4	4	-8	0	-8	-186
Linne - Lni	-17	-57	-16	-7	-33	-9	10	-7	-2	7		0	-47	-3	10	0	0	1	-17	-7	-2	-9	7	-9	-207
Maasbracht - Mbt	-10	-12	-2	-7	-41	1	-1	-5	-1	-1	0		-2	16	17	1	1	1	-10	0	11	-2	-1	-2	-49
Maria Hoop - Mrh	29	-3	14	-13	13	11	-8	-13	-22	-8	17	-13		-13	18	-8	-3	12	50	-13	6	7	-8	7	59
Montfort - Mft	16	-16	5	-2	-43	-2	-21	-1	-1	-21	24	26	-6		13	3	3	-4	16	-1	0	-6	-21	-6	-45
Nieuwstadt - Net	25	0	10	-10	27	11	-5	-10	17	-5	13	10	10	-10		19	19	11	25	-10	-10	2	-5	18	152
Pepinusbrug - Pep	21	-60	5	11	-44	2	-16	11	-1	-14	11	5	-50	9	20		1	7	-9	9	9	-1	-16	-1	-91
Pey - Pej	20	-56	4	10	-45	1	-17	10	-1	-19	10	4	-46	8	19	0		6	-10	8	8	-2	-17	-2	-107
Roermond - Rm	-9	-11	6	-17	5	-1	-16	-14	4	-9	1	1	-1	-2	18	6	6		-9	-9	-1	-1	3	-1	-51
Roosteren - Rst	0	42	-10	32	69	8	37	32	20	37	2	-3	52	32	39	-8	-8	0		32	32	-4	37	-1	469
Sint Joost - Sjt	17	-15	2	-1	-47	-1	-20	0	0	-20	-4	-20	-5	0	14	4	4	3	17		0	-5	-20	-5	-102
Sint Odiliënberg - Sob	15	-17	0	-3	-44	-3	-22	-2	-2	-22	27	4	-7	-1	16	2	2	0	15	-2		-7	-22	-7	-80
Sittard - Std	-6	-19	-2	-29	-3	-1	-24	-29	-2	-24	1	-2	-9	-29	1	0	0	-1	-6	-29	-29		-24	-1	-267
Stevensweert - Svt	14	-48	-45	2	-32	-1	0	2	-31	0	20	0	-38	4	11	-29	-29	3	14	4	4	-8		-8	-191
Susteren - Srn	0	-18	-1	-28	2	0	-23	-28	-1	-23	2	-1	-8	-28	24	1	1	0	0	-28	-28	0	-23		-208
Total	240	-470	-128	-91	-444	14	-221	-82	-121	-207	132	-63	-246	-6	412	-105	-99	84	289	-51	-39	-62	-208	-34	

Delta TT (relative)

Average: +3.98%
Minimum: -86.21%
Maximum: +492.86%

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		50%	-26%	33%	182%	-29%	48%	31%	51%	42%	2%	-20%	81%	22%	229%	-21%	-22%	-23%	0	25%	-20%	-13%	37%	-8%	28%
Echterbosch - Etb	45%		24%	-33%	28%	24%	-25%	-31%	-70%	-23%	22%	18%	13%	-28%	24%	-41%	-28%	26%	129%	-31%	-24%	3%	-21%	3%	0%
Echt, Kelvinweg - Ekw	-22%	-20%		-45%	-72%	33%	-36%	-43%	27%	-32%	-56%	0	0	30%	68%	45%	50%	38%	54%	-39%	-33%	-29%	-34%	0	-5%
Echt, Noorderpoort - Enp	49%	-28%	15%		-83%	0	-45%	0	4%	-44%	-7%	-37%	-9%	0	39%	25%	28%	19%	44%	0	0	-26%	-39%	-33%	-6%
Echt, Plats - Eps	93%	24%	-73%	-37%		0	-12%	-32%	-61%	36%	-18%	-32%	84%	-23%	97%	-69%	-72%	81%	479%	13%	-18%	45%	-7%	57%	24%
Echt, Station Arriva - Ec	-29%	0	11%	0	0		0	0	-7%	0	0	5%	67%	0	100%	11%	14%	0	33%	0	0	0	0	0	9%
Echt, Zuiderpoort - Ezp	26%	-56%	-56%	11%	-70%	-11%		9%	-51%	0	27%	0	-48%	13%	33%	-53%	-55%	0	24%	17%	10%	-38%	0	-48%	-14%
Hingen - Hin	43%	-28%	9%	-13%	-81%	-9%	-44%		0	-36%	-9%	-36%	-11%	0	61%	17%	19%	13%	39%	0	0	-8%	-32%	-11%	-5%
Koningsbosch - Knb	46%	-86%	17%	0	-64%	12%	-56%	0		-52%	26%	-33%	-80%	26%	57%	23%	-13%	32%	25%	33%	20%	-3%	-49%	-4%	-5%
Laak - Lak	30%	-53%	-55%	8%	-63%	-7%	0	7%	-47%		68%	0	-45%	11%	29%	-48%	-50%	0	27%	14%	9%	-24%	0	-29%	-9%
Linne - Lni	-27%	-50%	-43%	-15%	-50%	-24%	30%	-14%	-4%	25%		0	-44%	-6%	19%	0	0	6%	-26%	-14%	-5%	-18%	32%	-21%	-11%
Maasbracht - Mbt	-21%	-20%	-13%	-18%	-62%	5%	-4%	-13%	-2%	-5%	0		-4%	94%	45%	3%	3%	4%	-20%	0	26%	-6%	-7%	-7%	-1%
Maria Hoop - Mrh	60%	-27%	45%	-24%	59%	61%	-15%	-22%	-59%	-14%	37%	-19%		-20%	38%	-26%	-10%	34%	161%	-22%	11%	20%	-13%	24%	12%
Montfort - Mft	33%	-26%	18%	-12%	-64%	-10%	-39%	-7%	-3%	-36%	89%	153%	-11%		33%	9%	10%	-12%	30%	-8%	0	-17%	-32%	-20%	3%
Nieuwstadt - Net	167%	0	36%	-19%	71%	55%	-10%	-18%	50%	-9%	30%	26%	19%	-16%		68%	73%	38%	132%	-18%	-14%	11%	-8%	200%	38%
Pepinusbrug - Pep	55%	-76%	23%	85%	-72%	22%	-37%	69%	-8%	-30%	32%	16%	-68%	35%	74%		14%	32%	-21%	47%	25%	-4%	-30%	-5%	8%
Pey - Pej	56%	-73%	20%	91%	-76%	14%	-41%	71%	-7%	-40%	31%	13%	-65%	33%	76%	0		30%	-25%	47%	24%	-9%	-33%	-12%	6%
Roermond - Rm	-24%	-22%	30%	-41%	12%	-7%	-38%	-37%	14%	-23%	6%	4%	-2%	-7%	64%	27%	30%		-22%	-25%	-5%	-4%	9%	-6%	-3%
Roosteren - Rst	0	124%	-23%	114%	493%	44%	142%	103%	41%	119%	4%	-7%	186%	82%	186%	-19%	-20%	0		100%	65%	-12%	100%	-6%	79%
Sint Joost - Sjt	40%	-27%	8%	-10%	-72%	-8%	-43%	0	0	-38%	-8%	-35%	-10%	0	42%	16%	17%	12%	37%		0	-17%	-34%	-22%	-7%
Sint Odiliënberg - Sob	25%	-24%	0	-11%	-57%	-10%	-34%	-8%	-4%	-32%	82%	10%	-11%	-7%	35%	5%	5%	0	24%	-9%		-15%	-29%	-18%	-4%
Sittard - Std	-21%	-36%	-9%	-62%	-7%	-7%	-53%	-58%	-7%	-48%	3%	-6%	-19%	-50%	5%	0	0	-4%	-18%	-57%	-43%		-43%	-9%	-24%
Stevensweert - Svt	26%	-50%	-58%	7%	-56%	-5%	0	6%	-43%	0	91%	0	-42%	10%	25%	-44%	-45%	9%	25%	12%	8%	-20%		-24%	-7%
Susteren - Srn	0	-38%	-6%	-68%	6%	0	-59%	-64%	-4%	-52%	6%	-4%	-20%	-54%	240%	6%	7%	0	0	-62%	-45%	0	-46%		-11%
Average	31%	-26%	-5%	-3%	-5%	7%	-18%	-2%	-9%	-14%	22%	1%	-2%	7%	77%	-3%	-2%	16%	54%	1%	0%	-9%	-13%	0%	

WTT Veolia

Average TT: 23.65

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	14,3	0	0	0	0	0	0	0,36	0	0	0	1,45	6,36	0	0	0	19	0	0
Echt, Kelvinweg - Ekw	0	0		0	5,45	87,1	0	0	16,5	0	210	115	0	34,4	0	3,64	1,64	398	0	8,36	4,73	64,4	2,41	4,09
Echt, Noorderpoort - Enp	0	0	0,91		47,9	6,91	9,55	0	1,27	2,27	2	4,73	0	0	0	0,91	0	0,95	0	0	0	9,82	15,3	0
Echt, Plats - Eps	0	4,55	0			1,64	16,2	0	205	0	3,64	0	29,4	0	0	2,5	12	1,18	0	4,18	0	0	0	0
Echt, Station Arriva - Ec	0	160	230	0	10,6		13,1	12	186	150	195	1055	103	450	0	13,1	16,5	0	3,27	51,5	28	0	220	0
Echt, Zuiderpoort - Ezp	0	0	17,5	0	0	7,36		0	11,1	12,7	6	15,9	0	0	0	0	0	17,7	0	2,09	1,82	3,95	48,7	2,09
Hingen - Hin	0	0	0	0	0	6,5	0		0	4,27	0	0	0	6,14	0	0	0	10,9	0	0	1,14	1,09	4,82	0
Koningsbosch - Knb	0	0	0	0	113	215	0	0		0	26,7	6,09	0	0	0	1,18	6,82	146	0	0	0	170	0	3,68
Laak - Lak	0	0	0	0	0	194	11,8	0	0		1,27	45,5	3,82	14,3	0	24,5	0	241	0	0	2,05	167	3	12,7
Linne - Lni	0	5,14	148	0	0	155	0	0	0	0		105	29,2	2,32	2,41	30,7	0	1982	0	0	1,86	223	0	0
Maasbracht - Mbt	0	2,73	102	0	0	971	52,3	0	0	27,3	108		4,91	8,5	0	63,8	13,9	4561	11,6	0	0	1320	21,6	33,1
Maria Hoop - Mrh	0	0	0	0	17	125	0	0	0	0	0	0		0	0	0	5,27	81,1	0	126	0	110	0	1,32
Montfort - Mft	0	0	0	17,8	0	320	12,3	5,73	0	13,4	0	5,41	0		0	5,82	0	137	16,9	0	15	378	29,5	9,55
Nieuwstadt - Net	0	31,6	0	0	0	0,91	0	0	0	0	0	0	0	0		0	0	3,95	0	0	6,64	1208	0	0,41
Pepinusbrug - Pep	0	3,59	0	0	0	4,5	0	0	0	0	7,73	0	0	0	0		0,95	56	0	0	0	143	0	0
Pey - Pej	0	0	0	0	21,5	7,64	0	0	4,09	2,18	0	2,73	6,45	0	0	0		45,5	0	0	0	36,6	0	0,77
Roermond - Rm	15,1	6,82	239	147	0	0	59,2	62,2	131	245	1878	4061	142	1090	6,36	52	0		119	211	521	0	240	0
Roosteren - Rst	0	0	0	0	0	4,91	0	0	0	0	0	0	0	0	0	3,91	0	137		0	0	147	0	149
Sint Joost - Sjt	17,2	85	0	2,73	0	42,5	2,14	0	4,5	56,7	229	155	51,2	1,09	0	200	15,7	38,1	565		56	44,8	0	64,8
Sint Odiliënberg - Sob	0	19,6	0	19,6	0	16,4	2,91	2,18	0	3,14	0	1,86	0	14,3	0	0	0	7,77	0	0		64,8	0	0
Sittard - Std	11,9	28,9	0	0	0	0	0	4,55	173	170	230	1235	105	556	1302	43,9	0	0	94,5	71,9	102		132	0
Stevensweert - Svt	0	0	35	0	0	236	52,4	0	0	1,5	0	28	0	14,9	0	3	0	782	0	0	0	129		1,55
Susteren - Srn	14,5	44,9	0	0	0	0	0	0	12,5	4	191	24,5	248	0	0	636	13	0	239	100	161	0	0	

WTT Arriva

Average TT: 23.39

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	17,7	0	0	0	0	0	0	0,41	0	0	0	1,05	8	0	0	0	19,5	0	0
Echt, Kelvinweg - Ekw	0	0		0	1,55	116	0	0	21	0	93	115	0	44,5	0	5,27	2,45	550	0	5,09	3,18	45,6	1,59	4,09
Echt, Noorderpoort - Enp	0	0	1,05		8,27	6,91	5,23	0	1,32	1,27	1,86	3	0	0	0	1,14	0	1,14	0	0	0	7,27	9,27	0
Echt, Plats - Eps	0	5,64	0	1,64		1,64	14,3	0	80,7	0	3	0	54,1	0	0	0,77	3,41	2,14	0	4,73	0	0	0	0
Echt, Station Arriva - Ec	0	160	255	0	10,6		13,1	12	174	150	195	1111	172	450	0	14,5	18,9	0	4,36	51,5	28	0	220	0
Echt, Zuiderpoort - Ezp	0	0	7,64	0	0	6,55		0	5,45	12,7	7,64	15,9	0	0	0	0	0	17,7	0	2,45	2	2,45	48,7	1,09
Hingen - Hin	0	0	0	0	0	5,91	0		0	2,73	0	0	0	6,14	0	0	0	12,3	0	0	1,14	1	3,27	0
Koningsbosch - Knb	0	0	0	0	40,9	240	0	0		0	33,7	4,09	0	0	0	1,45	5,91	193	0	0	0	164	0	3,55
Laak - Lak	0	0	0	0	0	180	11,8	0	0		2,14	45,5	2,09	16	0	12,7	0	241	0	0	2,23	128	3	9,09
Linne - Lni	0	2,55	84	0	0	117	0	0	0	0		105	16,4	2,18	2,86	30,7	0	2099	0	0	1,77	182	0	0
Maasbracht - Mbt	0	2,18	88,6	0	0	1022	50,2	0	0	25,9	108		4,73	16,5	0	65,6	14,3	4744	9,32	0	0	1242	20,1	30,7
Maria Hoop - Mrh	0	0	0	0	27	202	0	0	0	0	0	0		0	0	0	4,73	109	0	98,3	0	132	0	1,64
Montfort - Mft	0	0	0	15,7	0	288	7,5	5,32	0	8,64	0	13,7	0		0	6,36	0	120	22	0	15	315	20	7,64
Nieuwstadt - Net	0	31,6	0	0	0	1,41	0	0	0	0	0	0	0	0		0	0	5,45	0	0	5,73	1342	0	1,23
Pepinusbrug - Pep	0	0,86	0	0	0	5,5	0	0	0	0	10,2	0	0	0	0		1,09	73,8	0	0	0	137	0	0
Pey - Pej	0	0	0	0	5,09	8,73	0	0	3,82	1,32	0	3,09	2,27	0	0	0		59,1	0	0	0	33,4	0	0,68
Roermond - Rm	11,5	5,32	311	86,2	0	0	36,6	39,3	150	190	1988	4224	139	1015	10,5	66,2	0		93,1	158	493	0	261	0
Roosteren - Rst	0	0	0	0	0	7,09	0	0	0	0	0	0	0	0	0	3,18	0	137		0	0	130	0	140
Sint Joost - Sjt	24,1	61,8	0	2,45	0	39,3	1,23	0	4,5	34,9	211	101	46	1,09	0	232	18,4	42,4	773		56	37,1	0	50,7
Sint Odiliënberg - Sob	0	15	0	17,5	0	14,7	1,91	2	0	2,14	0	2,05	0	13,4	0	0	0	7,77	0	0		55	0	0
Sittard - Std	9,41	18,5	0	0	0	0	0	1,91	161	88,6	236	1160	84,6	278	1371	43,9	0	0	77,3	31	58,5		75,6	0
Stevensweert - Svt	0	0	14,5	0	0	225	52,4	0	0	1,5	0	28	0	16,4	0	1,68	0	851	0	0	0	103		1,18
Susteren - Srn	14,5	27,7	0	0	0	0	0	0	12	1,91	202	23,6	200	0	0	673	13,8	0	239	37,9	88,1	0	0	

Delta WTT

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	5
Echt, Kelvinweg - Ekw	0	0			-4	29	0	0	4	0	-117	0	0	10	0	2	1	152	0	-3	-2	-19	-1	0	52
Echt, Noorderpoort - Enp	0	0	0		-40	0	-4	0	0	-1	0	-2	0	0	0	0	0	0	0	0	0	-3	-6	0	-55
Echt, Plats - Eps	0	1	0	2		0	-2	0	-124	0	-1	0	25	0	0	-2	-9	1	0	1	0	0	0	0	-108
Echt, Station Arriva - Ec	0	0	26	0	0		0	0	-12	0	0	56	69	0	0	1	2	0	1	0	0	0	0	0	142
Echt, Zuiderpoort - Ezp	0	0	-10	0	0	-1		0	-6	0	2	0	0	0	0	0	0	0	0	0	0	-2	0	-1	-17
Hingen - Hin	0	0	0	0	0	-1	0		0	-2	0	0	0	0	0	0	0	1	0	0	0	0	-2	0	-2
Koningsbosch - Knb	0	0	0	0	-72	25	0	0		0	7	-2	0	0	0	0	-1	47	0	0	0	-5	0	0	-1
Laak - Lak	0	0	0	0	0	-14	0	0	0		1	0	-2	2	0	-12	0	0	0	0	0	-39	0	-4	-68
Linne - Lni	0	-3	-64	0	0	-38	0	0	0	0		0	-13	0	0	0	0	117	0	0	0	-41	0	0	-41
Maasbracht - Mbt	0	-1	-14	0	0	51	-2	0	0	-1	0		0	8	0	2	0	182	-2	0	0	-78	-2	-2	142
Maria Hoop - Mrh	0	0	0	0	10	77	0	0	0	0	0	0		0	0	0	-1	28	0	-28	0	22	0	0	108
Montfort - Mft	0	0	0	-2	0	-32	-5	0	0	-5	0	8	0		0	1	0	-17	5	0	0	-63	-10	-2	-121
Nieuwstadt - Net	0	0	0	0	0	1	0	0	0	0	0	0	0	0		0	0	2	0	0	-1	134	0	1	136
Pepinusbrug - Pep	0	-3	0	0	0	1	0	0	0	0	3	0	0	0	0		0	18	0	0	0	-6	0	0	13
Pey - Pej	0	0	0	0	-16	1	0	0	0	-1	0	0	-4	0	0	0		14	0	0	0	-3	0	0	-10
Roermond - Rm	-4	-2	72	-61	0	0	-23	-23	19	-55	110	162	-3	-75	4	14	0		-26	-53	-27	0	21	0	51
Roosteren - Rst	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	-1	0	0		0	0	-17	0	-9	-25
Sint Joost - Sjt	7	-23	0	0	0	-3	-1	0	0	-22	-19	-55	-5	0	0	32	3	4	209		0	-8	0	-14	105
Sint Odiliënberg - Sob	0	-5	0	-2	0	-2	-1	0	0	-1	0	0	0	-1	0	0	0	0	0	0		-10	0	0	-21
Sittard - Std	-2	-10	0	0	0	0	0	-3	-12	-82	6	-75	-20	-278	69	0	0	0	-17	-41	-44		-57	0	-566
Stevensweert - Svt	0	0	-20	0	0	-12	0	0	0	0	0	0	0	1	0	-1	0	69	0	0	0	-26		0	11
Susteren - Srn	0	-17	0	0	0	0	0	0	-1	-2	12	-1	-48	0	0	37	1	0	0	-62	-73	0	0	0	-154
Total	1	-62	-11	-64	-122	88	-38	-26	-132	-172	4	93	-2	-333	73	74	-3	619	169	-186	-146	-162	-55	-32	

GTT Veolia

Average: 74.01
Minimum: 13.46
Maximum: 215.94

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		87,7	94,9	100	62,1	67,3	116	104	93,9	100	93,4	105	80,1	117	26,3	96	93,4	78,4	16	108	130	42,9	108	19,9	84,3
Echterbosch - Etb	105		68,9	123	36,5	31,4	117	127	76,6	123	96,6	81,7	14,7	137	111	68,9	66,4	64,1	48	128	150	69,4	131	63,4	88,6
Echt, Kelvinweg - Ekw	92,5	104		103	144	16	97,2	107	56,9	104	110	23,7	96,1	39,1	73,8	49,2	46,6	44,4	97,7	87	97,4	49,7	111	43,7	78
Echt, Noorderpoort - Enp	93,4	105	50,1		191	14,7	98,1	14,7	40,3	108	86,9	111	97	27,5	78,6	30,1	27,5	47,8	98,6	18,6	40,3	54,5	116	48,5	69,5
Echt, Plats - Eps	84,7	36,5	126	48,8		16	42,7	52,7	133	49,1	78,5	68,3	28,8	62,9	84,7	126	123	55,3	22,4	53,9	75,7	60,6	56,7	54,6	67
Echt, Station Arriva - Ec	63,7	31,4	16	13,5	16		16	17,3	23,7	22,4	51,9	28,8	23,7	27,5	45	16	13,5	19,9	27,5	18,6	40,3	20,9	30,1	14,9	26
Echt, Zuiderpoort - Ezp	103	180	126	48,8	106	16		52,7	133	17,3	46,7	36,5	172	62,9	85,8	126	123	55,3	109	53,9	75,7	60,6	25	54,6	81,3
Hingen - Hin	97,3	109	53,9	14,7	195	18,6	102		44,2	104	86,9	115	101	23,7	74,7	33,9	31,4	51,6	102	14,7	36,5	50,6	112	44,6	70,3
Koningsbosch - Knb	105	177	63,8	31,4	156	26,3	171	35,2		177	84,9	135	170	48	81,9	21,1	23,7	52,4	111	39,1	60,8	62,1	185	56,1	90,2
Laak - Lak	138	187	138	55,2	112	22,4	17,3	59,1	140		40,3	30,1	179	69,3	91,1	132	129	55,7	115	60,3	82,1	67	18,6	61	86,9
Linne - Lni	129	216	77,3	84,7	142	51,9	46,7	88,5	106	40,3		21,1	208	91,6	111	98,7	96,1	26,3	134	89,8	78,8	86,4	32,7	80,4	92,9
Maasbracht - Mbt	105	117	23,7	170	131	28,8	36,5	76,7	77,4	30,1	21,1		109	26,3	86,6	69,7	67,1	36,5	110	74,2	84,6	62,5	22,4	56,5	70,6
Maria Hoop - Mrh	102	18,6	65,1	119	32,7	27,5	113	123	72,8	119	92,8	137		133	107	65,1	62,5	66,8	44,2	124	115	65,6	127	59,6	86,7
Montfort - Mft	109	120	40,3	26,3	154	30,1	113	22,4	55,7	120	53,7	26,3	112		90,1	45,5	42,9	50,6	114	19,9	23,7	66	160	60	72
Nieuwstadt - Net	23,7	129	74,7	129	74,9	48,1	123	133	82,4	129	89,6	87,5	122	143		74,7	72,2	57,1	28,8	134	156	27,5	137	16	90,9
Pepinusbrug - Pep	94,7	163	53,6	21,1	146	16	99,3	25	21,1	103	74,7	66,4	159	37,8	71,6		13,5	46,5	99,8	28,8	50,6	51,9	113	45,9	69,7
Pey - Pej	92,2	160	51	18,6	143	13,5	96,8	22,4	23,7	106	72,1	63,8	157	35,2	69,1	13,5		44	97,3	26,3	48	49,3	111	43,3	67,7
Roermond - Rm	72,7	99,3	42,2	57	88	22,4	62,1	53,1	54,2	55,7	26,3	36,5	86,4	41,6	54	46,5	44		77,8	50,6	28,8	29,9	48	23,9	52,2
Roosteren - Rst	16	48	101	60,3	22,4	27,5	54,2	64,2	109	60,6	95,9	79,8	40,3	74,4	31,4	101	98,6	69,3		65,5	87,2	48	68,3	25	63
Sint Joost - Sjt	99,8	111	56,5	17,3	151	21,1	104	13,5	46,7	111	83,1	117	103	19,9	81,1	36,5	33,9	50,6	105		32,7	57	119	51	70,5
Sint Odiliënberg - Sob	122	133	78,3	39,1	166	42,9	126	35,2	68,5	133	61,3	71,6	125	23,7	93,4	58,3	55,7	28,8	127	32,7		78,8	140	72,8	83,2
Sittard - Std	41,6	105	47,5	102	92,9	20,9	95,5	106	55,2	102	62,4	60,3	94,5	116	28,8	47,5	45	29,9	46,7	107	129		110	16,9	72,2
Stevensweert - Svt	118	194	164	62,9	120	30,1	25	66,7	147	18,6	32,7	22,4	187	77	98,8	140	137	48	123	68	89,8	74,7		68,7	91,8
Susteren - Srn	18,6	97,3	41,5	95,7	69,8	14,9	89,5	99,5	49,2	95,9	53,1	54,3	88,5	110	17,3	41,5	39	23,9	23,7	101	123	16,9	104		63,8
Average	88,1	119	71,9	67	111	27,2	85,3	65,1	74,4	88,2	69,3	68,7	111	67,1	73,6	66,8	64,6	48	81,7	65,4	79,7	54,5	95	47	

GTT Arriva

Average: 66.92
Minimum: 13.46
Maximum: 189.22

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		158	74,2	136	184	50,6	141	140	149	147	99,2	87	163	150	122	78,6	76	59,6	16	141	107	57	155	18,6	109
Echterbosch - Etb	158		81	77,1	45,5	37,8	81,9	81	19,9	88,3	104	93,8	16	91,2	117	30,1	33,9	79,2	163	82,2	104	67,1	95,9	61,1	78,6
Echt, Kelvinweg - Ekw	72,4	79,3		54,5	40	19,9	61,8	57,5	70,3	68,2	33,9	23,7	84,4	71,1	96,5	65,2	62,7	50,6	143	62,1	62,1	38,1	72,9	41	62,2
Echt, Noorderpoort - Enp	133	74,2	55,7		37	14,7	33,9	14,7	65,2	40,3	78,8	59,5	79,3	27,5	91,3	60,1	57,5	54	138	18,6	40,3	41,9	48	35,9	56,5
Echt, Plats - Eps	180	44,2	37,4	33,6		16	38,3	37,4	35,2	66,5	60,4	50,2	49,3	47,6	138	26,3	23,7	101	185	60,5	60,4	89	52,4	83	65,9
Echt, Station Arriva - Ec	46,3	31,4	17,3	13,5	16		16	17,3	22,4	22,4	40,3	30,1	36,5	27,5	70,3	17,3	14,7	19,9	51,4	18,6	40,3	20,9	30,1	14,9	27,6
Echt, Zuiderpoort - Ezp	128	76,4	57,9	31,4	37	14,7		35,2	67,4	17,3	81	36,5	81,5	48	93,5	62,3	59,7	56,2	164	39,1	60,8	37,5	25	31,5	58,4
Hingen - Hin	135	76,7	58,3	13,5	39,6	17,3	36,5		67,8	42,9	81,3	62,1	81,9	23,7	93,9	62,7	60,1	54,4	140	14,7	36,5	44,5	50,6	38,5	58
Koningsbosch - Knb	149	19,9	72	54,1	36,5	28,8	72,9	57,9		79,3	95	84,8	25	82,2	108	25	21,1	70,2	154	73,3	95	58,2	87	52,2	69,6
Laak - Lak	141	82,8	64,3	37,8	43,4	21,1	17,3	41,6	73,8		87,4	30,1	87,9	54,4	99,9	68,7	66,1	62,6	146	45,5	67,2	50,5	18,6	44,5	63,2
Linne - Lni	92,9	99,8	31,4	77,5	74,3	40,3	82,2	81,3	90,8	69,3		21,1	105	85,9	117	85,7	83,1	27,5	98	82,6	74,4	67,5	61,6	61,5	74,4
Maasbracht - Mbt	82,6	89,5	21,1	55,7	50,2	30,1	35,2	59,5	80,6	28,8	21,1		94,7	72,3	107	75,5	72,9	37,8	87,8	63,4	85,1	57,3	21,1	51,3	60
Maria Hoop - Mrh	162	14,7	84,8	81	49,3	41,6	85,7	84,8	23,7	92,1	108	97,6		95	120	33,9	37,8	83	167	86,1	108	71	99,8	65	82,2
Montfort - Mft	145	87	68,5	23,7	49,8	27,5	46,7	21,1	78	53,1	91,6	72,3	92,1		104	72,9	70,3	41,6	151	18,6	23,7	54,7	60,8	48,7	65,4
Nieuwstadt - Net	88	114	79,8	91,2	140	56,3	96	95,1	105	102	103	92,6	119	105		99,4	96,9	65,3	93,1	96,4	118	25,9	110	52,3	93,2
Pepinusbrug - Pep	139	28,8	61,8	57,9	26,3	18,6	62,7	61,8	19,9	69,1	84,8	74,6	33,9	72	97,4		14,7	60	78,4	63	84,8	47,9	76,7	41,9	59,8
Pey - Pej	135	31,4	57,9	54,1	22,4	14,7	58,8	57,9	22,4	65,2	81	70,7	36,5	68,2	93,5	13,5		56,2	74,6	59,2	81	44,1	72,9	38,1	56,9
Roermond - Rm	54,3	76,2	48	51,9	100	21,1	56,4	49,3	65	62,8	27,5	37,8	81,3	39,1	78,3	59,9	57,3		59,4	46,7	27,5	28,9	76	22,9	53,4
Roosteren - Rst	16	163	79,3	141	189	55,8	146	145	154	152	102	92,1	168	155	127	83,7	81,1	64,8		146	168	62,1	160	23,7	116
Sint Joost - Sjt	138	79,3	60,9	16	42,1	19,9	39,1	13,5	70,3	45,5	83,9	64,7	84,4	19,9	96,5	65,2	62,7	50,6	143		32,7	47	53,1	41	59,5
Sint Odiliënberg - Sob	157	98,5	80,1	35,2	61,3	39,1	58,3	32,7	89,5	64,7	103	79,4	104	22,4	116	84,4	81,9	28,8	162	30,1		66,2	72,3	60,2	75,1
Sittard - Std	51,6	61,9	43,5	39,6	88	19,9	44,4	43,5	52,9	50,8	69	56,3	67	53,7	30,1	47,8	45,3	28,9	56,8	44,7	66,5		58,4	15,9	49,4
Stevensweert - Svt	149	90,4	67,3	45,5	51,1	28,8	25	49,3	81,5	18,6	89,1	22,4	95,6	62,1	108	76,4	73,8	70,2	154	53,1	74,9	58,2		52,2	69,4
Susteren - Srn	18,6	44,1	38,5	34,6	83	14,9	39,4	38,5	35,1	45,8	61,5	51,3	49,2	48,7	66,3	42,8	40,3	23,9	23,7	39,7	61,5	16,9	53,4		42,2
Average	112	74,8	58,3	54,6	65,5	28,2	59,8	57,2	66,9	64,9	77,7	60,5	79,8	66,2	99,6	58,1	56,2	54,2	115	60,2	73	50,1	70,1	43,3	

Delta GTT (absolute)

Average: -7.63
Minimum: -157.40
Maximum: +166.80

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		70	-21	36	122	-17	25	36	55	47	6	-18	83	33	95	-17	-17	-19	0	33	-23	14	47	-1	568
Echterbosch - Etb	53		12	-46	9	6	-35	-46	-57	-35	7	12	1	-46	6	-39	-32	15	115	-46	-46	-2	-35	-2	-230
Echt, Kelvinweg - Ekw	-20	-25		-49	-104	4	-35	-50	13	-35	-76	0	-12	32	23	16	16	6	45	-25	-35	-12	-38	-3	-363
Echt, Noorderpoort - Enp	39	-31	6		-154	0	-64	0	25	-68	-8	-51	-18	0	13	30	30	6	39	0	0	-13	-68	-13	-299
Echt, Plats - Eps	95	8	-88	-15		0	-4	-15	-98	17	-18	-18	20	-15	54	-99	-99	46	162	7	-15	28	-4	28	-25
Echt, Station Arriva - Ec	-17	0	1	0	0		0	0	-1	0	-12	1	13	0	25	1	1	0	24	0	0	0	0	0	37
Echt, Zuiderpoort - Ezp	25	-104	-68	-17	-69	-1		-17	-66	0	34	0	-91	-15	8	-63	-63	1	56	-15	-15	-23	0	-23	-527
Hingen - Hin	38	-32	4	-1	-155	-1	-65		24	-62	-6	-53	-19	0	19	29	29	3	38	0	0	-6	-62	-6	-285
Koningsbosch - Knb	44	-157	8	23	-120	3	-98	23		-98	10	-51	-145	34	26	4	-3	18	43	34	34	-4	-98	-4	-473
Laak - Lak	4	-104	-74	-17	-69	-1	0	-17	-66		47	0	-91	-15	9	-63	-63	7	31	-15	-15	-17	0	-17	-546
Linne - Lni	-36	-116	-46	-7	-67	-12	36	-7	-16	29		0	-103	-6	6	-13	-13	1	-36	-7	-4	-19	29	-19	-427
Maasbracht - Mbt	-23	-27	-3	-114	-81	1	-1	-17	3	-1	0		-14	46	20	6	6	1	-23	-11	1	-5	-1	-5	-243
Maria Hoop - Mrh	60	-4	20	-38	17	14	-27	-38	-49	-27	15	-39		-38	13	-31	-25	16	123	-38	-7	5	-27	5	-101
Montfort - Mft	37	-33	28	-3	-104	-3	-67	-1	22	-67	38	46	-20		14	27	27	-9	37	-1	0	-11	-99	-11	-152
Nieuwstadt - Net	64	-16	5	-38	65	8	-27	-38	22	-27	13	5	-3	-38		25	25	8	64	-38	-38	-2	-27	36	52
Pepinusbrug - Pep	44	-134	8	37	-120	3	-37	37	-1	-34	10	8	-125	34	26		1	13	-21	34	34	-4	-37	-4	-227
Pey - Pej	43	-129	7	36	-121	1	-38	36	-1	-41	9	7	-120	33	24	0		12	-23	33	33	-5	-38	-5	-248
Roermond - Rm	-18	-23	6	-5	12	-1	-6	-4	11	7	1	1	-5	-3	24	13	13		-18	-4	-1	-1	28	-1	27
Roosteren - Rst	0	115	-22	81	167	28	91	81	45	91	6	12	128	81	95	-17	-17	-5		81	81	14	91	-1	1226
Sint Joost - Sjt	38	-32	4	-1	-109	-1	-65	0	24	-65	1	-53	-19	0	15	29	29	0	38		0	-10	-65	-10	-254
Sint Odiliënberg - Sob	35	-34	2	-4	-105	-4	-68	-3	21	-68	42	8	-22	-1	22	26	26	0	35	-3		-13	-68	-13	-186
Sittard - Std	10	-43	-4	-62	-5	-1	-51	-62	-2	-51	7	-4	-27	-62	1	0	0	-1	10	-62	-62		-51	-1	-524
Stevensweert - Svt	31	-104	-96	-17	-69	-1	0	-17	-66	0	56	0	-91	-15	9	-63	-63	22	31	-15	-15	-17		-17	-516
Susteren - Srn	0	-53	-3	-61	13	0	-50	-61	-14	-50	8	-3	-39	-61	49	1	1	0	0	-61	-61	0	-50		-495
Total	546	-1006	-312	-286	-1048	25	-587	-183	-171	-537	192	-188	-719	-21	597	-199	-191	143	771	-118	-155	-101	-574	-86	

Delta GTT (relative)

Average: +7.54%
Minimum: -88.80%
Maximum: +743.98%

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		80%	-22%	36%	196%	-25%	21%	34%	59%	46%	6%	-17%	104%	28%	363%	-18%	-19%	-24%	0	31%	-18%	33%	43%	-6%	41%
Echterbosch - Etb	51%		17%	-37%	25%	20%	-30%	-36%	-74%	-28%	8%	15%	9%	-33%	5%	-56%	-49%	24%	239%	-36%	-31%	-3%	-27%	-4%	-1%
Echt, Kelvinweg - Ekw	-22%	-24%		-47%	-72%	24%	-36%	-46%	24%	-34%	-69%	0	-12%	82%	31%	33%	34%	14%	46%	-29%	-36%	-23%	-34%	-6%	-9%
Echt, Noorderpoort - Enp	42%	-29%	11%		-81%	0	-65%	0	62%	-63%	-9%	-46%	-18%	0	16%	100%	109%	13%	40%	0	0	-23%	-59%	-26%	-1%
Echt, Plats - Eps	112%	21%	-70%	-31%		0	-10%	-29%	-74%	36%	-23%	-26%	71%	-24%	63%	-79%	-81%	83%	725%	12%	-20%	47%	-8%	52%	32%
Echt, Station Arriva - Ec	-27%	0	8%	0	0		0	0	-5%	0	-22%	4%	54%	0	56%	8%	10%	0	87%	0	0	0	0	0	7%
Echt, Zuiderpoort - Ezp	24%	-58%	-54%	-36%	-65%	-8%		-33%	-49%	0	73%	0	-53%	-24%	9%	-50%	-51%	2%	51%	-28%	-20%	-38%	0	-42%	-20%
Hingen - Hin	39%	-29%	8%	-9%	-80%	-7%	-64%		53%	-59%	-6%	-46%	-19%	0	26%	85%	92%	5%	37%	0	0	-12%	-55%	-14%	-2%
Koningsbosch - Knb	42%	-89%	13%	72%	-77%	10%	-57%	64%		-55%	12%	-37%	-85%	71%	31%	18%	-11%	34%	39%	88%	56%	-6%	-53%	-7%	3%
Laak - Lak	3%	-56%	-53%	-32%	-61%	-6%	0	-30%	-47%		117%	0	-51%	-21%	10%	-48%	-49%	12%	27%	-25%	-18%	-25%	0	-27%	-17%
Linne - Lni	-28%	-54%	-59%	-8%	-48%	-22%	76%	-8%	-15%	72%		0	-50%	-6%	6%	-13%	-14%	5%	-27%	-8%	-6%	-22%	89%	-24%	-7%
Maasbracht - Mbt	-22%	-23%	-11%	-67%	-62%	4%	-4%	-22%	4%	-4%	0		-13%	175%	23%	8%	9%	4%	-21%	-15%	1%	-8%	-6%	-9%	-3%
Maria Hoop - Mrh	59%	-21%	30%	-32%	51%	51%	-24%	-31%	-67%	-23%	16%	-29%		-29%	12%	-48%	-40%	24%	278%	-31%	-6%	8%	-22%	9%	6%
Montfort - Mft	34%	-28%	70%	-10%	-68%	-9%	-59%	-6%	40%	-56%	71%	175%	-18%		16%	60%	64%	-18%	32%	-6%	0	-17%	-62%	-19%	8%
Nieuwstadt - Net	271%	-12%	7%	-29%	86%	17%	-22%	-28%	27%	-21%	15%	6%	-2%	-26%		33%	34%	14%	223%	-28%	-24%	-6%	-20%	226%	32%
Pepinusbrug - Pep	46%	-82%	15%	174%	-82%	16%	-37%	147%	-6%	-33%	14%	12%	-79%	91%	36%		10%	29%	-21%	119%	68%	-8%	-32%	-9%	17%
Pey - Pej	46%	-80%	14%	191%	-84%	10%	-39%	158%	-5%	-38%	12%	11%	-77%	94%	35%	0		28%	-23%	125%	69%	-11%	-34%	-12%	17%
Roermond - Rm	-25%	-23%	14%	-9%	14%	-6%	-9%	-7%	20%	13%	5%	4%	-6%	-6%	45%	29%	30%		-24%	-8%	-4%	-3%	58%	-4%	4%
Roosteren - Rst	0	240%	-22%	133%	744%	102%	169%	125%	42%	151%	7%	15%	317%	108%	304%	-17%	-18%	-7%		123%	92%	29%	134%	-5%	120%
Sint Joost - Sjt	38%	-29%	8%	-7%	-72%	-6%	-63%	0	50%	-59%	1%	-45%	-18%	0	19%	79%	85%	0	36%		0	-18%	-55%	-20%	-3%
Sint Odiliënberg - Sob	29%	-26%	2%	-10%	-63%	-9%	-54%	-7%	31%	-51%	68%	11%	-17%	-5%	24%	45%	47%	0	28%	-8%		-16%	-48%	-17%	-2%
Sittard - Std	24%	-41%	-9%	-61%	-5%	-5%	-54%	-59%	-4%	-50%	11%	-7%	-29%	-54%	4%	1%	1%	-3%	21%	-58%	-48%		-47%	-6%	-21%
Stevensweert - Svt	27%	-53%	-59%	-28%	-57%	-4%	0	-26%	-45%	0	173%	0	-49%	-19%	9%	-45%	-46%	46%	26%	-22%	-17%	-22%		-24%	-10%
Susteren - Srn	0	-55%	-7%	-64%	19%	0	-56%	-61%	-29%	-52%	16%	-6%	-44%	-56%	283%	3%	3%	0	0	-61%	-50%	0	-48%		-11%
Average	36%	-22%	-7%	4%	8%	7%	-20%	5%	0%	-15%	23%	0%	-4%	16%	68%	6%	7%	14%	87%	7%	-1%	-7%	-14%	0%	

WGTT Veolia

Average WTT: 39.20

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit	0		0	0	0	21,4	0	0	0	0	0	0	0,67	0	0	0	3,02	11,7	0	0	0	34,7	0	0
Echterbosch - Etb	0	0		0	13,1	155	0	0	36,2	0	445	182	0	49,7	0	8,95	4,24	841	0	15,8	8,85	133	5,06	9,94
Echt, Kelvinweg - Ekw	0	0	2,28		113	12,7	22,3	0	1,83	4,92	3,95	10,1	0	0	0	1,37	0	2,17	0	0	0	19,8	31,6	0
Echt, Noorderpoort - Enp	0	6,64	0			2,91	40,7	0	448	0	7,14	0	44,5	0	0	5,7	27,9	2,51	0	9,81	0	0	0	0
Echt, Plats - Eps	0	240	409	0	18,9		23,3	20,8	294	241	361	1601	163	689	0	23,3	31,8	0	5,01	87	40,3	0	331	0
Echt, Station Arriva - Ec	0	0	39,9	0	0	13,1		0	24,2	22	8,5	23,2	0	0	0	0	0	37,7	0	4,9	3,44	8,27	76,1	4,97
Echt, Zuiderpoort - Ezp	0	0	0	0	0	11	0		0	9,5	0	0	0	9,7	0	0	0	23,5	0	0	1,66	2,3	10,2	0
Hingen - Hin	0	0	0	0	256	332	0	0		0	54,1	12,3	0	0	0	1,92	10,8	274	0	0	0	319	0	7,66
Koningsbosch - Knb	0	0	0	0	0	311	20,4	0	0		1,83	68,4	8,13	28,4	0	54	0	433	0	0	3,73	329	5,07	27,7
Laak - Lak	0	9,82	309	0	0	217	0	0	0	0		170	56,8	4,16	5,02	67,3	0	3062	0	0	3,58	393	0	0
Linne - Lni	0	5,3	162	0	0	1472	76,3	0	0	41	176		9,9	13,1	0	124	27,5	6660	25,1	0	0	2427	34,6	66,8
Maasbracht - Mbt	0	0	0	0	25,2	192	0	0	0	0	0	0		0	0	0	11,4	155	0	266	0	206	0	2,71
Maria Hoop - Mrh	0	0	0	27,5	0	482	25,8	9,17	0	27,2	0	8,36	0		0	8,27	0	209	36,2	0	23,7	693	72,8	19,1
Montfort - Mft	0	70,5	0	0	0	2,19	0	0	0	0	0	0	0	0		0	0	7,78	0	0	14,2	1848	0	0,73
Nieuwstadt - Net	0	7,39	0	0	0	8,01	0	0	0	0	17	0	0	0	0		1,84	118	0	0	0	297	0	0
Pepinusbrug - Pep	0	0	0	0	52,1	14,7	0	0	6,46	4,81	0	5,8	14,3	0	0	0		100	0	0	0	78,5	0	1,97
Pey - Pej	29,7	13,5	504	205	0	0	87,5	87	254	342	2901	5930	279	1565	12,3	110	0		226	297	790	0	338	0
Roermond - Rm	0	0	0	0	0	7,51	0	0	0	0	0	0	0	0	0	9,19	0	271		0	0	207	0	233
Roosteren - Rst	40,8	172	0	4,72	0	69,2	4,75	0	6,37	121	389	320	108	1,81	0	292	23,1	74	1288		83,1	88,1	0	144
Sint Joost - Sjt	0	36,2	0	28,4	0	23,4	5,74	3,2	0	6,03	0	3,25	0	22,6	0	0	0	11,8	0	0		111	0	0
Sint Odiliënberg - Sob	17	57,2	0	0	0	0	0	9,59	329	347	377	2257	210	1110	1975	90,8	0	0	134	150	193		259	0
Sittard - Std	0	0	74,3	0	0	356	81,8	0	0	2,53	0	44,8	0	28	0	6,34	0	1104	0	0	0	241		3,12
Stevensweert - Svt	24,5	92,8	0	0	0	0	0	0	26,8	8,72	316	49,4	535	0	0	1554	33,7	0	377	224	317	0	0	
Susteren - Srn	0		0	0	0	21,4	0	0	0	0	0	0	0,67	0	0	0	3,02	11,7	0	0	0	34,7	0	0

WGTT Arriva

Average WTT: 38.23

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	25,8	0	0	0	0	0	0	0,73	0	0	0	1,54	14,4	0	0	0	33,6	0	0
Echt, Kelvinweg - Ekw	0	0		0	3,63	192	0	0	44,8	0	137	182	0	90,5	0	11,9	5,7	959	0	11,3	5,65	102	3,31	9,32
Echt, Noorderpoort - Enp	0	0	2,53		21,9	12,7	7,71	0	2,96	1,83	3,58	5,41	0	0	0	2,73	0	2,45	0	0	0	15,2	13,1	0
Echt, Plats - Eps	0	8,03	0	4,58		2,91	36,6	0	118	0	5,49	0	76,2	0	0	1,19	5,39	4,59	0	11	0	0	0	0
Echt, Station Arriva - Ec	0	240	442	0	18,9		23,3	20,8	278	241	281	1672	251	689	0	25,2	34,8	0	9,35	87	40,3	0	331	0
Echt, Zuiderpoort - Ezp	0	0	18,4	0	0	12,1		0	12,3	22	14,7	23,2	0	0	0	0	0	38,3	0	3,55	2,76	5,12	76,1	2,87
Hingen - Hin	0	0	0	0	0	10,2	0		0	3,9	0	0	0	9,7	0	0	0	24,7	0	0	1,66	2,02	4,6	0
Koningsbosch - Knb	0	0	0	0	59,7	364	0	0		0	60,5	7,71	0	0	0	2,27	9,61	367	0	0	0	299	0	7,11
Laak - Lak	0	0	0	0	0	293	20,4	0	0		3,97	68,4	3,99	22,3	0	28,1	0	486	0	0	3,06	248	5,07	20,2
Linne - Lni	0	4,54	126	0	0	169	0	0	0	0		170	28,6	3,91	5,32	58,4	0	3211	0	0	3,38	307	0	0
Maasbracht - Mbt	0	4,07	144	0	0	1538	73,6	0	0	39,3	176		8,61	36,2	0	134	29,8	6893	19,9	0	0	2223	32,7	60,6
Maria Hoop - Mrh	0	0	0	0	38,1	289	0	0	0	0	0	0		0	0	0	6,87	193	0	184	0	223	0	2,95
Montfort - Mft	0	0	0	24,8	0	441	10,6	8,65	0	12,1	0	23	0		0	13,3	0	172	47,9	0	23,7	574	27,6	15,5
Nieuwstadt - Net	0	61,9	0	0	0	2,56	0	0	0	0	0	0	0	0		0	0	8,9	0	0	10,7	1738	0	2,38
Pepinusbrug - Pep	0	1,31	0	0	0	9,29	0	0	0	0	19,3	0	0	0	0		2,01	153	0	0	0	274	0	0
Pey - Pej	0	0	0	0	8,15	16,1	0	0	6,11	2,96	0	6,43	3,32	0	0	0		128	0	0	0	70,1	0	1,73
Roermond - Rm	22,2	10,4	574	186	0	0	79,5	80,7	304	386	3042	6138	263	1468	17,8	142	0		173	274	755	0	536	0
Roosteren - Rst	0	0	0	0	0	15,2	0	0	0	0	0	0	0	0	0	7,61	0	253		0	0	268	0	221
Sint Joost - Sjt	56,4	123	0	4,37	0	65	1,78	0	9,59	49,6	393	176	88,3	1,81	0	522	42,7	74	1754		83,1	72,7	0	116
Sint Odiliënberg - Sob	0	26,9	0	25,6	0	21,3	2,65	2,97	0	2,94	0	3,61	0	21,4	0	0	0	11,8	0	0		93,3	0	0
Sittard - Std	21,1	33,8	0	0	0	0	0	3,95	315	173	417	2105	149	515	2063	91,3	0	0	163	63	99,8		138	0
Stevensweert - Svt	0	0	30,6	0	0	341	81,8	0	0	2,53	0	44,8	0	22,6	0	3,47	0	1616	0	0	0	188		2,37
Susteren - Srn	24,5	42,1	0	0	0	0	0	0	19,2	4,16	366	46,6	298	0	0	1602	34,8	0	377	88,5	159	0	0	

Delta WGTT

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	4	0	0	0	0	0	0	0	0	0	0	-1	3	0	0	0	-1	0	0	5
Echt, Kelvinweg - Ekw	0	0			-9	37	0	0	9	0	-308	0	0	41	0	3	1	118	0	-5	-3	-31	-2	-1	-150
Echt, Noorderpoort - Enp	0	0	0		-91	0	-15	0	1	-3	0	-5	0	0	0	1	0	0	0	0	0	-5	-19	0	-134
Echt, Plats - Eps	0	1	0	5		0	-4	0	-330	0	-2	0	32	0	0	-5	-23	2	0	1	0	0	0	0	-321
Echt, Station Arriva - Ec	0	0	33	0	0		0	0	-16	0	-80	71	88	0	0	2	3	0	4	0	0	0	0	0	105
Echt, Zuiderpoort - Ezp	0	0	-22	0	0	-1		0	-12	0	6	0	0	0	0	0	0	1	0	-1	-1	-3	0	-2	-35
Hingen - Hin	0	0	0	0	0	-1	0		0	-6	0	0	0	0	0	0	0	1	0	0	0	0	-6	0	-11
Koningsbosch - Knb	0	0	0	0	-196	32	0	0		0	6	-5	0	0	0	0	-1	93	0	0	0	-20	0	-1	-90
Laak - Lak	0	0	0	0	0	-18	0	0	0		2	0	-4	-6	0	-26	0	53	0	0	-1	-81	0	-8	-88
Linne - Lni	0	-5	-184	0	0	-48	0	0	0	0		0	-28	0	0	-9	0	149	0	0	0	-86	0	0	-211
Maasbracht - Mbt	0	-1	-17	0	0	65	-3	0	0	-2	0		-1	23	0	10	2	234	-5	0	0	-204	-2	-6	93
Maria Hoop - Mrh	0	0	0	0	13	98	0	0	0	0	0	0		0	0	0	-4	38	0	-82	0	17	0	0	79
Montfort - Mft	0	0	0	-3	0	-41	-15	-1	0	-15	0	15	0		0	5	0	-37	12	0	0	-118	-45	-4	-247
Nieuwstadt - Net	0	-9	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1	0	0	-3	-110	0	2	-119
Pepinusbrug - Pep	0	-6	0	0	0	1	0	0	0	0	2	0	0	0	0		0	34	0	0	0	-23	0	0	9
Pey - Pej	0	0	0	0	-44	1	0	0	0	-2	0	1	-11	0	0	0		28	0	0	0	-8	0	0	-36
Roermond - Rm	-8	-3	70	-18	0	0	-8	-6	51	44	141	208	-16	-96	6	32	0		-54	-23	-35	0	197	0	481
Roosteren - Rst	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	-2	0	-18		0	0	61	0	-12	37
Sint Joost - Sjt	16	-49	0	0	0	-4	-3	0	3	-71	4	-143	-20	0	0	230	20	0	466		0	-15	0	-28	403
Sint Odiliënberg - Sob	0	-9	0	-3	0	-2	-3	0	0	-3	0	0	0	-1	0	0	0	0	0	0		-18	0	0	-39
Sittard - Std	4	-23	0	0	0	0	0	-6	-14	-174	40	-153	-61	-595	88	1	0	0	29	-87	-93		-121	0	-1166
Stevensweert - Svt	0	0	-44	0	0	-15	0	0	0	0	0	0	0	-5	0	-3	0	511	0	0	0	-53		-1	390
Susteren - Srn	0	-51	0	0	0	0	0	0	-8	-5	50	-3	-237	0	0	48	1	0	0	-136	-158	0	0	0	-498
Total	12	-156	-163	-20	-328	118	-51	-13	-315	-237	-137	-13	-260	-640	94	288	-2	1211	452	-332	-294	-701	3	-60	

Sundays

OD Arriva (including train connections)

Total: 1416.7
Average: 2.46
Minimum: 0.0
Maximum: 240.75

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot	Per
Dieteren - Dit	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Echterbosch - Etb	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Echt, Kelvinweg - Ekw	0,0	0,0	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,0	2,8	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0	0,0	0,0	0,0	3,5	0,2%
Echt, Noorderpoort - Enp	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,0	1,25	0,1%
Echt, Plats - Eps	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Echt, Station Arriva - Ec	0,0	0,0	1,8	2,0	0,0	0,0	0,5	0,0	0,0	1,8	2,3	7,1	0,0	3,0	0,0	0,0	0,0	194,8	0,0	0,3	1,3	96,3	3,0	7,0	321	22,6%
Echt, Zuiderpoort - Ezp	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,0	1	0,1%
Hingen - Hin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Koningsbosch - Knb	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Laak - Lak	0,0	0,0	0,0	0,0	0,0	0,8	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,75	0,1%
Linne - Lni	0,0	0,0	1,0	0,0	0,0	1,3	0,0	0,0	0,0	0,0	0,0	1,3	0,0	0,0	0,0	0,0	0,0	23,3	0,0	0,0	0,0	0,0	0,0	0,0	26,8	1,9%
Maasbracht - Mbt	0,0	0,0	2,0	0,0	0,0	6,8	1,3	0,0	0,0	0,3	1,3	0,0	0,0	0,0	0,0	0,0	0,0	31,0	0,0	0,0	0,0	0,0	0,5	0,0	43	3,0%
Maria Hoop - Mrh	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Montfort - Mft	0,0	0,0	0,0	0,5	0,0	0,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	5,5	0,0	0,0	0,0	0,0	0,0	0,0	6,5	0,5%
Nieuwstadt - Net	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	7,5	0,0	0,0	7,5	0,5%
Pepinusbrug - Pep	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Pey - Pej	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Roermond - Rm	0,0	0,0	0,3	0,0	0,0	138,5	0,0	0,0	0,0	0,3	23,5	29,5	0,0	4,0	0,0	0,0	0,0	0,0	0,0	0,0	8,0	169,8	0,0	59,3	433	30,6%
Roosteren - Rst	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	0,0%
Sint Joost - Sjt	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0	0,0	0,0	0,0	0,25	0,0%
Sint Odiliënberg - Sob	0,0	0,0	0,0	0,3	0,0	0,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0	0,0	6,3	0,0	0,0	0,0	0,0	0,0	0,0	7,5	0,5%
Sittard - Std	0,0	0,0	0,0	0,0	0,0	91,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	6,5	0,0	0,0	240,8	0,0	0,0	0,0	0,0	0,0	41,5	380	26,8%
Stevensweert - Svt	0,0	0,0	0,0	0,3	0,0	2,0	0,5	0,0	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,0	0,0	3,75	0,3%
Susteren - Srn	0,0	0,0	0,0	0,0	0,0	5,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	79,1	0,0	0,0	0,0	95,0	0,0	0,0	180	12,7%
Total	0	0	5	3	0	248	3,25	0	0	2,5	27	38,3	0	7,75	6,5	0	0	581	0	0,25	9,25	369	3,75	108	1416,7	
Percentage	0,0%	0,0%	0,4%	0,2%	0,0%	17,5%	0,2%	0,0%	0,0%	0,2%	1,9%	2,9%	0,0%	0,6%	0,5%	0,0%	0,0%	41,1%	0,0%	0,0%	0,7%	26,0%	0,3%	7,6%		

TT Veolia

Average: 41.79
Minimum: 6
Maximum: 121

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		45		41	42	31	91	44	43	96	76	119	39	54	17	39	37	40	9	47	63	30	102	12	50,8
Echterbosch - Etb	46			62	25	21	42	65	57	47	69	61	8	73	66	50	48	51	34	66	82	54	53	48	51,3
Echt, Kelvinweg - Ekw																									
Echt, Noorderpoort - Enp	35	32			61	8	70	8	27	78	89	89	26	18	29	18	16	19	39	11	27	25	84	19	37,6
Echt, Plats - Eps	26	25		13		9	63	16	78	68	90	82	19	24	33	71	69	72	14	17	33	75	74	69	47,3
Echt, Station Arriva - Ec	28	21		7	9		9	10	16	14	36	28	15	18	19	9	7	14	18	11	27	15	20	9	16,4
Echt, Zuiderpoort - Ezp	41	38		26	59	8		29	31	10	32	24	32	37	32	24	22	25	45	30	46	28	16	22	29,9
Hingen - Hin	38	35		8	64	11	73		30	75	92	92	29	15	26	21	19	22	42	8	24	22	81	16	38,3
Koningsbosch - Knb	44	71		59	81	17	49	62		54	76	68	65	72	65	14	15	58	39	65	81	31	60	25	53,2
Laak - Lak	46	43		31	64	13	10	34	36		27	19	37	42	37	29	27	30	50	35	51	33	11	27	33,3
Linne - Lni	63	66		54	81	36	33	57	53	28		13	60	65	54	46	44	16	67	58	74	50	22	44	49,3
Maasbracht - Mbt	61	58		72	79	28	25	49	51	20	13		52	57	52	44	42	24	88	50	66	48	14	42	47
Maria Hoop - Mrh	43	11		59	22	18	39	62	54	44	66	58		70	63	47	45	81	31	63	121	51	50	45	52
Montfort - Mft	45	42		15	77	18	80	12	37	85	99	99	36		36	28	26	29	49	10	14	32	91	26	44,8
Nieuwstadt - Net	15	42		30	52	20	80	33	35	85	73	81	36	41		28	26	29	19	34	50	18	91	9	42,1
Pepinusbrug - Pep	35	62		50	72	8	70	53	14	74	67	59	56	63	56		6	19	39	56	72	22	81	16	47,7
Pey - Pej	34	61		49	71	7	69	52	16	75	66	58	55	62	55	7		18	38	55	71	21	80	15	47
Roermond - Rm	37	34		22	55	14	43	25	29	38	15	23	28	33	28	22	20		41	26	42	24	32	18	29,5
Roosteren - Rst	9	34		22	14	18	72	25	50	77	88	91	28	33	21	43	41	44		26	42	34	83	16	41,4
Sint Joost - Sjt	40	37		10	58	13	75	7	32	80	94	94	31	12	31	23	21	24	44		21	27	86	21	40
Sint Odiliënberg - Sob	55	52		25	87	28	90	22	47	95	109	109	46	15	46	38	36	39	59	20		42	101	36	54,4
Sittard - Std	29	37		25	58	15	75	28	30	80	68	46	31	36	19	23	21	24	33	29	45		86	11	38,6
Stevensweert - Svt	52	49		37	70	19	16	40	42	11	21	13	43	48	43	35	33	32	56	41	57	39		33	37,7
Susteren - Srn	11	31		19	48	9	69	22	24	74	62	40	25	30	10	17	15	18	15	23	39	11	80		31,5
Average	37,9	42,1		33,5	56,8	16,8	56,5	34,3	37,8	59,5	64,9	62,1	36,2	41,7	38,1	30,7	28,9	33,1	39,5	35,5	52,2	33,3	63,5	26,3	

TT Arriva

Average: 36.79
Minimum: 7
Maximum: 84

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		72	59	56		22	59	59	65	64	47	69	76	67	70	31	29	31	9	60	77	27	70	11	51,4
Echterbosch - Etb	74		42	39		26	42	42	12	47	60	52	9	50	83	20	23	44	78	43	60	40	53	34	44,2
Echt, Kelvinweg - Ekw	29	40		24		12	27	27	33	32	23	15	44	35	68	29	27	29	63	28	35	18	35	19	31,5
Echt, Noorderpoort - Enp	55	36	23			8	23	8	29	28	41	33	40	18	64	25	23	25	59	11	28	21	34	15	29,4
Echt, Plats - Eps																									
Echt, Station Arriva - Ec	19	21	10	7			9	10	14	14	28	20	25	18	58	10	8	14	23	11	28	15	20	9	17,8
Echt, Zuiderpoort - Ezp	52	37	24	21		8		24	30	10	42	25	41	34	65	26	24	26	56	27	44	18	16	12	30,1
Hingen - Hin	57	38	25	7		10	25		31	30	43	35	42	15	66	27	25	27	61	8	25	23	36	17	30,6
Koningsbosch - Knb	67	12	35	21		19	35	24		40	53	45	16	43	76	16	13	37	71	36	53	33	46	27	37,2
Laak - Lak	61	42	29	26		13	10	29	35		47	20	46	39	70	31	29	31	65	32	49	27	11	21	34,7
Linne - Lni	45	56	21	40		28	43	43	49	48		13	60	51	84	45	43	16	49	44	61	41	73	35	44,9
Maasbracht - Mbt	37	48	13	32		20	24	33	41	19	13		52	33	76	37	35	24	41	36	53	33	13	27	33,6
Maria Hoop - Mrh	77	8	45	42		29	45	45	15	50	63	55		53	86	23	26	47	81	46	63	43	56	37	47
Montfort - Mft	65	46	33	15		18	33	13	39	38	51	43	50		74	35	33	29	69	11	15	31	44	25	36,8
Nieuwstadt - Net	56	67	84	51		47	54	54	60	59	102	94	71	62		56	54	56	60	55	72	20	65	43	61
Pepinusbrug - Pep	59	19	27	24		11	27	27	12	32	45	37	23	35	68		8	29	33	28	45	25	38	19	30,5
Pey - Pej	56	21	24	21		8	24	24	14	29	42	34	25	32	65	7		26	30	25	42	22	35	16	28,3
Roermond - Rm	27	38	32	23		13	25	23	31	30	16	24	42	27	66	27	25		31	26	18	23	36	17	28,2
Roosteren - Rst	9	76	63	60		26	63	63	69	68	81	73	80	71	74	35	33	35		64	81	31	74	15	56,5
Sint Joost - Sjt	59	40	27	9		12	27	7	33	32	45	37	44	12	68	29	27	29	63		22	25	38	19	32
Sint Odiliënberg - Sob	74	55	42	24		27	42	22	48	47	60	52	59	14	83	44	42	19	78	20		40	53	34	44,5
Sittard - Std	23	34	51	18		14	21	21	27	26	69	61	38	29	20	23	21	23	27	22	39		32	10	29,5
Stevensweert - Svt	67	48	32	32		19	16	35	41	11	72	14	52	45	76	37	35	37	71	38	55	33		27	40,6
Susteren - Srn	11	29	46	13		9	16	16	22	21	64	56	33	24	54	18	16	18	15	17	34	11	27		25,9
Average	49	40,1	35,8	27,5		18,1	31,4	29,5	34,1	35,2	50,3	41,2	44	36,7	68,8	28,7	27,2	29,6	51,5	31,3	45,4	27,3	41,1	22,2	

Delta TT (absolute)

Average: -3.72
Minimum: -59.00
Maximum: +53.00

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		27		15		-9	-32	15	22	-32	-29	-50	37	13	53	-8	-8	-9	0	13	14	-3	-32	-1	-4
Echterbosch - Etb	28			-23		5	0	-23	-45	0	-9	-9	1	-23	17	-30	-25	-7	44	-23	-22	-14	0	-14	-172
Echt, Kelvinweg - Ekw																									
Echt, Noorderpoort - Enp	20	4				0	-47	0	2	-50	-48	-56	14	0	35	7	7	6	20	0	1	-4	-50	-4	-143
Echt, Plats - Eps																									
Echt, Station Arriva - Ec	-9	0		0			0	0	-2	0	-8	-8	10	0	39	1	1	0	5	0	1	0	0	0	30
Echt, Zuiderpoort - Ezp	11	-1		-5		0		-5	-1	0	10	1	9	-3	33	2	2	1	11	-3	-2	-10	0	-10	40
Hingen - Hin	19	3		-1		-1	-48		1	-45	-49	-57	13	0	40	6	6	5	19	0	1	1	-45	1	-131
Koningsbosch - Knb	23	-59		-38		2	-14	-38		-14	-23	-23	-49	-29	11	2	-2	-21	32	-29	-28	2	-14	2	-307
Laak - Lak	15	-1		-5		0	0	-5	-1		20	1	9	-3	33	2	2	1	15	-3	-2	-6	0	-6	66
Linne - Lni	-18	-10		-14		-8	10	-14	-4	20		0	0	-14	30	-1	-1	0	-18	-14	-13	-9	51	-9	-36
Maasbracht - Mbt	-24	-10		-40		-8	-1	-16	-10	-1	0		0	-24	24	-7	-7	0	-47	-14	-13	-15	-1	-15	-229
Maria Hoop - Mrh	34	-3		-17		11	6	-17	-39	6	-3	-3		-17	23	-24	-19	-34	50	-17	-58	-8	6	-8	-131
Montfort - Mft	20	4		0		0	-47	1	2	-47	-48	-56	14		38	7	7	0	20	1	1	-1	-47	-1	-132
Nieuwstadt - Net	41	25		21		27	-26	21	25	-26	29	13	35	21		28	28	27	41	21	22	2	-26	34	383
Pepinusbrug - Pep	24	-43		-26		3	-43	-26	-2	-42	-22	-22	-33	-28	12		2	10	-6	-28	-27	3	-43	3	-334
Pey - Pej	22	-40		-28		1	-45	-28	-2	-46	-24	-24	-30	-30	10	0		8	-8	-30	-29	1	-45	1	-366
Roermond - Rm	-10	4		1		-1	-18	-2	2	-8	1	1	14	-6	38	5	5		-10	0	-24	-1	4	-1	-6
Roosteren - Rst	0	42		38		8	-9	38	19	-9	-7	-18	52	38	53	-8	-8	-9		38	39	-3	-9	-1	284
Sint Joost - Sjt	19	3		-1		-1	-48	0	1	-48	-49	-57	13	0	37	6	6	5	19		1	-2	-48	-2	-146
Sint Odiliënberg - Sob	19	3		-1		-1	-48	0	1	-48	-49	-57	13	-1	37	6	6	-20	19	0		-2	-48	-2	-173
Sittard - Std	-6	-3		-7		-1	-54	-7	-3	-54	1	15	7	-7	1	0	0	-1	-6	-7	-6		-54	-1	-193
Stevensweert - Svt	15	-1		-5		0	0	-5	-1	0	51	1	9	-3	33	2	2	5	15	-3	-2	-6		-6	101
Susteren - Srn	0	-2		-6		0	-53	-6	-2	-53	2	16	8	-6	44	1	1	0	0	-6	-5	0	-53		-120
Total	243	-58		-142		27	-517	-117	-37	-497	-254	-392	146	-122	641	-3	5	-33	215	-104	-151	-75	-454	-40	

Delta TT (relative)

Average: +5.21%
Minimum: -83.10%
Maximum: +440.00%

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		60%		37%		-29%	-35%	34%	51%	-33%	-38%	-42%	95%	24%	312%	-21%	-22%	-23%	0	28%	22%	-10%	-31%	-8%
Echterbosch - Etb	61%			-37%		24%	0	-35%	-79%	0	-13%	-15%	13%	-32%	26%	-60%	-52%	-14%	129%	-35%	-27%	-26%	0	-29%
Echt, Kelvinweg - Ekw																								
Echt, Noorderpoort - Enp	57%	13%				0	-67%	0	7%	-64%	-54%	-63%	54%	0	121%	39%	44%	32%	51%	0	4%	-16%	-60%	-21%
Echt, Plats - Eps																								
Echt, Station Arriva - Ec	-32%	0		0			0	0	-13%	0	-22%	-29%	67%	0	205%	11%	14%	0	28%	0	4%	0	0	0
Echt, Zuiderpoort - Ezp	27%	-3%		-19%		0		-17%	-3%	0	31%	4%	28%	-8%	103%	8%	9%	4%	24%	-10%	-4%	-36%	0	-45%
Hingen - Hin	50%	9%		-13%		-9%	-66%		3%	-60%	-53%	-62%	45%	0	154%	29%	32%	23%	45%	0	4%	5%	-56%	6%
Koningsbosch - Knb	52%	-83%		-64%		12%	-29%	-61%		-26%	-30%	-34%	-75%	-40%	17%	14%	-13%	-36%	82%	-45%	-35%	6%	-23%	8%
Laak - Lak	33%	-2%		-16%		0	0	-15%	-3%		74%	5%	24%	-7%	89%	7%	7%	3%	30%	-9%	-4%	-18%	0	-22%
Linne - Lni	-29%	-15%		-26%		-22%	30%	-25%	-8%	71%		0	0	-22%	56%	-2%	-2%	0	-27%	-24%	-18%	-18%	232%	-20%
Maasbracht - Mbt	-39%	-17%		-56%		-29%	-4%	-33%	-20%	-5%	0		0	-42%	46%	-16%	-17%	0	-53%	-28%	-20%	-31%	-7%	-36%
Maria Hoop - Mrh	79%	-27%		-29%		61%	15%	-27%	-72%	14%	-5%	-5%		-24%	37%	-51%	-42%	-42%	161%	-27%	-48%	-16%	12%	-18%
Montfort - Mft	44%	10%		0		0	-59%	8%	5%	-55%	-48%	-57%	39%		106%	25%	27%	0	41%	10%	7%	-3%	-52%	-4%
Nieuwstadt - Net	273%	60%		70%		135%	-33%	64%	71%	-31%	40%	16%	97%	51%		100%	108%	93%	216%	62%	44%	11%	-29%	378%
Pepinusbrug - Pep	69%	-69%		-52%		38%	-61%	-49%	-14%	-57%	-33%	-37%	-59%	-44%	21%		33%	53%	-15%	-50%	-38%	14%	-53%	19%
Pey - Pej	65%	-66%		-57%		14%	-65%	-54%	-13%	-61%	-36%	-41%	-55%	-48%	18%	0		44%	-21%	-55%	-41%	5%	-56%	7%
Roermond - Rm	-27%	12%		5%		-7%	-42%	-8%	7%	-21%	7%	4%	50%	-18%	136%	23%	25%		-24%	0	-57%	-4%	13%	-6%
Roosteren - Rst	0	124%		173%		44%	-13%	152%	38%	-12%	-8%	-20%	186%	115%	252%	-19%	-20%	-20%		146%	93%	-9%	-11%	-6%
Sint Joost - Sjt	48%	8%		-10%		-8%	-64%	0	3%	-60%	-52%	-61%	42%	0	119%	26%	29%	21%	43%		5%	-7%	-56%	-10%
Sint Odiliënberg - Sob	35%	6%		-4%		-4%	-53%	0	2%	-51%	-45%	-52%	28%	-7%	80%	16%	17%	-51%	32%	0		-5%	-48%	-6%
Sittard - Std	-21%	-8%		-28%		-7%	-72%	-25%	-10%	-68%	1%	33%	23%	-19%	5%	0	0	-4%	-18%	-24%	-13%		-63%	-9%
Stevensweert - Svt	29%	-2%		-14%		0	0	-13%	-2%	0	243%	8%	21%	-6%	77%	6%	6%	16%	27%	-7%	-4%	-15%		-18%
Susteren - Srn	0	-6%		-32%		0	-77%	-27%	-8%	-72%	3%	40%	32%	-20%	440%	6%	7%	0	0	-26%	-13%	0	-66%	

WTT Veolia

Average TT: 21.67

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Noorderpoort - Enp	0	0			0	2	0	0	0	0	0	0	0	13,5	0	0	0	0	0	0	0	0	21	0
Echt, Plats - Eps	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Station Arriva - Ec	0	0		14	0		4,5	0	0	24,5	81	197	0	54	0	0	0	0	0	2,75	33,8	0	60	0
Echt, Zuiderpoort - Ezp	0	0		0	0	0		0	0	2,5	0	0	0	18,5	0	0	0	0	0	0	0	0	4	0
Hingen - Hin	0	0		0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laak - Lak	0	0		0	0	9,75	10	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linne - Lni	0	0		0	0	45	0	0	0	0		16,3	0	0	0	0	0	372	0	0	0	0	0	0
Maasbracht - Mbt	0	0		0	0	189	31,3	0	0	5	16,3		0	0	0	0	0	744	0	0	0	0	7	0
Maria Hoop - Mrh	0	0		0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Montfort - Mft	0	0		7,5	0	9	0	0	0	0	0	0	0		0	0	0	160	0	0	0	0	0	0
Nieuwstadt - Net	0	0		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	135	0	0
Pepinusbrug - Pep	0	0		0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Pey - Pej	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Roermond - Rm	0	0		0	0	0	0	0	0	9,5	353	679	0	132	0	0	0		0	0	336	0	0	0
Roosteren - Rst	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Sint Joost - Sjt	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0		0	0	0	0
Sint Odiliënberg - Sob	0	0		6,25	0	21	0	0	0	0	0	0	0	3,75	0	0	0	244	0	0		0	0	0
Sittard - Std	0	0		0	0	0	0	0	0	0	0	0	0	0	124	0	0	0	0	0	0		0	0
Stevensweert - Svt	0	0		9,25	0	38	8	0	0	0	0	6,5	0	0	0	0	0	16	0	0	0	0		0
Susteren - Srn	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

WTT Arriva

Average TT: 20.18

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Kelvinweg - Ekw	0	0		0		6	0	0	0	0	0	41,3	0	0	0	0	0	7,25	0	0	0	0	0	0
Echt, Noorderpoort - Enp	0	0	0			2	0	0	0	0	0	0	0	13,5	0	0	0	0	0	0	0	0	8,5	0
Echt, Plats - Eps																								
Echt, Station Arriva - Ec	0	0	17,5	14			4,5	0	0	24,5	63	141	0	54	0	0	0	0	0	2,75	35	0	60	0
Echt, Zuiderpoort - Ezp	0	0	0	0		0		0	0	2,5	0	0	0	17	0	0	0	0	0	0	0	0	4	0
Hingen - Hin	0	0	0	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0	0	0		0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laak - Lak	0	0	0	0		9,75	10	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linne - Lni	0	0	21	0		35	0	0	0	0		16,3	0	0	0	0	0	372	0	0	0	0	0	0
Maasbracht - Mbt	0	0	26	0		135	30	0	0	4,75	16,3		0	0	0	0	0	744	0	0	0	0	6,5	0
Maria Hoop - Mrh	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Montfort - Mft	0	0	0	7,5		9	0	0	0	0	0	0	0		0	0	0	160	0	0	0	0	0	0
Nieuwstadt - Net	0	0	0	0		0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	150	0	0
Pepinusbrug - Pep	0	0	0	0		0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Pey - Pej	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Roermond - Rm	0	0	8	0		0	0	0	0	7,5	376	708	0	108	0	0	0		0	0	144	0	0	0
Roosteren - Rst	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Sint Joost - Sjt	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	7,25	0		0	0	0	0
Sint Odiliënberg - Sob	0	0	0	6		20,3	0	0	0	0	0	0	0	3,5	0	0	0	119	0	0		0	0	0
Sittard - Std	0	0	0	0		0	0	0	0	0	0	0	0	0	130	0	0	0	0	0	0		0	0
Stevensweert - Svt	0	0	0	8		38	8	0	0	0	0	7	0	0	0	0	0	18,5	0	0	0	0		0
Susteren - Srn	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Delta WTT

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0			0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Kelvinweg - Ekw																									0
Echt, Noorderpoort - Enp	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-13	0	-13
Echt, Plats - Eps																									0
Echt, Station Arriva - Ec	0	0		0			0	0	0	0	-18	-56	0	0	0	0	0	0	0	0	1	0	0	0	-73
Echt, Zuiderpoort - Ezp	0	0		0		0		0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	-2
Hingen - Hin	0	0		0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0		0		0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laak - Lak	0	0		0		0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linne - Lni	0	0		0		-10	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	-10
Maasbracht - Mbt	0	0		0		-54	-1	0	0	0	0		0	0	0	0	0	0	0	0	0	0	-1	0	-56
Maria Hoop - Mrh	0	0		0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0
Montfort - Mft	0	0		0		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Nieuwstadt - Net	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	15	0	0	15
Pepinusbrug - Pep	0	0		0		0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
Pey - Pej	0	0		0		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Roermond - Rm	0	0		0		0	0	0	0	-2	24	30	0	-24	0	0	0		0	0	-192	0	0	0	-165
Roosteren - Rst	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Sint Joost - Sjt	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1	0		0	0	0	0	1
Sint Odiliënberg - Sob	0	0		0		-1	0	0	0	0	0	0	0	0	0	0	0	-125	0	0		0	0	0	-126
Sittard - Std	0	0		0		0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0		0	0	7
Stevensweert - Svt	0	0		-1		0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0		0	2
Susteren - Srn	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Total	0	0	0	-2	0	-65	-1	0	0	-2	6	-26	0	-26	7	0	0	-121	0	0	-191	15	-13	0	

GTT Veolia

Average: 83.47
Minimum: 12.18
Maximum: 306.06

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		98,3		103	92,7	69,4	209	107	93,9	216	161	241	90,6	119	26,3	96	93,4	78,4	16	110	130	42,9	223	19,9	111
Echterbosch - Etb	74,1			132	36,5	31,4	86,4	136	113	92,8	121	111	14,7	146	146	104	101	99	48	137	157	104	100	98,3	99,5
Echt, Kelvinweg - Ekw																									
Echt, Noorderpoort - Enp	89,1	65,5			148	14,7	159	14,7	39,1	169	183	183	57,8	27,5	74,2	27,5	25	43,4	94,2	18,6	39,1	50,1	177	44,1	79,3
Echt, Plats - Eps	54,1	36,5		35,7		16	143	39,6	169	149	178	167	28,8	49,8	66,7	160	158	156	22,4	40,9	61,3	161	157	155	100
Echt, Station Arriva - Ec	63,7	31,4		13,5	16		16	17,3	25	22,4	50,6	40,3	23,7	27,5	45	16	13,5	19,9	27,5	18,6	39,1	20,9	30,1	14,9	27
Echt, Zuiderpoort - Ezp	102	78,5		65	135	14,7		68,8	67,8	17,3	45,5	35,2	70,9	79,1	84,6	58,8	56,3	54	107	70,1	90,6	59,3	25	53,3	65,4
Hingen - Hin	92,9	69,3		14,7	151	18,6	163		42,9	166	187	187	61,6	23,7	70,4	31,4	28,8	47,3	98	14,7	35,2	46,3	173	40,3	80,2
Koningsbosch - Knb	101	142		80	182	26,3	105	83,9		112	140	130	135	96,7	147	22,4	23,7	118	71,7	87,7	108	57,8	119	51,8	97,3
Laak - Lak	136	84,9		71,4	142	21,1	17,3	75,2	74,2		39,1	28,8	77,3	85,5	89,8	65,2	62,7	53,1	114	76,5	97	65,7	18,6	59,7	70,6
Linne - Lni	132	114		101	171	50,6	46,7	105	104	40,3		21,1	107	115	114	94,7	92,1	25	137	106	126	89,5	32,7	83,5	91,3
Maasbracht - Mbt	128	104		306	161	40,3	36,5	94,4	93,4	30,1	21,1		96,5	105	109	84,4	81,9	35,2	172	95,7	116	84,9	22,4	78,9	85,3
Maria Hoop - Mrh	71,1	18,6		128	32,7	27,5	82,5	132	109	88,9	117	107		142	142	100	97,4	167	44,2	133	207	100	96,6	94,5	102
Montfort - Mft	102	78,3		23,7	177	27,5	172	19,9	51,9	178	196	196	70,6		83,2	40,3	37,8	53,7	107	17,3	22,4	59,1	235	53,1	91
Nieuwstadt - Net	23,7	94,4		80,9	105	48,1	188	84,7	83,7	194	157	167	86,8	95		74,7	72,2	57,1	28,8	86	106	27,5	202	16	94,5
Pepinusbrug - Pep	89,1	126		68,5	171	14,7	159	72,3	22,4	164	128	118	123	85,1	136		12,2	40,9	94,2	76,2	96,7	46,3	173	40,3	93,5
Pey - Pej	87,8	125		67,2	170	13,5	158	71,1	25	166	127	117	122	83,9	134	13,5		39,6	92,9	74,9	95,4	45	172	39	92,7
Roermond - Rm	72,7	64,4		48,3	118	22,4	59,5	52,2	55,5	53,1	23,7	33,9	54,2	62,4	54	46,5	44		77,8	53,5	73,9	29,9	45,5	23,9	53,2
Roosteren - Rst	16	48		47,3	22,4	27,5	154	51,1	110	161	183	179	40,3	61,3	31,4	101	98,6	83,5		52,4	72,9	48	169	25	81
Sint Joost - Sjt	95,5	71,9		17,3	128	21,1	166	13,5	45,5	172	190	190	64,2	19,9	76,8	33,9	31,4	47,3	101		31,4	52,7	180	46,7	81,6
Sint Odiliënberg - Sob	115	91,1		36,5	190	40,3	185	32,7	64,7	191	209	209	83,4	23,7	96	53,1	50,6	66,5	120	30,1		71,9	199	65,9	101
Sittard - Std	41,6	70,1		53,7	123	20,9	161	57,5	56,5	167	130	74,5	59,6	67,8	28,8	47,5	45	29,9	46,7	58,8	79,3		175	16,9	73,2
Stevensweert - Svt	116	92,6		79,1	149	28,8	25	82,9	81,9	18,6	31,4	21,1	84,9	93,1	97,5	72,9	70,3	45,5	121	84,2	105	73,4		67,4	74,6
Susteren - Srn	18,6	62,4		47,7	100	14,9	155	51,5	50,5	161	121	68,5	53,6	61,8	17,3	41,5	39	23,9	23,7	52,8	73,3	16,9	169		64,7
Average	82,8	80,4		62,6	124	27,8	120	66,5	71,7	124	124	119	73	75,9	85	63	60,7	62,9	80,3	67,9	89,3	61,5	132	54	

GTT Arriva

Average: 73.32
Minimum: 13.46
Maximum: 203.14

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		158	140	136		50,6	141	140	149	147	101	152	163	150	152	78,6	76	59,6	16	141	163	59,2	155	18,6	116
Echterbosch - Etb	158		81	77,1		37,8	81,9	81	19,9	88,3	104	93,8	16	91,2	162	30,1	33,9	79,2	163	82,2	104	69,3	95,9	63,3	82,4
Echt, Kelvinweg - Ekw	72,4	79,3		54,5		19,9	61,8	57,5	70,3	68,2	33,9	23,7	84,4	71,1	142	65,2	62,7	48	143	62,1	62,1	40,2	72,9	43,2	65,4
Echt, Noorderpoort - Enp	133	74,2	55,7			14,7	33,9	14,7	65,2	40,3	78,8	59,5	79,3	27,5	137	60,1	57,5	54	138	18,6	40,3	44,1	48	38,1	59,7
Echt, Plats - Eps																									
Echt, Station Arriva - Ec	44,1	31,4	17,3	13,5			16	17,3	22,4	22,4	40,3	30,1	36,5	27,5	114	17,3	14,7	19,9	49,2	18,6	40,3	20,9	30,1	14,9	29,9
Echt, Zuiderpoort - Ezp	126	76,4	57,9	31,4		14,7		35,2	67,4	17,3	81	36,5	81,5	48	139	62,3	59,7	56,2	161	39,1	60,8	37,5	25	31,5	61,2
Hingen - Hin	135	76,7	58,3	13,5		17,3	36,5		67,8	42,9	81,3	62,1	81,9	23,7	140	62,7	60,1	54,4	140	14,7	36,5	46,6	50,6	40,6	61,1
Koningsbosch - Knb	149	19,9	72	54,1		28,8	72,9	57,9		79,3	95	84,8	25	82,2	153	25	21,1	70,2	154	73,3	95	60,3	87	54,3	73,4
Laak - Lak	141	82,8	64,3	37,8		21,1	17,3	41,6	73,8		87,4	30,1	87,9	54,4	146	68,7	66,1	62,6	146	45,5	67,2	52,7	18,6	46,7	66,4
Linne - Lni	92,9	99,8	31,4	77,5		40,3	82,2	81,3	90,8	88,6		21,1	105	91,6	163	85,7	83,1	25	98	82,6	104	69,7	158	63,7	83,4
Maasbracht - Mbt	82,6	89,5	21,1	55,7		30,1	35,2	59,5	80,6	28,8	21,1		94,7	72,3	152	75,5	72,9	35,2	87,8	63,4	85,1	59,4	21,1	53,4	62,6
Maria Hoop - Mrh	162	14,7	84,8	81		41,6	85,7	84,8	23,7	92,1	108	97,6		95	166	33,9	37,8	83	167	86,1	108	73,1	99,8	67,1	86
Montfort - Mft	145	87	68,5	23,7		27,5	46,7	21,1	78	53,1	91,6	72,3	92,1		150	72,9	70,3	41,6	151	18,6	23,7	56,9	60,8	50,9	68,3
Nieuwstadt - Net	123	133	180	111		91,1	116	115	124	122	203	193	138	125		119	117	100	128	116	138	25,9	130	87,1	124
Pepinusbrug - Pep	139	28,8	61,8	57,9		18,6	62,7	61,8	19,9	69,1	84,8	74,6	33,9	72	143		14,7	60	78,4	63	84,8	50,1	76,7	44,1	63,6
Pey - Pej	135	31,4	57,9	54,1		14,7	58,8	57,9	22,4	65,2	81	70,7	36,5	68,2	139	13,5		56,2	74,6	59,2	81	46,3	72,9	40,3	60,8
Roermond - Rm	52,1	74	45,5	50,8		21,1	54,3	49,3	62,8	60,7	25	35,2	79,2	39,1	122	57,7	55,2		57,2	46,7	27,5	28,9	73,2	22,9	51,8
Roosteren - Rst	16	163	145	141		55,8	146	145	154	152	168	158	168	155	157	83,7	81,1	64,8		146	168	64,3	160	23,7	123
Sint Joost - Sjt	138	79,3	60,9	16		19,9	39,1	13,5	70,3	45,5	83,9	64,7	84,4	19,9	142	65,2	62,7	50,6	143		32,7	49,2	53,1	43,2	62,6
Sint Odiliënberg - Sob	157	98,5	80,1	35,2		39,1	58,3	32,7	89,5	64,7	103	83,9	104	22,4	161	84,4	81,9	28,8	162	30,1		68,4	72,3	62,4	78,2
Sittard - Std	51,6	61,9	109	39,6		19,9	44,4	43,5	52,9	50,8	134	122	67	53,7	30,1	47,8	45,3	28,9	56,8	44,7	66,5		58,4	15,9	56,6
Stevensweert - Svt	149	90,4	67,3	45,5		28,8	25	49,3	81,5	18,6	154	22,4	95,6	62,1	153	76,4	73,8	70,2	154	53,1	74,9	60,3		54,3	75,5
Susteren - Srn	18,6	44,1	104	34,6		14,9	39,4	38,5	35,1	45,8	127	117	49,2	48,7	110	42,8	40,3	23,9	23,7	39,7	61,5	16,9	53,4		51,3
Average	110	77	75,6	56,4		30,4	61,5	59	69,2	66,5	94,9	77,5	82	68,2	140	60,4	58,5	53,3	113	61,1	78,4	50	76	44,6	

Delta GTT (absolute)

Average: -8.26
Minimum: -250.36
Maximum: +127.94

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		60		32		-19	-69	32	55	-69	-60	-89	73	31	126	-17	-17	-19	0	31	32	16	-69	-1	60
Echterbosch - Etb	84			-55		6	-5	-55	-93	-5	-17	-17	1	-55	16	-74	-67	-20	115	-55	-53	-35	-5	-35	-420
Echt, Kelvinweg - Ekw																									
Echt, Noorderpoort - Enp	44	9				0	-125	0	26	-129	-105	-124	22	0	63	33	33	11	44	0	1	-6	-129	-6	-340
Echt, Plats - Eps																									
Echt, Station Arriva - Ec	-20	0		0			0	0	-3	0	-10	-10	13	0	69	1	1	0	22	0	1	0	0	0	65
Echt, Zuiderpoort - Ezp	24	-2		-34		0		-34	0	0	36	1	11	-31	55	3	3	2	54	-31	-30	-22	0	-22	-16
Hingen - Hin	42	7		-1		-1	-126		25	-123	-106	-125	20	0	69	31	31	7	42	0	1	0	-123	0	-327
Koningsbosch - Knb	48	-123		-26		3	-32	-26		-32	-45	-45	-110	-14	6	3	-3	-48	82	-14	-13	3	-32	3	-416
Laak - Lak	5	-2		-34		0	0	-34	0		48	1	11	-31	56	3	3	9	33	-31	-30	-13	0	-13	-17
Linne - Lni	-39	-15		-23		-10	36	-23	-13	48		0	-2	-23	49	-9	-9	0	-39	-23	-22	-20	125	-20	-33
Maasbracht - Mbt	-45	-15		-250		-10	-1	-35	-13	-1	0		-2	-32	43	-9	-9	0	-84	-32	-31	-26	-1	-26	-579
Maria Hoop - Mrh	91	-4		-47		14	3	-47	-85	3	-9	-9		-47	24	-66	-60	-84	123	-47	-99	-27	3	-27	-398
Montfort - Mft	44	9		0		0	-125	1	26	-125	-105	-124	22		67	33	33	-12	44	1	1	-2	-174	-2	-390
Nieuwstadt - Net	99	39		30		43	-72	30	41	-72	46	26	52	30		44	44	43	99	30	31	-2	-72	71	579
Pepinusbrug - Pep	50	-98		-11		4	-96	-11	-3	-95	-43	-43	-89	-13	7		3	19	-16	-13	-12	4	-96	4	-549
Pey - Pej	47	-94		-13		1	-99	-13	-3	-100	-46	-46	-85	-16	5	0		17	-18	-16	-14	1	-99	1	-590
Roermond - Rm	-21	10		2		-1	-5	-3	7	8	1	1	25	-23	68	11	11		-21	-7	-46	-1	28	-1	43
Roosteren - Rst	0	115		94		28	-9	94	44	-9	-15	-21	128	94	126	-17	-17	-19		94	95	16	-9	-1	809
Sint Joost - Sjt	42	7		-1		-1	-126	0	25	-126	-106	-125	20	0	65	31	31	3	42		1	-3	-126	-3	-350
Sint Odiliënberg - Sob	42	7		-1		-1	-126	0	25	-126	-106	-125	20	-1	65	31	31	-38	42	0		-3	-126	-3	-394
Sittard - Std	10	-8		-14		-1	-117	-14	-4	-117	5	47	7	-14	1	0	0	-1	10	-14	-13		-117	-1	-352
Stevensweert - Svt	33	-2		-34		0	0	-34	0	0	123	1	11	-31	56	3	3	25	33	-31	-30	-13		-13	100
Susteren - Srn	0	-18		-13		0	-116	-13	-15	-116	6	48	-4	-13	93	1	1	0	0	-13	-12	0	-116		-299
Total	580	-117		-398		54	-1212	-183	43	-1186	-507	-778	142	-191	1131	38	48	-103	606	-172	-241	-133	-1139	-96	

Delta GTT (relative)

Average: +8.88%
Minimum: -86.05%
Maximum: +535.49%

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		61%		31%		-27%	-33%	30%	59%	-32%	-37%	-37%	80%	26%	480%	-18%	-19%	-24%	0	28%	25%	38%	-31%	-6%	26%
Echterbosch - Etb	113%			-41%		20%	-5%	-40%	-82%	-5%	-14%	-15%	9%	-37%	11%	-71%	-66%	-20%	239%	-40%	-34%	-34%	-4%	-36%	-7%
Echt, Kelvinweg - Ekw																									
Echt, Noorderpoort - Enp	49%	13%				0	-79%	0	67%	-76%	-57%	-68%	37%	0	85%	118%	130%	24%	46%	0	3%	-12%	-73%	-14%	9%
Echt, Plats - Eps																									
Echt, Station Arriva - Ec	-31%	0		0			0	0	-10%	0	-20%	-25%	54%	0	153%	8%	10%	0	79%	0	3%	0	0	0	10%
Echt, Zuiderpoort - Ezp	23%	-3%		-52%		0		-49%	-1%	0	78%	4%	15%	-39%	65%	6%	6%	4%	50%	-44%	-33%	-37%	0	-41%	-2%
Hingen - Hin	46%	11%		-9%		-7%	-78%		58%	-74%	-57%	-67%	33%	0	99%	100%	109%	15%	43%	0	4%	1%	-71%	1%	7%
Koningsbosch - Knb	48%	-86%		-32%		10%	-31%	-31%		-29%	-32%	-35%	-81%	-15%	4%	11%	-11%	-40%	115%	-16%	-12%	4%	-27%	5%	-12%
Laak - Lak	4%	-3%		-47%		0	0	-45%	-1%		124%	4%	14%	-36%	62%	5%	6%	18%	29%	-41%	-31%	-20%	0	-22%	1%
Linne - Lni	-30%	-13%		-23%		-20%	76%	-22%	-12%	120%		0	-2%	-20%	43%	-9%	-10%	0	-29%	-22%	-17%	-22%	382%	-24%	15%
Maasbracht - Mbt	-35%	-14%		-82%		-25%	-4%	-37%	-14%	-4%	0		-2%	-31%	40%	-11%	-11%	0	-49%	-34%	-27%	-30%	-6%	-32%	-18%
Maria Hoop - Mrh	127%	-21%		-37%		51%	4%	-36%	-78%	4%	-8%	-9%		-33%	17%	-66%	-61%	-50%	278%	-35%	-48%	-27%	3%	-29%	-2%
Montfort - Mft	43%	11%		0		0	-73%	6%	50%	-70%	-53%	-63%	30%		80%	81%	86%	-22%	41%	7%	6%	-4%	-74%	-4%	3%
Nieuwstadt - Net	418%	41%		37%		90%	-39%	35%	48%	-37%	30%	15%	59%	32%		59%	61%	75%	344%	35%	29%	-6%	-36%	444%	76%
Pepinusbrug - Pep	56%	-77%		-15%		26%	-61%	-15%	-11%	-58%	-34%	-37%	-72%	-15%	5%		21%	47%	-17%	-17%	-12%	8%	-56%	10%	-14%
Pey - Pej	54%	-75%		-20%		10%	-63%	-18%	-10%	-61%	-36%	-39%	-70%	-19%	4%	0		42%	-20%	-21%	-15%	3%	-58%	3%	-18%
Roermond - Rm	-28%	15%		5%		-6%	-9%	-6%	13%	14%	5%	4%	46%	-37%	126%	24%	25%		-26%	-13%	-63%	-3%	61%	-4%	6%
Roosteren - Rst	0	240%		198%		102%	-6%	183%	40%	-5%	-8%	-12%	317%	153%	401%	-17%	-18%	-22%		179%	130%	34%	-5%	-5%	82%
Sint Joost - Sjt	44%	10%		-7%		-6%	-76%	0	55%	-74%	-56%	-66%	32%	0	85%	92%	100%	7%	42%		4%	-7%	-70%	-7%	4%
Sint Odiliënberg - Sob	37%	8%		-4%		-3%	-68%	0	38%	-66%	-51%	-60%	24%	-5%	68%	59%	62%	-57%	35%	0		-5%	-64%	-5%	-2%
Sittard - Std	24%	-12%		-26%		-5%	-72%	-24%	-6%	-70%	4%	63%	12%	-21%	4%	1%	1%	-3%	21%	-24%	-16%		-67%	-6%	-10%
Stevensweert - Svt	28%	-2%		-42%		0	0	-41%	0%	0	392%	6%	13%	-33%	57%	5%	5%	55%	27%	-37%	-28%	-18%		-19%	16%
Susteren - Srn	0	-29%		-27%		0	-75%	-25%	-30%	-72%	5%	70%	-8%	-21%	535%	3%	3%	0	0	-25%	-16%	0	-68%		10%
Average	47%	4%		-9%		10%	-33%	-6%	8%	-28%	8%	-17%	26%	-7%	116%	18%	20%	2%	59%	-6%	-7%	-6%	-13%	10%	

WGTT Veolia

Average WTT: 33.91

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Kelvinweg - Ekw																								
Echt, Noorderpoort - Enp	0	0			0	3,69	0	0	0	0	0	0	0	20,7	0	0	0	0	0	0	0	0	44,3	0
Echt, Plats - Eps	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Station Arriva - Ec	0	0		26,9	0		8,01	0	0	39,2	114	284	0	82,6	0	0	0	0	0	4,65	48,8	0	90,3	0
Echt, Zuiderpoort - Ezp	0	0		0	0	0		0	0	4,33	0	0	0	39,5	0	0	0	0	0	0	0	0	6,25	0
Hingen - Hin	0	0		0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laak - Lak	0	0		0	0	15,9	17,3	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linne - Lni	0	0		0	0	63,2	0	0	0	0		26,4	0	0	0	0	0	581	0	0	0	0	0	0
Maasbracht - Mbt	0	0		0	0	272	45,6	0	0	7,53	26,4		0	0	0	0	0	1092	0	0	0	0	11,2	0
Maria Hoop - Mrh	0	0		0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Montfort - Mft	0	0		11,9	0	13,8	0	0	0	0	0	0	0		0	0	0	295	0	0	0	0	0	0
Nieuwstadt - Net	0	0		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	207	0	0
Pepinusbrug - Pep	0	0		0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Pey - Pej	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Roermond - Rm	0	0		0	0	0	0	0	0	13,3	557	1001	0	250	0	0	0		0	0	592	0	0	0
Roosteren - Rst	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Sint Joost - Sjt	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,8	0		0	0	0	0
Sint Odiliënberg - Sob	0	0		9,13	0	30,3	0	0	0	0	0	0	0	5,93	0	0	0	416	0	0		0	0	0
Sittard - Std	0	0		0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0	0		0	0
Stevensweert - Svt	0	0		19,8	0	57,6	12,5	0	0	0	0	10,6	0	0	0	0	0	22,7	0	0	0	0		0
Susteren - Srn	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

WGTT Arriva

Average WTT: 30.27

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Kelvinweg - Ekw	0	0		0		9,93	0	0	0	0	0	65,2	0	0	0	0	0	12	0	0	0	0	0	0
Echt, Noorderpoort - Enp	0	0	0			3,69	0	0	0	0	0	0	0	20,7	0	0	0	0	0	0	0	0	12	0
Echt, Plats - Eps																								
Echt, Station Arriva - Ec	0	0	30,3	26,9			8,01	0	0	39,2	90,8	212	0	82,6	0	0	0	0	0	4,65	50,4	0	90,3	0
Echt, Zuiderpoort - Ezp	0	0	0	0		0		0	0	4,33	0	0	0	24	0	0	0	0	0	0	0	0	6,25	0
Hingen - Hin	0	0	0	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0	0	0		0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laak - Lak	0	0	0	0		15,9	17,3	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linne - Lni	0	0	31,4	0		50,4	0	0	0	0		26,4	0	0	0	0	0	581	0	0	0	0	0	0
Maasbracht - Mbt	0	0	42,3	0		203	44	0	0	7,21	26,4		0	0	0	0	0	1092	0	0	0	0	10,6	0
Maria Hoop - Mrh	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Montfort - Mft	0	0	0	11,9		13,8	0	0	0	0	0	0	0		0	0	0	229	0	0	0	0	0	0
Nieuwstadt - Net	0	0	0	0		0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	194	0	0
Pepinusbrug - Pep	0	0	0	0		0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Pey - Pej	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Roermond - Rm	0	0	11,4	0		0	0	0	0	15,2	587	1039	0	156	0	0	0		0	0	220	0	0	0
Roosteren - Rst	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Sint Joost - Sjt	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	12,6	0		0	0	0	0
Sint Odiliënberg - Sob	0	0	0	8,81		29,3	0	0	0	0	0	0	0	5,61	0	0	0	180	0	0		0	0	0
Sittard - Std	0	0	0	0		0	0	0	0	0	0	0	0	0	196	0	0	0	0	0	0		0	0
Stevensweert - Svt	0	0	0	11,4		57,6	12,5	0	0	0	0	11,2	0	0	0	0	0	35,1	0	0	0	0		0
Susteren - Srn	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Delta WGTT

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0			0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Kelvinweg - Ekw																									0
Echt, Noorderpoort - Enp	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-32	0	-32
Echt, Plats - Eps																									0
Echt, Station Arriva - Ec	0	0		0			0	0	0	0	-23	-72	0	0	0	0	0	0	0	0	2	0	0	0	-94
Echt, Zuiderpoort - Ezp	0	0		0		0		0	0	0	0	0	0	-16	0	0	0	0	0	0	0	0	0	0	-16
Hingen - Hin	0	0		0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0		0		0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laak - Lak	0	0		0		0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linne - Lni	0	0		0		-13	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	-13
Maasbracht - Mbt	0	0		0		-69	-2	0	0	0	0		0	0	0	0	0	0	0	0	0	0	-1	0	-72
Maria Hoop - Mrh	0	0		0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0
Montfort - Mft	0	0		0		0	0	0	0	0	0	0	0		0	0	0	-66	0	0	0	0	0	0	-66
Nieuwstadt - Net	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	-12	0	0	-12
Pepinusbrug - Pep	0	0		0		0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
Pey - Pej	0	0		0		0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Roermond - Rm	0	0		0		0	0	0	0	2	30	38	0	-93	0	0	0		0	0	-371	0	0	0	-395
Roosteren - Rst	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Sint Joost - Sjt	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1	0		0	0	0	0	1
Sint Odiliënberg - Sob	0	0		0		-1	0	0	0	0	0	0	0	0	0	0	0	-236	0	0		0	0	0	-237
Sittard - Std	0	0		0		0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0		0	0	8
Stevensweert - Svt	0	0		-8		0	0	0	0	0	0	1	0	0	0	0	0	12	0	0	0	0		0	5
Susteren - Srn	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	-9	0	-83	-2	0	0	2	7	-34	0	-109	8	0	0	-289	0	0	-370	-12	-33	0	

D2 Travel Cost Analysis

Fares Veolia

Average: €3.56
Minimum: €1.09
Maximum: €7.71

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		4,13	5,00	4,76	2,27	3,67	4,80	5,02	5,92	5,35	7,25	6,02	5,76	6,04	1,81	5,38	4,87	5,37	1,32	5,22	7,01	3,05	5,95	1,37	4,67
Echterbosch - Etb	4,31		3,03	2,79	2,91	2,59	2,83	3,05	3,65	3,38	7,57	4,05	1,39	3,86	6,22	3,41	2,90	5,69	3,85	3,04	4,83	5,59	3,98	4,89	3,9
Echt, Kelvinweg - Ekw	5,03	2,88		1,54	6,41	1,34	1,57	1,80	2,70	2,13	2,63	1,91	2,54	2,86	4,97	2,16	1,64	4,44	5,47	1,79	3,83	4,34	2,73	3,64	3,06
Echt, Noorderpoort - Enp	4,80	2,65	1,55		6,21	1,11	1,35	1,15	2,47	2,16	3,57	2,57	2,31	2,16	4,99	1,93	1,41	4,21	5,24	1,34	3,14	4,36	2,75	3,41	2,91
Echt, Plats - Eps	2,29	2,75	1,66	1,42		1,21	1,45	1,68	2,58	2,01	6,20	2,68	2,41	2,49	4,84	2,04	1,52	4,31	1,84	1,67	3,46	4,21	2,60	3,51	2,65
Echt, Station Arriva - Ec	3,70	2,43	1,34	1,10	1,21		1,13	1,36	2,26	1,69	3,07	2,36	2,09	2,16	3,63	1,71	1,20	3,10	2,16	1,34	3,14	3,00	2,28	2,30	2,16
Echt, Zuiderpoort - Ezp	4,83	2,67	1,78	1,33	1,45	1,13		1,59	2,49	1,45	3,59	1,91	2,33	2,40	4,76	1,95	1,44	4,23	2,39	1,58	3,37	4,13	2,04	3,43	2,53
Hingen - Hin	5,06	2,90	1,81	1,15	1,68	1,36	1,60		2,73	1,90	3,82	2,83	2,56	1,90	4,99	2,18	1,67	4,46	2,63	1,09	2,88	4,36	2,50	3,66	2,68
Koningsbosch - Knb	6,23	4,07	2,97	2,73	2,85	2,53	2,77	2,99		3,32	7,51	3,99	3,73	4,01	6,16	1,44	1,94	5,63	3,79	3,19	4,98	5,53	3,92	4,83	3,96
Laak - Lak	5,38	3,22	2,78	1,88	2,00	1,68	1,44	2,14	2,74		3,03	2,32	2,88	2,95	5,31	2,50	1,99	4,78	5,81	2,13	3,92	4,68	1,48	3,98	3,09
Linne - Lni	7,27	5,37	2,62	4,03	6,19	3,83	3,59	4,29	6,92	3,04		1,62	5,03	3,93	7,21	6,69	6,17	1,88	7,71	4,28	2,94	7,08	2,44	5,88	4,78
Maasbracht - Mbt	6,04	4,64	1,89	7,23	3,41	2,34	2,86	2,65	3,92	2,31	1,60		4,29	1,84	5,97	3,68	3,16	2,59	6,47	2,65	2,81	5,34	1,71	4,64	3,65
Maria Hoop - Mrh	5,79	1,23	2,53	2,30	2,41	2,09	2,33	2,55	3,46	2,89	7,07	3,56		3,36	5,72	2,91	2,40	5,19	3,36	2,54	7,15	5,09	3,48	4,39	3,64
Montfort - Mft	5,18	3,91	2,84	2,16	2,69	2,37	2,61	1,90	3,74	3,17	2,55	1,84	3,57		6,00	3,19	2,68	5,47	6,50	1,70	1,86	5,37	3,76	4,67	3,47
Nieuwstadt - Net	1,84	6,06	4,96	4,73	3,22	3,63	4,76	4,98	5,58	5,32	7,21	7,49	5,72	5,79		5,34	4,83	5,33	2,27	5,18	6,77	2,13	5,91	1,33	4,8
Pepinusbrug - Pep	5,68	3,52	2,42	2,18	7,06	1,98	2,22	2,44	1,43	2,77	6,96	3,44	3,18	3,45	5,61		1,39	5,08	6,11	2,64	4,43	4,98	3,37	4,28	3,77
Pey - Pej	5,17	3,02	1,92	1,68	6,55	1,48	1,71	1,94	1,95	2,27	6,46	2,94	2,68	2,95	5,11	1,41		4,58	5,61	2,14	3,93	4,48	2,87	3,78	3,33
Roermond - Rm	5,40	5,53	4,43	4,20	4,31	3,10	4,23	3,95	5,05	4,03	1,88	2,62	5,19	2,94	5,33	4,81	4,30		5,83	3,75	1,96	5,20	3,43	4,00	4,15
Roosteren - Rst	1,35	3,70	4,57	2,37	1,84	2,16	1,51	5,48	6,38	2,96	6,34	3,63	3,36	3,43	2,26	4,95	5,32	4,37		2,61	4,41	3,51	3,55	1,82	3,56
Sint Joost - Sjt	5,26	3,10	2,00	1,34	6,64	1,56	1,80	1,09	2,92	2,35	4,02	3,02	2,76	1,71	5,19	2,38	1,87	2,85	5,69		2,68	4,56	2,95	3,86	3,11
Sint Odiliënberg - Sob	7,05	4,90	3,80	3,14	3,67	3,35	3,59	2,88	4,72	4,15	2,94	3,68	4,55	1,87	7,28	4,18	3,66	1,95	7,49	2,69		6,35	4,74	5,65	4,27
Sittard - Std	3,70	4,54	4,33	4,10	4,21	3,00	4,13	4,36	4,95	4,69	7,08	5,36	5,09	5,16	1,94	4,71	4,20	5,20	3,32	4,34	6,14		5,28	2,30	4,44
Stevensweert - Svt	2,89	3,82	2,73	2,48	2,60	2,28	2,04	2,74	3,34	1,49	1,60	1,72	3,48	3,55	5,91	3,10	2,59	2,59	6,41	2,73	4,52	5,28		4,58	3,24
Susteren - Srn	1,40	4,73	3,63	3,40	2,78	2,30	3,43	3,66	4,25	3,99	4,18	4,66	4,39	4,46	1,33	4,01	3,50	4,00	1,83	3,64	5,44	2,30	4,58		3,56
Average	4,59	3,73	2,9	2,78	3,68	2,26	2,6	2,86	3,75	2,99	4,7	3,31	3,53	3,27	4,89	3,31	2,9	4,23	4,48	2,75	4,16	4,56	3,4	3,75	

*Fares * Passengers Flows Veolia*

Average: €2.82

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	1,76	0	0	0	0	0	0	0,06	0	0	0	0,13	1,03	0	0	0	2,79	0	0
Echt, Kelvinweg - Ekw	0	0		0	0,58	12,9	0	0	1,72	0	10,6	14,7	0	3,64	0	0,39	0,15	84,1	0	0,33	0,35	11,6	0,12	0,83
Echt, Noorderpoort - Enp	0	0	0,07		3,67	0,96	0,31	0	0,11	0,1	0,16	0,23	0	0	0	0,09	0	0,19	0	0	0	1,59	0,75	0
Echt, Plats - Eps	0	0,5	0			0,22	1,39	0	8,68	0	0,56	0	3,73	0	0	0,09	0,35	0,2	0	0,3	0	0	0	0
Echt, Station Arriva - Ec	0	18,6	34,1	0	1,43		1,64	1,63	28	18,1	21,4	131	14,3	54,1	0	2,49	2,83	0	0,39	6,3	3,14	0	25,1	0
Echt, Zuiderpoort - Ezp	0	0	0,57	0	0	0,92		0	0,45	1,84	0,65	1,22	0	0	0	0	0	2,88	0	0,14	0,15	0,56	6,21	0,31
Hingen - Hin	0	0	0	0	0	0,8	0		0	0,17	0	0	0	0,78	0	0	0	2,03	0	0	0,13	0,2	0,23	0
Koningsbosch - Knb	0	0	0	0	4,66	31,9	0	0		0	4,78	0,36	0	0	0	0,13	0,88	29,4	0	0	0	28,4	0	0,66
Laak - Lak	0	0	0	0	0	23,3	1,7	0	0		0,14	5,27	0,13	1,21	0	1,02	0	37,1	0	0	0,18	23	0,4	1,81
Linne - Lni	0	0,24	10,5	0	0	16	0	0	0	0		13	1,37	0,18	0,33	4,56	0	219	0	0	0,13	32,2	0	0
Maasbracht - Mbt	0	0,21	12,9	0	0	120	5,97	0	0	3,14	13,3		0,39	0,92	0	6,52	1,29	473	1,47	0	0	207	2,64	5,48
Maria Hoop - Mrh	0	0	0	0	1,86	14,5	0	0	0	0	0	0		0	0	0	0,44	12	0	5,44	0	16	0	0,2
Montfort - Mft	0	0	0	2,25	0	37,9	0,59	0,78	0	0,72	0	0,58	0		0	0,58	0	22,6	2,07	0	1,86	56,4	1,71	1,49
Nieuwstadt - Net	0	3,31	0	0	0	0,16	0	0	0	0	0	0	0	0		0	0	0,73	0	0	0,62	143	0	0,06
Pepinusbrug - Pep	0	0,16	0	0	0	0,99	0	0	0	0	1,58	0	0	0	0		0,19	12,9	0	0	0	28,5	0	0
Pey - Pej	0	0	0	0	2,38	1,61	0	0	0,53	0,1	0	0,27	0,24	0	0	0		10,4	0	0	0	7,12	0	0,17
Roermond - Rm	2,21	0,75	53	15,1	0	0	5,96	6,46	23,6	24,7	208	425	16,7	110	1,21	11,4	0		17	22	53,6	0	24,2	0
Roosteren - Rst	0	0	0	0	0	0,59	0	0	0	0	0	0	0	0	0	0,45	0	17,1		0	0	15,1	0	17
Sint Joost - Sjt	2,15	4,79	0	0,37	0	5,1	0,08	0	0,4	2,57	18,8	8,25	2,88	0,16	0	19	1,27	4,17	69,8		6,82	7,04	0	10,9
Sint Odiliënberg - Sob	0	1,34	0	2,28	0	1,83	0,16	0,26	0	0,19	0	0,17	0	1,79	0	0	0	0,8	0	0		8,95	0	0
Sittard - Std	1,51	2,48	0	0	0	0	0	0,4	29,5	16	42,8	200	11,3	49,5	133	9	0	0	9,5	6,12	9,2		12,5	0
Stevensweert - Svt	0	0	1,24	0	0	26,9	6,68	0	0	0,2	0	3,45	0	1,29	0	0,14	0	59,6	0	0	0	17		0,21
Susteren - Srn	1,84	4,52	0	0	0	0	0	0	2,32	0,36	24,9	4,23	26,5	0	0	150	3,02	0	29,1	8,12	14,1	0	0	

Fares Arriva

Average: €3.23
Minimum: €1.09
Maximum: €6.80

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		4,09	2,74	2,50	1,69	2,30	2,54	2,76	3,36	3,09	4,48	3,01	4,59	3,57	3,72	3,12	2,61	4,72	1,32	2,75	4,54	2,67	3,69	1,37	3,1
Echterbosch - Etb	4,61		3,62	3,38	3,50	3,18	3,41	3,64	1,54	3,97	5,36	4,64	3,31	4,45	6,46	2,09	2,59	5,59	5,05	3,63	5,42	5,41	4,56	4,11	4,1
Echt, Kelvinweg - Ekw	2,77	3,13		3,73	1,66	1,34	1,57	1,80	2,39	2,13	2,63	1,91	3,62	2,61	4,61	2,16	1,64	3,61	3,21	1,79	3,58	3,12	2,73	2,27	2,6
Echt, Noorderpoort - Enp	2,54	2,90	1,55		1,43	1,11	1,34	1,15	2,16	1,90	3,29	2,57	3,39	2,16	4,39	1,93	1,41	3,52	2,98	1,34	3,14	3,34	2,49	2,04	2,4
Echt, Plats - Eps	2,65	3,31	1,66	1,42		1,21	1,45	1,68	2,58	2,01	3,39	2,68	3,81	2,49	4,49	2,04	1,52	3,63	3,09	1,67	3,46	3,45	2,60	2,14	2,5
Echt, Station Arriva - Ec	2,33	2,68	1,33	1,10	1,21		1,13	1,36	1,95	1,69	3,07	2,36	3,18	2,16	4,17	1,71	1,20	3,31	2,76	1,34	3,14	3,12	2,28	1,82	2,2
Echt, Zuiderpoort - Ezp	2,57	2,92	1,57	1,33	1,45	1,13		1,59	2,19	1,45	3,31	2,88	3,42	2,61	4,41	1,95	1,44	3,55	3,00	1,79	3,58	3,36	2,04	2,06	2,4
Hingen - Hin	2,80	3,15	1,81	1,15	1,68	1,36	1,60		2,42	2,16	3,54	2,83	3,65	1,90	4,64	2,18	1,67	3,78	3,23	1,09	2,88	3,59	2,75	2,29	2,5
Koningsbosch - Knb	3,97	1,62	2,97	2,73	2,85	2,53	2,77	2,99		3,32	4,71	3,99	2,12	3,80	5,81	1,94	1,44	4,95	4,40	2,98	4,77	4,76	3,92	3,46	3,4
Laak - Lak	3,12	3,47	2,12	1,88	2,00	1,68	1,44	2,14	2,74		3,86	2,32	3,97	3,16	4,96	2,50	1,99	4,10	3,55	2,34	4,13	3,91	1,48	2,61	2,8
Linne - Lni	4,51	4,86	2,62	3,28	3,39	3,07	3,31	3,54	4,13	3,04		1,62	5,36	3,93	6,35	3,89	3,38	1,88	4,94	3,53	2,94	5,30	2,44	4,00	3,7
Maasbracht - Mbt	3,78	4,13	1,89	2,55	2,66	2,34	2,86	2,34	3,40	2,31	1,60		4,63	3,82	5,62	3,16	2,65	2,59	4,21	2,79	4,59	4,57	1,71	3,27	3,2
Maria Hoop - Mrh	4,96	1,23	3,96	3,72	3,84	3,52	3,76	3,98	1,88	4,31	5,70	4,98		4,79	6,80	2,43	2,93	5,94	5,39	3,97	5,76	5,75	4,91	4,45	4,3
Montfort - Mft	3,81	4,16	2,82	2,16	2,69	2,37	2,61	1,90	3,43	3,17	4,55	3,84	4,66		5,65	3,19	2,68	2,92	4,24	1,70	1,44	4,60	3,76	3,30	3,3
Nieuwstadt - Net	3,94	6,16	4,81	4,57	4,69	4,37	4,60	4,83	5,42	5,16	6,55	5,83	6,65	5,64		5,19	4,67	6,78	4,38	4,82	6,61	2,13	5,75	3,44	5,1
Pepinusbrug - Pep	3,42	2,17	2,42	2,18	2,30	1,98	2,21	2,44	1,43	2,77	4,16	3,44	2,66	3,25	5,26		1,39	4,39	3,85	2,43	4,22	4,21	3,37	2,91	3
Pey - Pej	2,91	2,68	1,92	1,68	1,80	1,48	1,71	1,94	1,95	2,27	3,66	2,94	3,18	2,75	4,75	1,41		3,89	3,35	1,93	3,72	3,71	2,86	2,41	2,6
Roermond - Rm	4,75	5,10	3,62	3,51	3,63	2,60	3,55	3,77	4,37	4,10	1,88	2,62	5,60	2,94	6,59	4,13	3,62		5,18	3,76	1,96	5,54	3,43	4,24	3,9
Roosteren - Rst	1,35	4,54	3,20	2,96	3,07	2,75	2,99	3,22	3,81	3,55	4,94	4,22	5,04	4,03	4,17	3,58	3,06	5,17		3,21	5,00	3,13	4,14	1,82	3,6
Sint Joost - Sjt	3,00	3,35	2,00	1,34	1,88	1,56	1,80	1,09	2,62	2,35	3,74	3,02	3,85	1,71	4,84	2,38	1,87	3,98	3,43		2,68	3,79	2,95	2,49	2,7
Sint Odiliënberg - Sob	4,79	5,14	4,68	3,14	3,67	3,35	3,59	2,88	4,41	4,15	5,53	3,68	5,64	1,87	6,63	4,18	3,66	1,95	5,23	2,69		5,59	4,74	4,28	4,2
Sittard - Std	2,70	4,91	3,57	3,33	3,44	3,12	3,36	3,59	4,18	3,92	3,45	4,59	5,41	4,39	1,94	3,94	3,43	5,54	3,13	3,58	5,37		4,51	2,19	3,8
Stevensweert - Svt	3,72	4,07	2,73	2,48	2,60	2,28	2,04	2,74	3,34	1,49	2,44	1,72	4,57	3,76	5,56	3,10	2,59	4,70	4,15	2,94	4,73	4,51		3,21	3,3
Susteren - Srn	1,40	3,61	2,26	2,03	2,14	1,82	2,06	2,29	2,88	2,62	4,00	3,29	4,11	3,09	3,24	2,64	2,13	4,24	1,83	2,27	4,07	2,19	3,21		2,8
Average	3,32	3,62	2,69	2,53	2,58	2,28	2,51	2,59	2,98	2,91	3,91	3,26	4,19	3,25	5	2,82	2,42	4,12	3,74	2,62	3,99	3,99	3,32	2,88	

*Fares * Passengers Flows Arriva*

Average: €2.67

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	2,17	0	0	0	0	0	0	0,15	0	0	0	0,12	1,02	0	0	0	2,7	0	0
Echt, Kelvinweg - Ekw	0	0		0	0,15	12,9	0	0	1,52	0	10,6	14,7	0	3,32	0	0,39	0,15	68,5	0	0,33	0,33	8,37	0,12	0,51
Echt, Noorderpoort - Enp	0	0	0,07		0,84	0,96	0,31	0	0,1	0,09	0,15	0,23	0	0	0	0,09	0	0,16	0	0	0	1,21	0,68	0
Echt, Plats - Eps	0	0,6	0	0,19		0,22	1,39	0	8,68	0	0,31	0	5,89	0	0	0,09	0,35	0,17	0	0,3	0	0	0	0
Echt, Station Arriva - Ec	0	20,5	34,1	0	1,43		1,64	1,63	24,2	18,1	21,4	131	21,8	54,1	0	2,49	2,83	0	0,5	6,3	3,14	0	25,1	0
Echt, Zuiderpoort - Ezp	0	0	0,5	0	0	0,92		0	0,4	1,84	0,6	1,83	0	0	0	0	0	2,42	0	0,16	0,16	0,46	6,21	0,19
Hingen - Hin	0	0	0	0	0	0,8	0		0	0,2	0	0	0	0,78	0	0	0	1,72	0	0	0,13	0,16	0,25	0
Koningsbosch - Knb	0	0	0	0	4,66	31,9	0	0		0	3	0,36	0	0	0	0,18	0,65	25,9	0	0	0	24,4	0	0,47
Laak - Lak	0	0	0	0	0	23,3	1,7	0	0		0,18	5,27	0,18	1,29	0	1,02	0	31,8	0	0	0,19	19,2	0,4	1,19
Linne - Lni	0	0,22	10,5	0	0	12,8	0	0	0	0		13	1,46	0,18	0,29	2,65	0	219	0	0	0,13	24,1	0	0
Maasbracht - Mbt	0	0,19	12,9	0	0	120	5,97	0	0	3,14	13,3		0,42	1,91	0	5,61	1,08	473	0,96	0	0	177	2,64	3,86
Maria Hoop - Mrh	0	0	0	0	2,97	24,5	0	0	0	0	0	0		0	0	0	0,53	13,8	0	8,49	0	18	0	0,2
Montfort - Mft	0	0	0	2,25	0	37,9	0,59	0,78	0	0,72	0	1,22	0		0	0,58	0	12,1	1,35	0	1,44	48,3	1,71	1,05
Nieuwstadt - Net	0	3,36	0	0	0	0,2	0	0	0	0	0	0	0	0		0	0	0,93	0	0	0,6	143	0	0,16
Pepinusbrug - Pep	0	0,1	0	0	0	0,99	0	0	0	0	0,94	0	0	0	0		0,19	11,2	0	0	0	24,1	0	0
Pey - Pej	0	0	0	0	0,65	1,61	0	0	0,53	0,1	0	0,27	0,29	0	0	0		8,85	0	0	0	5,9	0	0,11
Roermond - Rm	1,94	0,7	43,3	12,6	0	0	5	6,17	20,4	25,2	208	425	18,1	110	1,5	9,76	0		15,1	22,1	53,6	0	24,2	0
Roosteren - Rst	0	0	0	0	0	0,75	0	0	0	0	0	0	0	0	0	0,33	0	20,2		0	0	13,5	0	17
Sint Joost - Sjt	1,23	5,17	0	0,37	0	5,1	0,08	0	0,36	2,57	17,5	8,25	4,02	0,16	0	19	1,27	5,82	42,1		6,82	5,86	0	7,01
Sint Odiliënberg - Sob	0	1,4	0	2,28	0	1,83	0,16	0,26	0	0,19	0	0,17	0	1,79	0	0	0	0,8	0	0		7,87	0	0
Sittard - Std	1,1	2,68	0	0	0	0	0	0,33	24,9	13,4	20,8	172	12	42,1	133	7,53	0	0	8,98	5,04	8,05		10,7	0
Stevensweert - Svt	0	0	1,24	0	0	26,9	6,68	0	0	0,2	0	3,45	0	1,37	0	0,14	0	108	0	0	0	14,6		0,15
Susteren - Srn	1,84	3,45	0	0	0	0	0	0	1,57	0,24	23,8	2,99	24,8	0	0	98,9	1,84	0	29,1	5,07	10,5	0	0	

Fares delta (absolute)

Average: -€0.33
Minimum: -€4.78
Maximum: +€2.59

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Tot
Dieteren - Dit		-0,05	-2,26	-2,26	-0,58	-1,37	-2,26	-2,26	-2,57	-2,26	-2,77	-3,02	-1,17	-2,47	+1,91	-2,26	-2,26	-0,65	0	-2,47	-2,47	-0,38	-2,26	0	-36
Echterbosch - Etb	+0,30		+0,59	+0,59	+0,59	+0,59	+0,59	+0,59	-2,11	+0,59	-2,22	+0,59	+1,92	+0,59	+0,24	-1,32	-0,30	-0,09	+1,19	+0,59	+0,59	-0,18	+0,59	-0,78	4
Echt, Kelvinweg - Ekw	-2,26	+0,25		+2,19	-4,76	0	-0,00	0	-0,31	-0,00	0	0	+1,09	-0,25	-0,35	0	0	-0,82	-2,26	0	-0,25	-1,21	+0,00	-1,37	-10
Echt, Noorderpoort - Enp	-2,26	+0,25	0		-4,78	0	-0,00	0	-0,31	-0,26	-0,28	0	+1,09	0	-0,61	0	0	-0,68	-2,26	0	0	-1,02	-0,26	-1,37	-13
Echt, Plats - Eps	+0,36	+0,56	0	0		0	-0,00	0	0	-0,00	-2,80	0	+1,40	0	-0,35	0	0	-0,68	+1,25	0	0	-0,77	-0,00	-1,37	-2
Echt, Station Arriva - Ec	-1,37	+0,25	-0,00	0	0		-0,00	0	-0,31	-0,00	0	0	+1,09	0	+0,54	0	0	+0,21	+0,61	0	0	+0,12	-0,00	-0,48	1
Echt, Zuiderpoort - Ezp	-2,26	+0,25	-0,21	0	0	0		0	-0,31	0	-0,28	+0,96	+1,09	+0,21	-0,35	0	0	-0,68	+0,61	+0,21	+0,21	-0,77	-0,00	-1,37	-3
Hingen - Hin	-2,26	+0,25	0	0	0	0	-0,00		-0,31	+0,25	-0,28	0	+1,09	0	-0,35	0	0	-0,68	+0,61	0	0	-0,77	+0,25	-1,37	-4
Koningsbosch - Knb	-2,26	-2,45	0	0	0	0	-0,00	0		-0,00	-2,80	0	-1,61	-0,21	-0,35	+0,50	-0,50	-0,68	+0,61	-0,21	-0,21	-0,77	-0,00	-1,37	-12
Laak - Lak	-2,26	+0,25	-0,66	0	0	0	0	0	0		+0,83	-0,00	+1,09	+0,21	-0,35	0	0	-0,68	-2,26	+0,21	+0,21	-0,77	-0,00	-1,37	-6
Linne - Lni	-2,77	-0,51	0	-0,75	-2,80	-0,75	-0,28	-0,75	-2,80	0		0	+0,33	0	-0,86	-2,80	-2,80	0	-2,77	-0,75	0	-1,77	0	-1,88	-25
Maasbracht - Mbt	-2,26	-0,51	0	-4,68	-0,75	0	0	-0,31	-0,52	0	0		+0,33	+1,98	-0,35	-0,52	-0,52	0	-2,26	+0,14	+1,78	-0,77	0	-1,37	-11
Maria Hoop - Mrh	-0,83	0	+1,43	+1,43	+1,43	+1,43	+1,43	+1,43	-1,58	+1,43	-1,38	+1,43		+1,43	+1,08	-0,48	+0,53	+0,75	+2,03	+1,43	-1,38	+0,66	+1,43	+0,06	15
Montfort - Mft	-1,37	+0,25	-0,02	0	0	0	-0,00	0	-0,31	-0,00	+2,00	+2,00	+1,09		-0,35	0	0	-2,55	-2,26	0	-0,42	-0,77	-0,00	-1,37	-4
Nieuwstadt - Net	+2,11	+0,10	-0,15	-0,15	+1,47	+0,74	-0,15	-0,15	-0,15	-0,15	-0,67	-1,66	+0,93	-0,15		-0,15	-0,15	+1,45	+2,11	-0,36	-0,15	0	-0,15	+2,11	7
Pepinusbrug - Pep	-2,26	-1,35	0	0	-4,76	0	-0,00	0	0	-0,00	-2,80	0	-0,51	-0,21	-0,35		0	-0,68	-2,26	-0,21	-0,21	-0,77	-0,00	-1,37	-18
Pey - Pej	-2,26	-0,34	0	0	-4,76	0	-0,00	0	0	-0,00	-2,80	0	+0,50	-0,21	-0,35	0		-0,68	-2,26	-0,21	-0,21	-0,77	-0,00	-1,37	-16
Roermond - Rm	-0,65	-0,43	-0,82	-0,69	-0,68	-0,50	-0,68	-0,18	-0,68	+0,07	0	0	+0,41	0	+1,26	-0,68	-0,68		-0,65	+0,01	0	+0,34	0	+0,24	-5
Roosteren - Rst	0	+0,84	-1,37	+0,59	+1,24	+0,59	+1,48	-2,26	-2,57	+0,59	-1,41	+0,59	+1,68	+0,59	+1,91	-1,37	-2,26	+0,80		+0,59	+0,59	-0,38	+0,59	0	1
Sint Joost - Sjt	-2,26	+0,25	0	0	-4,76	0	-0,00	0	-0,31	-0,00	-0,28	0	+1,09	0	-0,35	0	0	+1,12	-2,26		0	-0,77	-0,00	-1,37	-10
Sint Odiliënberg - Sob	-2,26	+0,25	+0,88	0	0	0	-0,00	0	-0,31	-0,00	+2,59	0	+1,09	0	-0,65	0	0	0	-2,26	0		-0,77	-0,00	-1,37	-3
Sittard - Std	-1,00	+0,37	-0,77	-0,77	-0,77	+0,12	-0,77	-0,77	-0,77	-0,77	-3,64	-0,77	+0,32	-0,77	0	-0,77	-0,77	+0,34	-0,18	-0,77	-0,77		-0,77	-0,11	-15
Stevensweert - Svt	+0,83	+0,25	0	0	0	0	0	0	0	0	+0,83	0	+1,09	+0,21	-0,35	0	0	+2,10	-2,26	+0,21	+0,21	-0,77		-1,37	1
Susteren - Srn	0	-1,12	-1,37	-1,37	-0,64	-0,48	-1,37	-1,37	-1,37	-1,37	-0,18	-1,37	-0,28	-1,37	+1,91	-1,37	-1,37	+0,24	0	-1,37	-1,37	-0,11	-1,37		-18
Total	-29	-2	-5	-6	-25	0	-2	-6	-18	-2	-18	-1	15	0	3	-11	-11	-3	-17	-3	-4	-13	-2	-20	

Fares delta (relative)

Average: -9.22%
Minimum: -77.03%
Maximum: +158.45%

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		-1%	-45%	-47%	-26%	-37%	-47%	-45%	-43%	-42%	-38%	-50%	-20%	-41%	106%	-42%	-46%	-12%	0	-47%	-35%	-12%	-38%	0	-27%
Echterbosch - Etb	7%		19%	21%	20%	23%	21%	19%	-58%	17%	-29%	15%	138%	15%	4%	-39%	-11%	-2%	31%	19%	12%	-3%	15%	-16%	10%
Echt, Kelvinweg - Ekw	-45%	9%		142%	-74%	0	0%	0	-11%	0%	0	0	43%	-9%	-7%	0	0	-19%	-41%	0	-7%	-28%	0%	-38%	-4%
Echt, Noorderpoort - Enp	-47%	9%	0		-77%	0	0%	0	-12%	-12%	-8%	0	47%	0	-12%	0	0%	-16%	-43%	0	0	-23%	-9%	-40%	-11%
Echt, Plats - Eps	16%	20%	0	0		0	0%	0	0	0%	-45%	0	58%	0	-7%	0%	0	-16%	68%	0	0	-18%	0%	-39%	2%
Echt, Station Arriva - Ec	-37%	10%	0%	0	0		0%	0	-14%	0%	0	0	52%	0	15%	0	0	7%	28%	0	0	4%	0%	-21%	2%
Echt, Zuiderpoort - Ezp	-47%	9%	-12%	0%	0	0		0%	-12%	0	-8%	50%	47%	9%	-7%	0	0	-16%	25%	13%	6%	-19%	0%	-40%	0%
Hingen - Hin	-45%	9%	0	0	0	0	0%		-11%	13%	-7%	0	42%	0	-7%	0	0	-15%	23%	0	0	-18%	10%	-37%	-2%
Koningsbosch - Knb	-36%	-60%	0	0%	0%	0	0%	0%		0%	-37%	0	-43%	-5%	-6%	35%	-26%	-12%	16%	-6%	-4%	-14%	0%	-28%	-10%
Laak - Lak	-42%	8%	-24%	0	0	0	0	0	0		27%	0%	38%	7%	-7%	0	0	-14%	-39%	10%	5%	-16%	0%	-34%	-4%
Linne - Lni	-38%	-9%	0	-19%	-45%	-20%	-8%	-18%	-40%	0		0	7%	0	-12%	-42%	-45%	0	-36%	-18%	0%	-25%	0%	-32%	-17%
Maasbracht - Mbt	-37%	-11%	0	-65%	-22%	0	0	-12%	-13%	0	0		8%	108%	-6%	-14%	-16%	0	-33%	5%	63%	-14%	0	-30%	-4%
Maria Hoop - Mrh	-14%	0	56%	62%	59%	68%	61%	56%	-46%	49%	-19%	40%		42%	19%	-17%	22%	14%	61%	56%	-19%	13%	41%	1%	26%
Montfort - Mft	-26%	6%	-1%	0	0	0	0%	0	-8%	0%	78%	109%	30%		-6%	0	0	-47%	-33%	0	-23%	-14%	0%	-29%	2%
Nieuwstadt - Net	115%	2%	-3%	-3%	46%	20%	-3%	-3%	-3%	-3%	-9%	-22%	16%	-3%		-3%	-3%	27%	93%	-7%	-2%	0	-3%	158%	18%
Pepinusbrug - Pep	-40%	-38%	0	0	-67%	0	0%	0	0	0%	-40%	0	-16%	-6%	-6%		0	-13%	-37%	-8%	-5%	-15%	0%	-32%	-14%
Pey - Pej	-44%	-11%	0	0%	-73%	0	0%	0%	0	0%	-43%	0	19%	-7%	-7%	0		-15%	-40%	-10%	-5%	-17%	0%	-36%	-13%
Roermond - Rm	-12%	-8%	-18%	-16%	-16%	-16%	-16%	-4%	-14%	2%	0	0	8%	0	24%	-14%	-16%		-11%	0%	0	7%	0%	6%	-5%
Roosteren - Rst	0	23%	-30%	25%	67%	28%	98%	-41%	-40%	20%	-22%	16%	50%	17%	84%	-28%	-42%	18%		23%	13%	-11%	17%	0	12%
Sint Joost - Sjt	-43%	8%	0	0	-72%	0	0%	0	-11%	0%	-7%	0	39%	0	-7%	0	0%	39%	-40%		0	-17%	0%	-36%	-6%
Sint Odiliënberg - Sob	-32%	5%	23%	0	0	0	0%	0	-7%	0%	88%	0	24%	0	-9%	0	0	0	-30%	0		-12%	0%	-24%	1%
Sittard - Std	-27%	8%	-18%	-19%	-18%	4%	-19%	-18%	-16%	-16%	-51%	-14%	6%	-15%	0	-16%	-18%	7%	-6%	-18%	-13%		-15%	-5%	-13%
Stevensweert - Svt	29%	7%	0	0%	0	0	0	0	0	0	52%	0	31%	6%	-6%	0	0	81%	-33%	8%	5%	-15%		-30%	6%
Susteren - Srn	0	-24%	-38%	-40%	-23%	-21%	-40%	-37%	-32%	-34%	-4%	-29%	-6%	-31%	144%	-34%	-39%	6%	0%	-38%	-25%	-5%	-30%		-17%
Average	-21%	-1%	-4%	2%	-15%	2%	2%	-5%	-19%	0%	-6%	5%	29%	4%	13%	-10%	-11%	0%	-4%	-1%	-2%	-13%	-1%	-18%	

*Fares * Passenger Flow delta (absolute)*

Average: -0.15
Minimum: -51.25
Maximum: +48.411

	Dit	Etb	Ekw	Enp	Eps	Ec	Ezp	Hin	Knc	Lak	Lni	Mbt	Mrh	Mft	Nst	Ppn	Pej	Rm	Rst	Sjt	Sob	Std	Svt	Srn	Avg
Dieteren - Dit		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echterbosch - Etb	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echt, Kelvinweg - Ekw	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	-16	0	0	0	-3	0	0	-20
Echt, Noorderpoort - Enp	0	0	0		-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3
Echt, Plats - Eps	0	0	0	0		0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Echt, Station Arriva - Ec	0	2	0	0	0		0	0	-4	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	6
Echt, Zuiderpoort - Ezp	0	0	0	0	0	0		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hingen - Hin	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koningsbosch - Knb	0	0	0	0	0	0	0	0		0	-2	0	0	0	0	0	0	-4	0	0	0	-4	0	0	-10
Laak - Lak	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	-5	0	0	0	-4	0	-1	-10
Linne - Lni	0	0	0	0	0	-3	0	0	0	0		0	0	0	0	-2	0	0	0	0	0	-8	0	0	-13
Maasbracht - Mbt	0	0	0	0	0	0	0	0	0	0	0		0	1	0	-1	0	0	-1	0	0	-30	0	-2	-32
Maria Hoop - Mrh	0	0	0	0	1	10	0	0	0	0	0	0		0	0	0	0	2	0	3	0	2	0	0	18
Montfort - Mft	0	0	0	0	0	0	0	0	0	0	0	1	0		0	0	0	-11	-1	0	0	-8	0	0	-20
Nieuwstadt - Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Pepinusbrug - Pep	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0		0	-2	0	0	0	-4	0	0	-7
Pey - Pej	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0		-2	0	0	0	-1	0	0	-5
Roermond - Rm	0	0	-10	-2	0	0	-1	0	-3	0	0	0	1	0	0	-2	0		-2	0	0	0	0	0	-18
Roosteren - Rst	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3		0	0	-2	0	0	2
Sint Joost - Sjt	-1	0	0	0	0	0	0	0	0	0	-1	0	1	0	0	0	0	2	-28		0	-1	0	-4	-32
Sint Odiliënberg - Sob	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		-1	0	0	-1
Sittard - Std	0	0	0	0	0	0	0	0	-5	-3	-22	-29	1	-7	0	-1	0	0	-1	-1	-1		-2	0	-71
Stevensweert - Svt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	-2		0	46
Susteren - Srn	0	-1	0	0	0	0	0	0	-1	0	-1	-1	-2	0	0	-51	-1	0	0	-3	-4	0	0		-65
Average	-2	1	-10	-2	-4	7	-1	0	-13	-2	-27	-29	11	-7	0	-57	-2	16	-31	-1	-5	-67	-2	-7	

Regional train-bus alignment: the strengths and weaknesses of a multimodal concession

Gerald Hoekstra

Abstract

The introduction and obligation of tendering PT (concessions) in Europe has led to more focus on cost-efficiency and contracts. An additional effect in regional PT is the increase of undesirable boundaries between train and bus, e.g. in the form of non-aligned tariffs and bad interchange possibilities. The goal of a multimodal concession is to abolish these boundaries and establish an integrated PT system by tendering regional train and bus simultaneously. When the organisational part of integration is established this way, it becomes possible establish operational integration, which is defined as the alignment of the networks, schedules, information, tickets & tariffs, and Traffic Control of regional train and bus. Our analysis shows that internal coordination (in a multimodal concession), set against cases where integration is arranged by a contract or a partnership, indeed leads to more focus and better tuning of most of the five levels. In a particular case, on balance passengers are offered a better aligned PT system and the operator can operate more efficiently. However, not in each case a multimodal concession is most suitable and the risks for operators are large. Besides that, the implementation often is a difficult process. It is concluded that in cases it is possible to tender a multimodal concession, the pros often outweigh the cons.

Introduction

All across Europe, Competitive Tendering (CT) of Public Transport (PT) has been regulated since the year 2000. In the Netherlands, the Passenger Transport Act 2000 (Wet Personenenvervoer 2000, 2001) organised the reorganisation of the Dutch regional PT system. Although CT of concessions has led to, in most places, more customer focus and more efficient operations (Beck, 2011; Mouwen & Rietveld, 2013), also some externalities were noticed. The system, namely, resulted in unwanted boundaries at concession borders, both spatial and between modalities (see figure S.1), expressed in, for example, tariff variations and poor connections. Borders will always remain in a PT system where many operators are present, but some of them can be taken away and others can be reduced. To make the modal borders disappear, an often proposed solution is CT of multimodal concessions. In such a concession, the operator obtains the right to perform PT by both regional train and bus in a particular area. For operators, more efficient operations become possible, since no competition exists between train and bus anymore. A Public Transport Authority (PTA) only has to deal with one operator, which simplifies the current situation. Though, also some expected drawbacks of multimodal concessions can be mentioned. For example, multimodal concessions are often larger and only larger operators are able to bid on them. The exact benefits and drawback are not clear. Therefore, the main question of this study is *What are the pros and cons of contracting out regional multimodal public transport concessions for travellers, authorities, and operators instead of regional unimodal concessions?* Thereby, the focus is on regional train and bus solely in a non-urban context.

Research methods

A research structure is set up to gain more insight in the functioning of different concessions. Firstly, a literature study was carried out to be able to connect to research already done and to operationalise 'integration', the goal of a multimodal concession. The rest of the study is split up into two main lines of research. The first line is about coordination of a multimodal PT network. Based on literature, three alternative coordination models are distinguished, and three corresponding cases in the Netherlands are linked to those coordination mechanisms. Using expert interviews at both the PTAs and operators the functioning of the concession(s) on the topic of integration. More specifically,

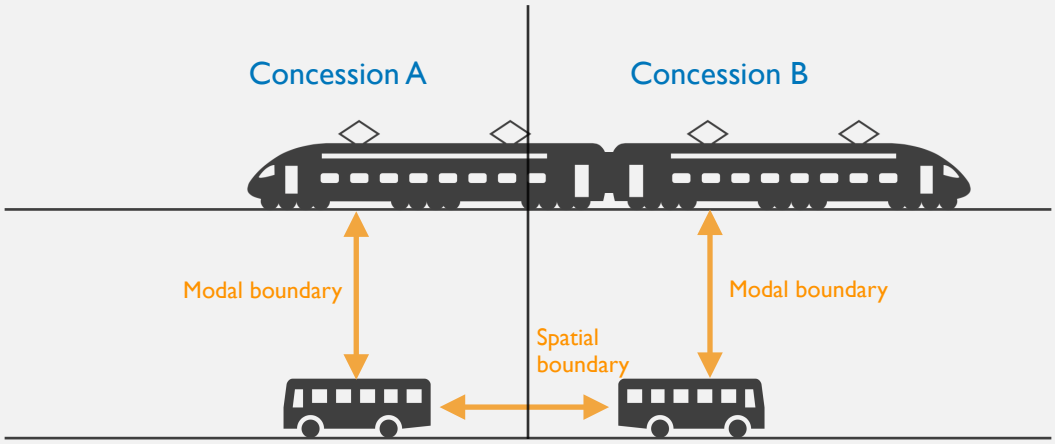


Figure P.1 | Visualisation of spatial (horizontal) and modal (vertical) boundaries in PT

they are asked how train-bus alignment on different topics is organised. General lessons concerning integration at different coordination mechanisms and a performance comparison are the output of this part of the research. The second part of the study concerns the impact of an integrated network on passengers. A specific network where the network and timetable have changed into a feeder network was chosen. The data used is network data (timetable and stop distance) in combination with smartcard data from the current network. Two analyses are done. The travel time analysis is an average travel time calculation from and to all towns, before and after. This analysis is carried out for all possible OD pairs and real demand (based on smartcard data). Also, coefficients obtained from literature are added to the different travel time components to simulate the valuation of these aspects by passengers. The second analysis concerns the calculation of the average regular fare for all possible OD pairs and real demand. Finally, an example from the current political debate is used to combine the two research parts. The factors influencing implementation are studied using a network and coordination analysis. Based on this case, also some external opportunities and threats for multimodal concessions are obtained. In the conclusion, an answer is given on the main question, and a visualisation in the form of a SWOT analysis is created.

Literature

As mentioned already, the aim when applying a multimodal concession is to create an integrated PT system. In literature, already some articles are dedicated to the meaning and operationalisation of the concept of (intermodal) integration. According to Saliara (2014, p536), "Through intermodal integration, [...] passengers perceive the transit system as one, unified, rather than fragmented system, and the offered services as "seamless" journeys with minimum interruption, independently of the number of modes or operators involved". As depicted in table P.1, intermodal integration can be divided into three levels: organisational, operational, and physical integration (Saliara, 2014). A real integrated system is integrated on all three levels. Organisational integration is a prerequisite for the other two levels and is about the existence of and arrangements between stakeholders, PTA(s) and operator(s). Actual execution of integrated services is the topic of operational integration. Part of operational integration is a feeder network where bus lines are branched onto the railway lines, a pulse timetable where interchange nodes are created for train and bus at train stations, integrated information provision, integrated fares and tickets valid in all vehicles, and integrated vehicle management (buses wait on delayed trains). Also on a physical levels, facilities must be designed well to accommodate integrated services. This aspect, however, is outside the scope of this research.

Table P.1 | Three levels of PT intermodal integration, adapted from Saliara (2014).

Organisational integation	Operational integration	Physical integration
Existence of one or more independent PTA(s) The PTA has the responsibility to regulate PT in a region	**Network layout** Feeder network where buses are branched onto railway lines	**Access to facilities** All users can reach facilities easily
Arrangements between operators Operators consult each other	**Schedule** Pulse timetable with transfer points for regional trains and buses	**Location of facilities** Transfer points at suitable locations in PT network
	Information All PT related information is available at one place	**Design of stations** Take away physical barriers to transfer
	Fares & tickets Fares and tickets are valid in all vehicles in the system	**Control of vehicle movements** No conflicts between pedestrians and vehicle movements
	Vehicle management Interchanges train-bus are guaranteed in case of delay	

Coordination

The interaction between PTA, operator, and passengers determines the way PT is offered and used. For the provision of PT, especially the interaction between PTA and operator is of interest. Many ways of organisation are possible (Van de Velde, 1999). Strategic planning is mostly the responsibility of the PTA or a political council. On the lowest (operational) level, the operator is in charge to arrange ticket sales, information, personnel and vehicle management. The differentiation mostly occurs at the tactical level: network layout, schedules, fare and ticket determination, and vehicle type. This interaction also highly influences the way in which integration is achieved. Using the three concepts of economic organisation, namely market (prices), hierarchy (impose), and network (consultation) (Powell, 1990), three possible ways of coordinating a multimodal network are defined.

- **Contractual coordination**: coordination is achieved by a contract explicitly stating what the operator has to do, also on the topic of integration. This type of coordination can be used in unimodal concessions where the PTA is revenue responsible. The PTA has a development function and can steer the operators towards integration.
- **Partnership coordination**: consultation is the keyword of partnership coordination. When the operator is revenue responsible, a PTA does not have the absolute power to enforce integration. The way to go is setting up a partnerships between the PTA and operator(s). Integration is reached by informal contact.
- **Internal coordination**: when one operator is responsible for different modalities, it can organise integration internally. There is no role for the PTA in this. This can only be done in a multimodal concession where the operator is revenue responsible.

To test the extent in which the three forms of coordination function in practice, a case study is set up. In all cases, the regional trains are tendered and one of the coordination

mechanisms exists. The interviewees is asked how network, timetable, information, tickets/ fares, and vehicle management are aligned to each other. Also the plan requirements are consulted for the formal regulations. Note that in the Netherlands tickets (smartcards) and information (travel apps) are already integrated on a national level to a high extent.

- **Groningen** (contractual coordination): the province of Groningen is a case characterised by a separate net-cost rail and gross-cost bus concession. The province itself is PTA for the rail concession, but the bus concession has been delegated to the OV-bureau. This organisation is established especially for this purpose. The OV-bureau has tendered an integrated bus concession for two provinces (Groningen and Drenthe). Although formally seen the OV-bureau is part of the province of Groningen, it is found that sometimes conflicts of interest arise on the topic of integration. The interest of the OV-bureau increase ridership is not necessarily compatible with cooperation with the train operator. Specifically, this translates in a network that on some places is integrated (probably when there is a (shared) financial interest to do that) and fares, information, and vehicle management that are hardly integrated. Schedule integration has been achieved from a common interest.
- **Fryslân** (partnership coordination): features of the second case are unimodal concessions for regional train and bus, but the operator is the same. The PTA, the province of Fryslân, coordinates both net-cost concessions. That leads to a situation in which the operator mainly focuses on what is demanded in both contracts separately. Integration is not a key point in that. Two divisions within the operator focus on their own part in the PT chain and only some points of integration get attention. Timetables are aligned to each other, information partly, but network layout, fares, and vehicle management hardly.
- **Limburg** (internal coordination): a full multimodal concession is applied in the province of Limburg. The operator operates both regional trains and buses, restricted by a net-cost contract of the province. Network and timetable are designed simultaneously for train and bus. Also, information and fares are integrated. Integrated vehicle management, however, is not arranged.

In the interviews, several causes are mentioned for non-integrated levels of operational integration. In some cases, feeder networks are not applied, according to the interviewees, because of unsuitable geographical structures, passenger flows to one major destination where short-circuits are preferred, or already overcrowded trains. The extent to which fares are integrated is dependent on existing business cases and arrangements (that cannot be simply changed), the possibility of income loss for the operator, no perceived added value for passengers (depends on distance), and uncertainty around a possible operator change at the end of the concession. An important finding is the fact that an integrated network and fare structure mostly are dependent on each other. Important for information integration is a shared vision on marketing. Vehicle management was hardly aligned in all cases. That mainly has to do with a too complicated procedure. It is a topic that probably get some attention in the near future.

(Financial) interests are found to play a big role in the pursuit for integration. Therefore, it seems that only two organisational structures are really suitable for integration. In a multimodal concession, there is an incentive for the operator itself to arrange integration. The operator can control the whole PT chain, has all possible data, and will integrate the system. The other option is a Verkehrsverbund model. In this, the PTA has the integration function. By tendering gross-cost contracts, the operators only perform the services.

Network

Besides the supply side, the demand side is also affected by the introduction of an integrated PT system. It is often assumed that a feeder network, pulse timetable, and fare integration are beneficial for passengers. In a case study, a specific network is chosen to assess this hypothesis. Using smartcard data and timetables, both networks are compared to each other. Current smartcard data is also applied on the former network, which makes comparison easier, but does not account for

changes in travel patterns. Specific travel time aspects (access time, in-vehicle time, transfer time, and transfer resistance) are added in coefficients to model the valuation of different trip components by passengers. The values are obtained from literature. Since a distinction is made between the valuation of in-vehicle train and bus, the other factors are scaled. The values used are 2.18 for waiting time, 1.28 for in-vehicle time bus, 1.0 for in-vehicle time train, 2.18 for transfer time, and 12.8 as a transfer penalty (Abrantes & Wardman, 2011; Bunschoten, 2012; De Keizer & Hofker, 2013).

The particular case is Roermond-Sittard, where until a few years ago a national railway operator and a regional bus operator were active. Currently, a multimodal concession is tendered. The region is part of Limburg, as described above. The network has changed into a feeder network with a pulse timetable and integrated fares. From the analysis, it follows that average travel times, both weighted and unweighted, have decreased in a range of -0.3% to -12.2% (see table P.2). This is the case for both all OD pairs as well as real demand (based on smartcard data). The number of multimodal passengers is, however, small. Therefore, the improved train-bus and bus-bus interchanges have more influence on these outcomes than the network itself. The main disadvantage is the disappearance of some direct bus lines. These passengers are most disadvantaged by the new network. However, also some new direct lines are offered now.

By using the integrated (paying boarding rate only once) and unintegrated tariffs, a financial comparison is also made. As expected, most passengers are paying less then before. There are, however, two exceptions. First of all, the new train tariff structure is cheaper on trips <7 kilometre, but more expensive above that limit. This is a political choice of the PTA, but can negatively influence on-going train passengers. Next, some passengers are changed from a unimodal to a multimodal trip. Although the trip duration might be shorter, some of them travel a longer distance and pay more. However, this is a very small group of passengers. All in all, it can be concluded that most passengers benefit from the new situation, both in terms of travel time and price. That is striking, since more efficient operations is also part of the multimodal concession.

Table P.2 | Average passenger travel times in minutes for the different PT networks on working days.

	Objective TT			Perceived TT		
	NS / Veolia	Arriva	Δ	NS / Veolia	Arriva	Δ
All OD pairs	36.8	34.1	-2.7 -7.3%	74.0	66.9	-4.1 -9.6%
Actual demand	23.7	23.4	-0.3 -1.3%	39.2	38.2	-1.0 -2.6%

Implementation

A lot of strengths and weaknesses of multimodal concessions itself are already mentioned. In order to get insight into the external factors that play a role in the implementation and to combine the knowledge obtained from both analyses, a suitable case from the current political debate is chosen for further investigation. The regional train services Leeuwarden-Meppel(-Zwolle) and Groningen-Zwolle are designated for decentralisation by the Dutch cabinet (Bureau woordvoering kabinetsformatie, 2017). Already in 2011, Federatie Mobiliteitsbedrijven Nederland (2011) proposed a plan to add these railway lines in a multimodal concession. This plan was reviewed by Janse de Jonge (2012) and a number of network improvements were assessed. An update of this document shows that on the current bus network a €3,000,000

save per year can be achieved, mainly by scratching some parallel bus lines and opening of new stations.

The question is how this integration can be achieved from a coordination point of view. Five alternatives are proposed and assessed, ranging from no organisational change at all to a full multimodal concession in three provinces (Groningen, Fryslân, and Drenthe). Since the railway plans of FMN (2011) are already discussed extensively in the media, the opinion and arguments of all relevant stakeholders are noted. It seems that existing interests at operators and labour unions play a important role. Other factors found are a limited public and political attention. Besides, current concession boundaries, durations, and coordination systems are seen as important factors. After weighing all arguments, the most promising alternatives seems to be in-between the extremes. Firstly, two multimodal concessions around both railway lines could be implemented. Alternatively, the services could be added to another contiguous regional rail concession. Bus concessions will then remain the same, but more focus on integration is needed. The first option will almost certainly lead to a better integrated system, but requires quite some organisational effort to reach. Contrary, the second alternative is easier to arrange, but requires a lot of attention from the PTA during the concessions. The PTA has to take more control on integration topics. The

Figure P.2 | SWOT analysis of a multimodal concession

	Positive	Negative
Internal	**Strengths** • Feeder network (shorter TTs and better interchanges) • Integrated network and timetable design • Integrated tickets and fares • One source of information • A clear point of contact for almost all PT • Operator has control and oversees the whole PT chain • Financial compensation train-bus	**Weaknesses** • Feeder network causes more interchanges • Feeder network not always suitable • High investment risks / less potential operators • More coordination between ICs and regional trains needed
External	**Opportunities** • Political attention • Pressurised PT budgets • Directly competing train and bus operators • Subsidiarity • Several potential areas in the Netherlands	**Threats** • Complex organisational structures • Limited public attention • Current interest (e.g. operators of directly awarded contracts and labour unions) • Duration on-going concessions • Operator change on the track takes much time • Cumbersome process infrastructural changes

final decision is arbitrary, but from an integration point of view a multimodal concessions seems to be best in this case.

Conclusion

It is concluded that an integrated PT system has many advantages for passengers, such as a better network, fares, and one source of information. This can be arranged by a multimodal concession. A beneficial aspect of a multimodal concession for the operator is the ability to control the whole PT chain and be able to compensate financially between train and bus. The advantage for the PTA is somewhat less clear, but an easier way of coordination is a main aspect. Some disadvantages can also be mentioned, such as more interchanges, a loss of direct bus lines, and impossibilities to introduce a feeder network. However, usually on balance the pros outweigh the cons for passengers. However, that does not mean that everywhere multimodal concessions must be implemented. A organisation in which the PTA takes more lead can also help to establish an integrated network. Sometimes implementation is retained. That could have to do with current interests, a lack of attention (both public and political), and possible implementation issues. All aspects are summarised into a SWOT analysis, as depicted in figure P.2.

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