Improving the Mobility

Surabaya - Indonesia

Dennis Jongen

Final Report

Transport & Traffic Management

Academy SLM - NHTV Breda & Dishub Surabaya

March - June 2014

IMPROVING THE MOBILITY

INDONESIA - SURABAYA

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Summary	The (local) government is searching for ways to improve their mobility system by implementing a new public transport (PT) system. For this new PT system the complete transport system will change. This is the reason why the government is looking for inspiration and recommendations from abroad while Surabaya doesn't have experience with PT systems.
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INDONESIA - SURABAYA

FINAL REPORT

Surabaya (Indonesia), March-June 2013
Placement Company: Dinas Perhubungan Pemerintah Kota Surabaya (Dishub Surabaya)

Student: Dennis Jongen (studentnr. 111846)
Company Supervisor: Tundjung Iswandaru, S.T., MM, Rizki Amalia
Supervising Lecturer: Jan Willem Proper

Internship - Improving the Mobility in Surabaya

NHTV Breda - 3rd academic year
Transport and Traffic Management ("Mobiliteit") @ Academy SLM

Summary

The increase of the population in Surabaya is creating pressure on the transport and traffic system in Surabaya. The total number of cars/motorcycles is increasing since 2008. The number of cars and motorcycles has increased a lot in the last years due to several reasons. These increases lead to different traffic problems, like a lot of traffic jams. The expectation is that this increase will continue in the upcoming years. The (local) government is searching for ways to improve their mobility system by implementing a new public transport (PT) system. For this new PT system the complete transport system will change. This is the reason why the government is looking for inspiration and recommendations from abroad while Surabaya doesn't have experience with PT systems.

The new PT system will include a MRT plan (Monorail and tram) and a new bus network. For this last bus network, the only existing PT system (the Angkot system) at the moment will be stopping. The Angkot system includes 4500 inactive and active vehicles that are operating separately on fixed routes throughout the city of Surabaya. Besides this bus network, there are plans for a monorail (east-west corridor) and a tram line (north-south corridor).

This research provides some recommendations based on a compare and contrast structure. In the Netherlands mobility problems are solved by working throughout some basic stages (policy, research, investment, operational). In this research this structure has been used to compare and contrast some elements. The elements that are used for this research are chosen in cooperation with the local government.

The major differences between the Netherlands and Surabaya are especially caused by missing the interaction between mobility and spatial planning (city planning) in Surabaya. The transport system has to be viewed with a wider perspective.

The planned network has to be focused on the intermodal system and the environment, the placement of future malls, hospitals and offices have to be placed around PT lines. Stops have to be designed with an interaction to their surroundings; this can be done with the using of the node-placement model where the best location is in balance. P+R areas can decrease the commuter flows from outside the city (the 2 million people that lives around the city and frequently travelling to the city) when these areas are located more strategically outside the city centre instead of inside the centre. When the new PT system is ready to operate, there can be made a start with the promotion of this new system. The ticketing system can support the way to promote the system. Working together with stores, restaurants and other facilities makes the card and the PT network more attractive with providing discounts or other privileges.

Besides these recommendations, the most important one is to reconsider the plan for the monorail. The monorail plan is technically possible but the investment and operational costs are extremely high in contrast to other modes. Using the same mode for the east-west/north-south corridor is more wisely due to the high amount of advantages (share the materiel, more flexible and lower investment/operational costs).

PREFACE

In this report, the research to provide recommendations for the implementation of a new public transport system in Surabaya will be presented. This research is the result of the second internship at "Transport and Traffic Management (Mobiliteit)" (3rd year) at NHTV in Breda.

The reason for this specific assignment can be found in the question for more inspiration about public transport abroad. This research is focusing on giving examples and recommendations to implement the planned (new) public transport system.

It was a great experience to discover the differences and similarities between Indonesia and the Netherlands.

I would like to thank the people on the placement company for their great hospitality and their support during my internship; special thanks to Mr. Tundjung Iswandaru (company supervisor), Mrs. Rizki Amalia (Planner Assistence MRT) and the complete staff of the "Angkutan" (transportation) department. Also thanks to the supervising lecturer, Jan Willem Proper, from the NHTV for the guidance during the whole internship and especially, his visit to the company in Surabaya (which was very vulnerable for this report).

3rd year student Transport and Traffic management (NHTV Breda)
Dennis Jongen, June 2014

Index

1

Introduction

Chapter 1
Introduction

The increase of the population in Surabaya is creating pressure on the transport and traffic system in Surabaya. The total number of cars/motorcycles is increasing since 2008. The number of cars and motorcycles has increased a lot in the last years (table 1.1.). These increases lead to different traffic problems, like a lot of traffic jams. At some spots or routes, the traffic jams are so heavy that the delay time is more than 30-60 minutes. One of the problems that are causing the traffic jams is that there is barely any alternative way to travel inside the city of Surabaya (Dishub Surabaya, 2014).

	Cars	Motorcycles
2008	244.435	1.028.686
2009	526.837	3.007.739
2010	823.849	4.465.144
2011	974.266	5.726.514
Increase % 2008-2011	+ 299 %	+ 457 %

Table 1.1 - Total number of cars and motorcycles (period 2008-2011) (Dishub Surabaya, 2013)

Because there is no alternative way to travel like good public transport, the government is searching for ways to improve the mobility in Surabaya. One of the current projects is to improve the public transport (starting from this point: PT) (Dishub Surabaya, 2013); this project includes a tramline and a monorail through the city (centre). It's the first time that such a big project about PT has been launched in Surabaya. That is the reason why the local government asked for this research about examples of PT concepts (from abroad) so they can learn about these realized projects.

Research Location

Surabaya is a city in Indonesia that is located in the northern shore of the island (East-) Java; it's also the capital city of East-Java, with a population of 3.1 million in the city. In the area around Surabaya (the metropolitan area) the population is around 5.1 million. The expectation is that the population will increase in the upcoming years (Dishub Surabaya, 2014).

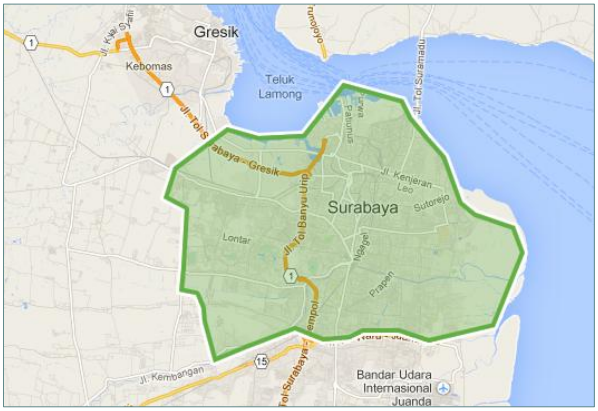


Figure 1.1 - Surabaya, Indonesia *(Google Maps)*

Description Chance (problem)

The local government (Surabaya Transportation Department) is in the planning process of a new public transport system. It is a chance for this (local) government to get more information about examples of public transport (from abroad) with special focus on:

- Choosing a PT mode
- Network design (routes)
- Facilities (stops/parking (P+R))
- Promote the PT (ticketing system)

This information will support the implementation of their new public transport system.

A new PT system should lead to an increase of the people that are using PT, so the use of cars and motorcycles could decrease which will have a positive effect on the economics and environment. When the Government will not improve their PT system, they have to search for different ways to improve the mobility system which are not available.

Research Objective

Creating recommendations with the "Compare and Contrast" method, which are focused on creating PT (modes), creating a PT network, operational facilities (stops/park and ride) and promotion (ticketing).

Research Questions

Which concepts from the Netherlands can (Dinas Perhubungan) Surabaya use for the implementation of their new Public Transport system?

1. **What is the current situation about transport and traffic in Surabaya?**
    a. What is the organization structure from the government (transport department)?
    b. What are characteristics of the traffic system in the current situation?
    c. What are characteristics of the public transport?
    d. What are characteristics of the MRT and Bus project in Surabaya?

2. **Which stages are required to solve a transport problem in the Netherlands?**
    a. What are these basic stages in the Netherlands?
    b. Which stages correspond with the way of solving a transport problem in Surabaya?
    c. Which stages are interesting to use for the compare and contrast with Surabaya?

3. **What is important for Surabaya in the feasibility study/stage (from the best practice)?**
    a. What are the required steps to choose a way of public transport in the Netherlands?
    b. What are the required steps to create a public transport network?
    c. What are the differences in this stage with Surabaya and what can be recommended to Surabaya?

4. **What is important for Surabaya in the operational stage (from the best practice)?**
    a. What is the design of the bus stops in the Netherlands?
    b. How are the P+R systems working in the Netherlands?
    c. What are the differences in this stage with Surabaya and what can be recommended to Surabaya?

5. **What is important for Surabaya (from the best practice) in the promotional stage?**
    a. How is the Netherlands promoting the public transport?
    b. How works the current ticket system in the Netherlands?
    c. What are the differences in this stage with Surabaya and what can be recommended to Surabaya?

6. **What are the recommendations for the local government in Surabaya (Dinas Perhubungan) to implement a new public transport system?**

Definitions

Because the situation in Indonesia is different than in other countries, there is a list with definitions which include the most popular transport types that can be found in Surabaya.

Figure 1.2 - Most important ways of transport *(source: Cities Development Initiative for Asia)*

Name	Description
Dinas Perhubungan Pemerintah Kota Surabaya *or* **Dishub Surabaya** *or* **Dishub**	Transportation department from the local government Surabaya (in Dutch: "Afdeling Verkeer en Vervoer van de Gemeente")
MRT Surabaya	Mass Rapid Transport Surabaya (contains for example: Tram and Monorail)
PT	Public Transport
Angkot	A mini van that is converted to carry passengers.
Becak	A non-motorized three-wheeled taxi service.
TOD	Transit Oriented Development
CBD	Central Business District

Table 1.2. Definitions during this research (Cities Development Initiative for Asia, 2013)

Report outline

This research provides some recommendations based on a compare and contrast structure. In the Netherlands mobility problems are solved by working throughout some basic stages (policy, research, investment, operational). This research is focused on the "basic" transport and traffic problems who are leading to the urgency to improve the public transportation in Surabaya.

Compare and Contrast method

In this research, a couple of PT elements are been compared between the Netherlands and Surabaya. To introduce the global situation and the PT plan in Surabaya, chapter 2 will include basic information about Surabaya. In this chapter also the information about the PT plan is included. This information is used for some elements during compare and contrast in the later chapters.

After this, the basic stages of solving mobility problems in the Netherlands will be presented. This information is required to present the structure of the contrast and compare. These basic stages (policy, research, investment, operation) are the thread of this research. Every stage (except investment stage) will be used for a compare and contrast that is focused on some elements from every single stage. The elements will be firstly described in the Dutch situation, afterwards in Surabaya. At the end of every chapter, there will be some conclusions and recommendations. The final conclusions and recommendations are presented in chapter 7.

The policy stage is not chosen as a separate chapter (stage) for this research because it is not requested by the local government in Surabaya, but in the Netherlands this stage is so important for the development of the mobility and spatial planning, this subject is shortly highlighted in chapter 3 ("basic stages").

Within the research stage (4) the elements choosing PT modes and choosing a PT network is chosen to compare and contrast. The government is still thinking about their choice for the monorail and tram in combination with the busses, this is the reason to use these two elements in the research stage to compare and contrast.

Investment stage is not used in this research because this request a more economical study, besides this, at this moment the government is already negotiating with (financial) partners.

In the current situation, there are barely any PT stops and there is no P+R facility in Surabaya. In the plans for the new PT system, these two elements will be created in Surabaya. The government indicates that the examples of stops and P+R areas from abroad will support them in the implementation of their new PT plan. These elements are used for compare and contrast in the operational stage (chapter 5).

The promotion element has been chosen as a separate stage (chapter) in this report because it is required to have a working PT system before promoting the system start (CROW Kennisbank, 2014). The government is planning to use an electronic ticketing system in their new PT plan. Since the Netherlands is almost at the end of the implementation of the electronic chip card (OV-Chipkaart), the ticket system will be used in the compare and contrast.

2

Current situation SBY

Chapter 2
Current situation Surabaya

This chapter contains the information about the current traffic and transport situation in Surabaya. It starts with a description of the organization structure from the local government. Afterwards, the current road structure has been described. The third paragraph of this chapter is about the characteristics of the public transport. At the end of this chapter, there will be a better look into the MRT and Bus project of Surabaya. The goal of this information is to obtain more knowledge about the current transport and traffic situation in Surabaya.

2.1 Organization Structure

The main responsibility of the traffic and transport system is placed at the government. The "transportation department" (in Indonesia it called: "Dinas Perhubungan), is responsible for the traffic and transport system (including public transport). These departments work on national, regional (province) and local (city) level. In this case, there is a specific transportation department for the city of Surabaya (Dinas Perhubungan Pemerintah Kota Surabaya). This organization includes a couple of small departments, which has their own special function. This organization structure is as followed (based on the "Struktur Organisasi 2008").There are 4 major departments within "Dinas Perhubungan Kota Surabaya":

1. **Facilities department**
   This department take care about the facilities that are needed for the transportation department, for example they design: bus stops, P+R areas and terminals.
2. **Traffic department**
   Handles the traffic situation in Surabaya by controlling the (dynamic) traffic systems, signs, traffic lights and traffic support.
3. **Transport department**
   This department take care about all transportation services on the road like public transport and taxi (they are not operating the service but they support these services in their process to get the right permission and correct required documents). Besides the transportation on the road, they also take care about basic support for the transportation in the air and sea, for example controlling the telecommunication towers (to prevent collisions with air traffic) and they provide for the issuance of small boat licenses.
4. **Operational department**
   The most important task for this department is to check if the people follow the rules and the law for the transport en traffic section. They are checking the regulation by using emission, safety, and education tests. Besides controlling, they also take care about traffic education programs for schools and supporting driving courses to improve driving skills of the drivers in Surabaya.

2.2 Traffic System (on the Road)

As described before, the increase of the population is creating pressure on the transport and traffic system in Surabaya. The city area is expanding every year which means the demand to new roads is also growing (Australia-Indonesia Partnership, 2010). The lack of coordination between mobility and spatial planning has lead to difficulties in the traffic network of Surabaya. Large buildings as Malls and major companies located themselves at locations where the traffic network already was weak. (Dishub Surabaya, 2013)

Road Structure (and design)

The road structure can be classified in 4 different types of roads. There is no official classification model like "Duurzaam Veilig" in the Netherlands, so the design of the roads can be different within the same category (Dishub Surabaya, 2013).

1. **Highway (toll road) - Jalan Tol;** a single connection between Gresik - Sidoarjo is built as a highway. It connects Surabaya with both cities and connects the north with the south of Surabaya. For this highway (Highway nr. 1) a fee is required (toll road).
2. **Primary roads:** these roads are the most important (and crowded) roads in the city of Surabaya, the number of lanes is at least 2 (or more) and is separated from the opposite direction.
3. **Secondary roads**: within the city, these roads connecting the residential areas with each other and these roads have mostly 1-2 lanes in each direction (they are not separated everywhere)
4. **Local / Residential roads;** inside the residential areas, there are roads who serve the (local) destination traffic. Ongoing traffic is not expected on these roads.

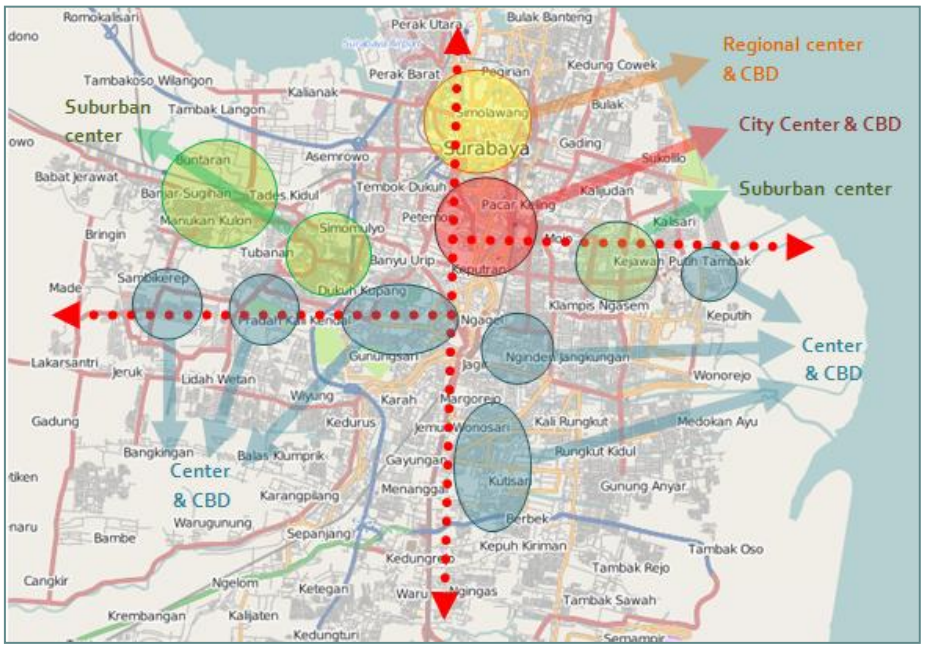


Figure 2.1 - Overview map with important corridor locations (North - South & East - West)
(source: Openstreetmaps.org + studi Dishub, 2013)

The most important corridors in the city of Surabaya are the North-South and East-West corridor. Along these routes, the most important areas are located. At figure 2.1 there is overview map with these corridors and the important areas along these corridors (City Form Lab, Singapore University of Technology and Design, 2014).

Modal split

The vehicles composition in Surabaya is different than in the Netherlands. A couple of the vehicles that is used in Surabaya are not being used in the Netherlands. Figure 2.2 shows the modal split from Surabaya (2012) including these other vehicles.

The most important conclusions from this modal split are:

- **Using of motorcycles is very high**; that's also no surprise if this will be compared with the number of motorcycles in Surabaya
- **Remarkable is the high rate of normal bicycles** that is caused due to the high amount of becaks (bicycle taxi); this taxi is popular in the outskirts of Surabaya.
- **Using public transport (mirkolet, angguna and bus) is limited**; especially the bus is very unpopular.

For a description of the vehicles, see chapter 1.

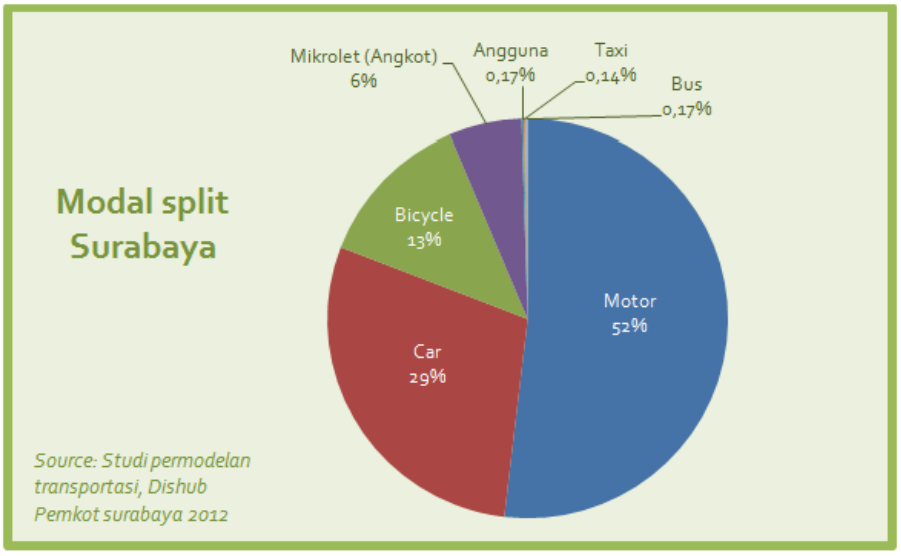
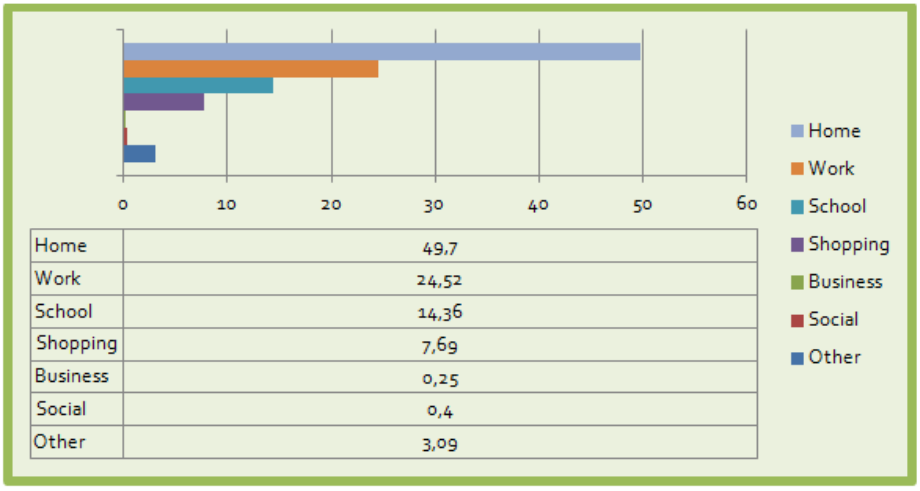


Figure 2.2 - Modal split *(source: Dishub Surabaya, 2013)*

In the same study (as the results of the modal split) to the basic information of the traffic in Surabaya, they tried to investigate what the main reasons are to travel in Surabaya. (Dishub Surabaya, 2013) The result of this research is listed in figure 2.3.

The most important conclusions from the reasons to travel are:

- Almost every trip starts or ends at home (49,7% is going home and the other 50,3% is to another destination).
- The popular destinations are school and work. This means that mostly these trips will take place at rush hour on weekdays.
- Remarkable is that business and social trips are less if it is compared with the main reasons (school/work/shopping).



Home	49,7
Work	24,52
School	14,36
Shopping	7,69
Business	0,25
Social	0,4
Other	3,09

Figure 2.3 - Reasons to travel *(Dishub Surabaya, 2013)*

2.3 Public Transport

The local government believes that the current public transport does not work well, the public transport system includes at this moment three important ways of travelling (Dishub Surabaya, 2013):

- **Angkot (mini-van)**
  The Angkot is the most used way of public transport in Surabaya. The Angkot consists at this moment 58 routes with 4789 vehicles and 10.000 drivers. The number of vehicles includes many old vehicles that are not used anymore; the government estimates that 1000-2000 vehicles are active at this moment. Within the 10.000 drivers, there are full- and part-time drivers.
- **Bus (city and intercity busses)**
  Within the city of Surabaya, there are 270 city busses that are used on 22 routes. With a percentage ± 0,17 % in the modal split, this way of the travelling is not popular in Surabaya. These busses only operate on the North-South corridor in Surabaya.
- **Train**
  The train is not operated by the local government but by the national train company "PT Kerata Api". This transport is not included in this research because it is also not included in the MRT / bus plan.

Route & Infrastructure

The current structure of the public transport is not structured and is complicated. The lines are not connected with each other but operate mostly from terminal to terminal. Because there is no interaction with the spatial planning, some routes use roads that are not optimal for public transport (too small or crowded). (Cities Development Intiative for Asia, 2011)

Only in the city centre, on a select number of important roads, there are exclusive lanes for busses. These exclusive lanes have to be shared with motorcycles and angkot busses. These lanes are mostly not physically separated but only signed as special lane. At the terminals, the angkot and bus service arrive. There are no fast connections between these vehicles. At the train station, there is no bus terminal. Passengers that are travelling from train to bus have to take another bus to the bus terminal (Cities Development Intiative for Asia, 2011).

Organization & Finance

The organization behind the existing public transport is complicated because it does not have a clearly structure. First of all, the organization from the angkot, the most popular way of public transport at this moment (figure 2.2).

The angkot service is arranged by four important organizations. Dishub is involved because of their power to provide the vehicle and route permission. The owner of the Angkot, the driver and the operator are three functions. Sometimes this is the same person for each function. Dishub explains in their own report that the organization of the angkot system is very complicated and unclear, they summarize this in figure 2.5.

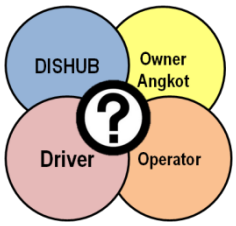


Figure 2.5 - Organization Angkot system (Dishub Surabaya, 2013)

However, the finance system of the current angkot is very simple. The passengers pay a flat fare (around Rp. 4000 IDR ≈ € 0,25) for a single-trip, they have to pay this fare to the driver (they do not receive a ticket). The received money will be the income for the driver (and operator / owner). Therefore, there is no subsidy from the (local) government.

2.4 MRT & Bus project Surabaya

The question to improve the public transport has become more important during the last decennia. The significant increase of traffic forces the government to act. One of the plans is the MRT project, it is a big project which includes a tram and monorail line for Surabaya. This MRT project is now the most important project besides the bus project. The bus project will transform the current bus system and network into a new bus system and network. In this paragraph, these projects are been described.

MRT Surabaya

The MRT project stands for Mass Rapid Transit, a system that can transport many people with one vehicle. In Surabaya, they choose for a monorail and tram. The choice for these both two concepts caused by the fact that these concepts are more popular than for example a bus line. Besides this, the average speed is also higher than for a normal bus. Only for the monorail, it was also not possible to build at ground level so they have to think about a system that will transport people in the air instead of on the ground. (Dishub Surabaya, 2014)

Figure 2.5 - Boyorail (the new monorail) (*Dishub, 2014*)

Monorail

The monorail will serve the important east-west connection (23 km) in the future

Key features of the Monorail

- Costs: Rp. 8,592,400,000,000 IDR (≈540 million euro)
- Independent / separate way (no interaction with other traffic)
- Automatic operation (without driver)
- Headway: 10 minutes (possibility up to 90 seconds)

Figure 2.6 - Surotram (the new tram) (*Dishub, 2014*)

TRAM

The tram will serve the important north-south connection (16.7 km) in the future.

Key features of the Tram

- Costs: 1 340 061 690 000 IDR (≈ 85 million euro)
- Operation on street level
- Interaction with other traffic on intersections
- Headway: 10 minutes

The tram will be connected to the monorail service (east-west corridor) at Joyoboyo (Wonokromo - central point of Surabaya).

THE BUS PLAN

At the same moment with the big MRT project, a second project is on the priority list of the local government. This project includes the restructuration of the bus network in Surabaya. The current angkot and city bus will be replaced.

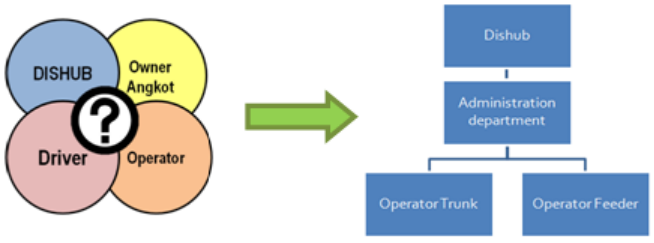
Trunk (bus)	Feeder (bus)
	
Trunk will operate at major routes	Feeder will operate in residential areas and connects these areas to the trunk (bus).

Tabel 2.3 - New bus system: Trunk (bus) + Feeder (bus) *(source: Dishub, 2014)*

In table 2.3, the two new types of busses are presented. These busses will be the part of the new bus network. The current angkots that can be rebuilt will be used for the Feeder system. Headway for the new bus system will be around 5 minutes, so the waiting time for these busses is limited until 5 minutes (Dishub Surabaya, 2013).

ORGANIZATION

In this plan, the organization structure will change also. In the current situation (chapter 2.3), the organization is not structured and complicated. The plan is to create a clear structure for the organization (figure 2.7).



Dishub	Administration department	Operator
Regulation Enforcement Providing subsidies Regulate rates	Managing income Managing subsidy Managing service fee	Operate the network Maintaining Following the regulation / arrangements

Figure 2.7 - Transformation from complicated to structured organization *(Dishub, 2014)*

FINANCE

The new bus network will get subsidy from the government to operate on the new network in Surabaya. The drivers are paid normally from the operator instead of the old system (where they have to get their income via the fares). The passengers will also buy travel tickets instead of they pay directly to the driver. The system of finance will be more like the European public transport systems.

The operators for the Tender and Feeder busses will be chosen via tender. All companies can enter the competition to get the operational contract.

ONE INTEGRATED PUBLIC TRANSPORT NETWORK

The main idea is that the different types of public transport are connected with each other, so that there will be one integrated public transport network. This network contains transport on every level (residential until city-wide) (The World Bank, 2014).

The plan is that the bus system will change next year (2015) and the MRT project has to be finish in 2016.

WILLINGNESS TO PAY (WTP)

In an earlier study to the MRT plan, the local government already calculated the willingness to pay (WTP). The WTP is showing the price that people wants to pay to travel with the monorail, tram or the busses. With this fare in their minds, the local government already chooses a basic fare (only for busses) for a single trip in the future. In table 2.2, these fares are listed (Dishub Surabaya, 2013).

	Willingness to Pay (WTP) *in Rp. (IDR)*	WTP *in EUR*	Basic fare *in Rp. (IDR)*	Basic fare *in EUR*
Monorail	Rp. 9.919 (IDR)	€ 0,63	*Unknown yet*	*Unknown yet*
Tram	Rp. 6.348 (IDR)	€ 0,40	*Unknown yet*	*Unknown yet*
Trunk (Bus)	Rp. 5.885 (IDR)	€ 0,37	Rp. 5.500 (IDR)	€ 0,35
Feeder (Bus)	Rp. 5.479 (IDR)	€ 0,35	Rp. 5.000 (IDR)	€ 0,32

Tabel 2.2 Willingness to Pay + Basic future fares (only bus) *(Dishub, 2014)*

3

Basic stages (Mobility)

Chapter 3

Basic stages to solve Mobility problems

In places where the mobility has significant problems, the government tries to find ways to solve these problems. The way to find a solution is in many cases not that easy and can be very complicated. In the Netherlands the government works with some basic stages to come closer to the choice of the right solution. In this chapter there will be more information about these basic stages from the Netherlands.

To get an overview of the reasons and the problems, the most used method is to put those problems in a model. This model is showing the reasons for a problem. In figure 3.1, there is an example of such model. *The information in figure 3.1 is only showing an example of a causal model, the list possible causes and reasons can be continued but is stopped in this example to improve the view of the model.*

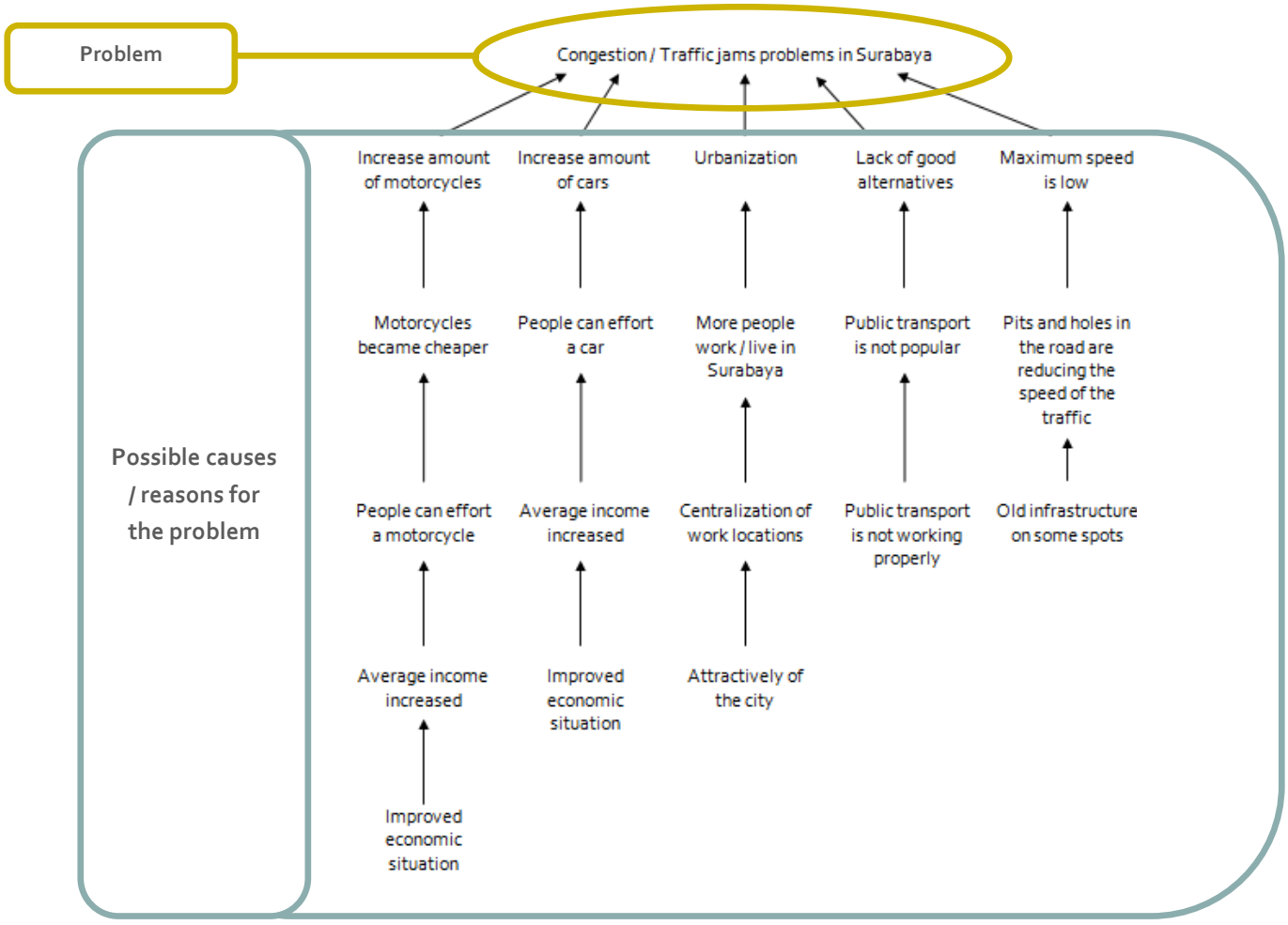


Figure 3.1 - Example Causal model with possible reasons for the traffic problem
*Model is based on example from course *(Herpen & Dongen, Yr. 2012-2013)*

2.1 THE BASIC STAGES

If there is a problem, there is something that causing the problems. At the first place the important question is: what can cause this problem, these causes and more information about the problem will be explained during a problem analysis. The real problem has to be formulated.

After the information of the problem is complete, the first stage will be followed from the basic stages. The information from these stages is based on data from CROW (Beleid, proces en basisinformatie) and the courses "Bestuur en Beleid", "Mobiliteit en Beleid" and "PMVV/PMSE" at NHTV University (Breda).

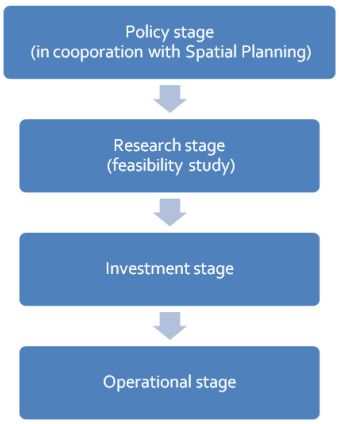


Figure 3.2 - Basic stages for mobility problems *(CROW, Van Herpen, Smalheer, 2014)*

GOVERNMENTAL STAGE (POLICY)

Policy is very important in the Netherlands. It is not only about the mobility policy, but also about the spatial planning policy. In the Netherlands these two government departments are coordinating their policies with each other. The search to a solution (and the final plan) has to fit in the current policy of the government.

There are three levels of policy that are important for the transport and traffic system. The most important elements of each policy (plan) are (information based on lectures "Mobiliteit en Beleid" (NHTV) from 2012:

National transport and traffic plan

- Essential elements of the national policy
- Expected activities from the national government, provinces and local government
- Coordination with economy and environment
- Phasing, prioritizing and indication of the realization costs
- Expiring date (when the plan has to be renewed)

Provincial transport and traffic plan

- Detailed information from the essential elements of the national plan
- Coordination with spatial planning, economy and environment
- Phasing, prioritizing and indication of funding for the local government ("gemeenten")
- Expiring date for implementation from the provincial plan into the local plan

Local transport and traffic plan

- Detailed information from the essential elements of the national and provincial plan
- Coordination with spatial planning, economy and environment
- Phasing, prioritizing and indication of funding
- Expiring date of the plan

Every level has their own tasks and has an own budget. The last years, the tasks of the national government are getting more decentralized. Especially, the local government is getting more tasks which put pressure on their budget. The choice for decentralization is because Municipalities are the closest to the people and can make effective policy (Rijksoverheid, 2014).

Besides the specific transport and traffic plans, these plans have to operate in coordination with the plans of spatial planning. For example, it is not possible to place attractions (hospitals, malls, offices) randomly in the city; the structure spatial plan ("bestemmingsplan") from the government decides this. To decide what will be the best location, the government considers all the pros and cons. Mobility is one of the most important criteria for choosing the (new) locations.

In this stage there are more parties than the government, these parties giving advice and their opinion about the plan(s). These parties are mostly the people who are involved with this project (residents, local companies and important organizations in the area; hospitals, stores).

"Het bestemmingsplan" is an instrument for the government to control the usage of their areas. Every 10 years, for each plot (area), the government decides what will be the function of that specific plot (area). With "het bestemmingsplan" the government can try to avoid the wrong use of their areas. The government can label the specific area with a particular function, but the government cannot force the owner to build something.

The major functions for the areas in the Netherlands are (Herpen & Dongen, Yr. 2012-2013):

- Living (reside)
- Retail
- Company
- Agricultural
- Leisure
- Traffic
- Nature

Figure 3.3 - Major functions "bestemmingsplan" *(Van Herpen, 2014)*

In figure 3.3 there is an example of a "bestemmingsplan" which shows the functions of a specific area in the Netherlands. The colors are displaying the function of the area (yellow is for example for living).

Besides "het bestemmingsplan", the government has other instruments to control the areas.

Research Stage

After the agreement in the policy stage, there will be some researches to the feasibility of the plans from the first stage. This research stage is also named the planning stage. The research stage is getting more on detail level than the policy stage. In this stage the focus is more on subjects like network design. In this report, two examples of researches will be more detailed: "How to choose the type of public transport?" and "How we create a public transport network?". These examples will be explained in the Dutch situation, compared with the situation in Surabaya. In the research stage the licenses and authorizations for the project are also controlled.

Investment (-decision) stage

When the masterplan and the public transport type/route/network has been decided, the next stage is the investment stage. During the investment stage, the organization is going to decide who will execute the project. In case of a tender project, the tender will start in this stage. The list with specifications and conditions of the project will also be created and published in this stage.

Operational stage (implementation)

The project will be more detailed again after finishing the major decisions in the previous stages. This operational stage contains the realization of the facilities, for example: bus stops, terminals and P+R.

After everything is finished for the operation (including all the previous stages), the promotion and marketing processes will start. The important question is: "How we attract people to this (realized) public transport?"

In this report, the themes around the facilities and promotion (attract people to public transport) will be more detailed in chapter 5 and 6.

2.2 Compare and Contrast with Surabaya

The Netherlands and the situation in Surabaya are hard to compare because of their different level (national and local/city level). Still, it is possible to compare the basic stages to solve a problem (as the situation in the Netherlands at paragraph 2.1). The stages are matching at some specific points, in this paragraph the way of solving a mobility problem from the Netherlands will be compared with the way of solving a mobility problem in Surabaya.

Different structure

The structure that the Netherlands use to solve a mobility problem does not exist in Surabaya, but there are stages that exist. In Surabaya, the government starts to check the problem and collect data from the location that has mobility problems. The different with the Netherlands is that they often use best practices from outside instead of developing own concepts based on own research.

Major difference: Policy stage is missing

The major different with the Netherlands is that the policy stage does not exist in Surabaya. The interaction with spatial planning is also not there, this is maybe one of the reasons from the last years that caused the mobility problems in Surabaya. The way how the city extends can have a big impact on the existing mobility network. If the network is not growing with the expansion of the city, the network could be overloaded at crowded points.

In the last years, there is a change in this not existing stage; slowly the government is using structure visions for the future of the city which contains global plans and ideas for the future (Gov. Surabaya, 2014).

Operational stage (implementation)

At this moment, the local government has no experience with the operation of a complete public transport system. They only facilitate the public transport with

their permission and checks. In the upcoming years, when the new public transport will be launched, the government needs to learn more about this stage.

Similarities

Similar to the Netherlands are some parts from the research and the investment stage. The research stage in Indonesia includes some elements like the calculation of the trip generation, the willingness to pay and the rerouting process. (Dishub Surabaya, 2013/2014). These elements are also included in the research stage from the Netherlands. The investment stage is need for the realization of the new public transport because without financial support, the system cannot be realized. The new public transport will use tender to operate, so this step is also included in the investment stage (equal to situation in the Netherlands).

2.3 Interesting stages for Surabaya

In this report, there will be a focus on some items from these stages (from 2.2) to find a solution for a mobility problem. The items that are chosen in this report are:

- **Research stage**
  - Choosing a type of public transport for a new route (which type of Public Transport)
  - Creating a public transport network
- **Operational stage**
  - Implementation of facilities (bus stops, P+R)
  - Promoting the public transport

The reason that there is no item from the policy stage is that there is no similar policy stage in Surabaya. The reason for skipping the investment stage is that this stage is already in process and the local government doesn't need information about this stage (The World Bank, 2014). The other items are chosen because the local government indicates that they need more information about these items.

More information about these specific choices is listed in chapter 1 ("Compare and Contrast method").

4

Research Stage

Chapter 4
Research Stage: Creating Public Transport

The research stage contains the feasibility studies to the plans from the first stage (policy stage). In this report, two types of research studies are detailed. The first one is: "How to choose the mode of public transport?" and the second study: "How we create a public transport network?".

4.1 Choosing the type of public transport

In the first part of this chapter, the focus is on choosing the mode of PT. The way how the Netherlands choose the PT modes is described in this paragraph. Afterwards this way of working will be compared with the situation in Surabaya.

4.1.1 Choosing the type of PT in the Netherlands

The level on which the public transport will operate is important to determine which mode of transport is available to implement. Based on the reader Public Transport (Proper, 1 - Reader OV - Inleiding OV, 2013) in table 4.1, there is a list with three levels including the matching public transport.

Local (city)	Regional (urban area)	National
• (City)bus	• Lightrail	• Intercity train
• (City)Tram	• Metro	• High speed train
	• (Fast)tram	
	• (Intercity)bus	

Table 4.1 - Different ways of public transport (all levels) (Proper, 1 - Reader OV - Inleiding OV, 2013)

Local level (City level)

For the city / urban area, the modes of transport are: bus, tram, metro, lightrail. Table 4.2 shows the differences from these modes based on speed, infrastructure and capacity. Capacity is for example important to decide if the demand from passengers is matching with the capacity of the vehicle.

	Lightrail	Metro	(Fast)Tram	Intercity bus	City Tram*	City bus*
Maximum speed (km/h)	100 <> 120	80	50 <> 80	50 <> 80	50 <> 70	30 <> 50
Average speed (km/h)	40 <> 50	30 <> 40	25 <> 35	20 <> 30	20 <> 25	15 <> 20
Use of rail?	rail	rail	rail (road)	road	rail (road)	road
Infrastructure	Independent	Independent	Independent/ Separate lane	Partly separate lane	Independent/ Separate lane	Partly separate lane
Capacity (max. passengers)	600	400	120	120	120	80

Table 4.2 - Different ways of public transport (city level) *(Proper, 1 - Reader OV - Inleiding OV, 2013)*
** these elements are added based on data from* (OVinNL, 2013)

Other important criteria to choose a mode for a public transport section are listed in table 4.3. The list of criteria based on technical requirements or regulation can exclude a mode. It could be possible that in a specific area there is no space to implement a railway.

Technical requirements / Regulation (law) on the route	**Other criteria**
• Free space • Implementation in landscape • Bend radius • Safety systems • Integration with other traffic • Height differences	• Connection / Expansion with / from existing network? • Quality • Reliability • Costs • Environment (sustainability) • Image • Realization time

Table 4.3 - Technical, regulation and other criteria - Choosing PT mode
(KpVV, 2009 / Proper, 1 - Reader OV - Inleiding OV, 2013)

Costs

After there are chosen a couple of modes based on the above named criteria, the final decision mostly depends on the costs of each mode. The costs can be divided into 4 major categories:

1. Investment costs (realization of the project, especially: infrastructure)
2. Maintenance costs (maintain the infrastructure)
3. Exploitation costs (trains or vehicles)
4. Operational costs (driver, km costs)

	Lightrail	Metro	(Fast)Tram	Intercity bus	City Tram*	City bus*
Investment Infra-structure (per km)	3,3 <> 28,5 mln.	75 mln.	3,3 <> 28,5 mln.	11 mln.	3,3 <> 28,5 mln.	2 mln.
Maintenance Infra-structure (per year)	450.000 <> 550.000	815.000	450.000 <> 550.000	68.000 <> 90.000	450.000 <> 550.000	68.000
Exploitation costs (per year)	130.000 <> 300.000	130.000 <> 640.00	145.000 <> 238.000	30.000 <> 62.000	145.000 <> 238.000	30.000 <> 62.000
Operational costs (per hour)	200-250	250-350	150-200	70-100	150-200	70-100
Order of total price	€€€	€€€€	€€€	€€	€€€	€

Table 4.4 - Costs of public transportation in the Netherlands in euro *(Koolen, 2007)*
Prices are listed in local currency (euro) - @June 2014: 1 euro ≈ 16.000 IDR

The most expensive choice is the metro (in table 4.4); this is caused by the high costs of tunnels and other special structures. The costs for the bus are low because it doesn't require (mostly) special infrastructure or special structures.

The list of costs from table 4.4 includes a range from basic till extreme structures for every mode.

The price level is different in Surabaya and the Netherlands, the **order of the total price** is listed in the last row of the table to give a better impression of the costs.

4.1.2 Compare and Contrast with Surabaya

If the situation will be compared with the new MRT plans for the future, there are differences in the way of the decision for the mode has been made in order to the basic way in the Netherlands.

In the begin phase, before the MRT plan was set up, the original plan was to set up a BRT (Bus rapid transit) network. The choice for the BRT plan was based on different reasons (Dishub Surabaya, 2014):

- Investment and exploitation costs are the lowest
- More flexibility throughout the city of Surabaya
- Experiences in other Indonesian cities (and on long distance in Surabaya) with busses
- No experience with other types of public transport
- Bus material is already available and supported by the national government

Political reasons have led to cancel the realization of the BRT network. Main reason was the weak (public) image of busses instead of high quality transportation (like tram, metro and monorail). Besides the image, at the east-west corridor, it is difficult to implement transport over land (on street level) due to underground problems with flooding and overcrowded areas at street level.

The local government requested a new plan where a monorail (east-west) and tramline (north-south) would be part of it. This new research resulted in the current MRT plan. The studies to the current MRT plan conclude that the exploitation of the tramline can be successful and profitable (Dishub Surabaya, 2014). Surrounding the construction of the monorail, there are more doubts because of the high financial cost. The differences in costs between the tram and monorail are visible in table 4.5.

Investment costs	
Monorail	**Tram**
€ 23.335.755 mln/km	€ 4.734.513 mln/km

Subsidy per journey (per ticket)	
Monorail	**Tram**
€ 1,70-1,80 (27.500-30.000 IDR)	€ 0,12-0,25 (2000-4000 IDR)

Table 4.5 - Costs for implementation tram and monorail in current MRT plan *(Dishub (Economically study to MRT Surabaya), 2014)*

The subsidy per journey is the required subsidy when the expected demand is realized. That means that when the monorail will operate, the average demand per hour is ± 6000 passengers (Dishub - Economically study, 2014). In headway of 10 minutes, this means that in each tram the expected average demand will be ± 1000 passengers. The demand is higher than the capacity of one tram (set) that means that it will be a challenge to get this high demand, especially in the off-peak hours. That puts pressure on the estimated subsidy. That does not mean that the plan is technically unfeasible. After the decision of the monorail and tram made, several studies showed that it is technically possible to implement these two modes on the chosen corridors in Surabaya.

Besides the MRT plan, the current bus system with the little busses (Angkot) will be transformed to a bus network that consists of city busses and little district busses. These two bus systems will be connected to the MRT network. More about this part in paragraph 4.2.

4.1.3 Results

Conclusions

The way how Surabaya decided to choose for the monorail and tram is different than it should be in the Netherlands. The decision in Surabaya is not based on a research to the possibilities and costs of the modes but is more based on political preference.

Besides the political preference, transport over land (on street-level) is difficult on the east-west corridor due to lack of space. The critical part of the plan will be keeping the monorail (financial) "alive". Technically it is possible to implement the tram and monorail.

The subsidy for the monorail is calculated on high demand numbers, if this high demand will not be realized, the subsidy has to increase. For the peak (rush) hours it is possible to get this high demand, but in the off-peak hours it will be challenging. The marketing and promotion has to focus on these times, to get more people into the monorail (and tram) during off-peak hours. More about this subject, in chapter 6 (promotion).

Recommendations

To avoid the high investment, exploitation and operational costs, it is an interesting idea to search for different modes of public transport on the east-west corridor. A tramline can be a solution that can be combined with the north-south tramline on different subjects. The combination has a couple of advantages:

- Buying material (trains) in one large order (can lead to discount from the manufacture)
- One type of trains is cheaper in maintenance
- Less knowledge is required for operating trams than for monorail
- Possibility to share trains from both tramline in case of technical failures of trains
- More experiences in the world with trams (avoid failure costs)
- In case of infrastructure failures, parts of the tramline can used as bus lane for replacement bus services

In earlier study, the conclusion was that it is technically not possible to operate on street-level on the whole east-west corridor. That means that on different spots, the tramline has to be operating in the air on a specified height. This is technically possible, for example like the project "RandstadRail" in Rotterdam/Den Haag (the Netherlands).

RandstadRail Rotterdam/Den Haag (The Hague)

RandstadRail are three lightrail connections that are located in the area of Rotterdam and Den Haag (The Hague). These lightrail connections were formally heavy rail connections from the national train company (NS). To stimulate the use of urban public transport, the regional government (in cooperation with the national government) decided in 2006 to change these lines into lightrail connections. Lightrail is a mode between train and tram/metro and it is operating with light vehicles. The light vehicles have the advantage that they can accelerate quickly; this has a positive impact on the journey times.

The vehicles from RandstadRail are equipped with a multifunctional wheel-system, so the vehicles can be used on metro, tram and train tracks. RandstadRail is used for journeys in the urban areas of Rotterdam and Den Haag but can also be used for inner-city trips within the cities of Rotterdam and Den Haag. In case of disruption(s) on the train connection between Rotterdam and Den Haag, one of the lightrail connections is being used as an alternative way for train passengers.

Figures 4.1 - Best practice - RandstadRail Rotterdam/Den Haag *(Urbannet.com & RET.nl)*

4.2 Creating a PT network

Create a PT network sounds simple because it is just connecting PT lines in one area with each other. The choices behind the way how these lines can be connected are more complicated, in this paragraph the stages for creating a PT network in the Netherlands is described.

4.2.1 Creating a public transport Network in the Netherlands

A tram, bus or metro line is mostly part of a complete public transport network, so passengers can change between these vehicles and reach more destinations with

public transport. When the network will be (re)designed, there a lot choices to make. In a tender structure where a (private) company will operate the public transport, the government set up a list of requirements in the (tender)contract and the private company will create the network (that matches with the tender contract). In this process of creating the network, it is important to decide first what will be the basic network type.

The two major types of network are as followed (table 4.6).

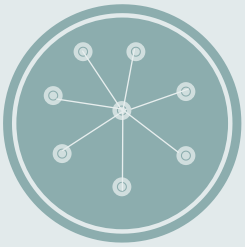
Connecting network	Opening network
	
Apply on: International, National, Interregional, Regional or Urban level	**Apply on:** City, local level
Characteristics on Urban / City level	
Total distance: 5-25 km	Total distance: 1-10 km
Average speed: 30-50 km/h	Average speed: 20-30 km/h
Distances between stops: 1-3 km	Distances between stops: 500m - 1 km
Headway: 20-30 minutes	Headway: 10-20 minutes
Journey time: 10-50 min.	Journey time: 5-30 min.
Summarize	
High quality PT, more passengers (bundling), direct routes, less stops	Little vehicles, more flexibility, social function, many stops, everything is connected
(Middle-)long distance, city-to-city or in urban area	Short distance, door-to-door

Table 4.6 - Characteristics connecting and open network (PT) *(Proper, Netwerken OV (Cursus PV-lj2), 2013)*

Afterwards, it is important to decide which destinations will be connected to the public transport network. This partly determines what will be the lay-out of the different lines within your network.

Interesting destinations

While setting up a PT network, the following elements are important to keep in mind (Proper, Netwerken OV (Cursus PV-lj2), 2013):

1. Density (of residential areas), this is important because this is the place where the customers of the PT lives (and frequently starts their journey).
2. Important locations (these are destinations for the customers - CBD, hospitals, malls)
3. Quality of the routes for PT (comfort and speed)
4. Possible locations for stops (and terminals)

Lines

When this information is clear, the types of lines can be chosen. There are around 10 types of lines that can be used for a PT network (see appendix I). The network can be built up with a combination of different types of lines. Even one PT line can have a couple of types. For example, in the city of Breda:

Breda - Bus line 1 (Westerpark - Centre - Station - Heusdenhout)

- At the westside (Westerpark); End loop
- At the eastside (Heusdenhout); Crosslinking *(with busline 7)*
- In overview; transversal *(district -> city centre/station -> district)*

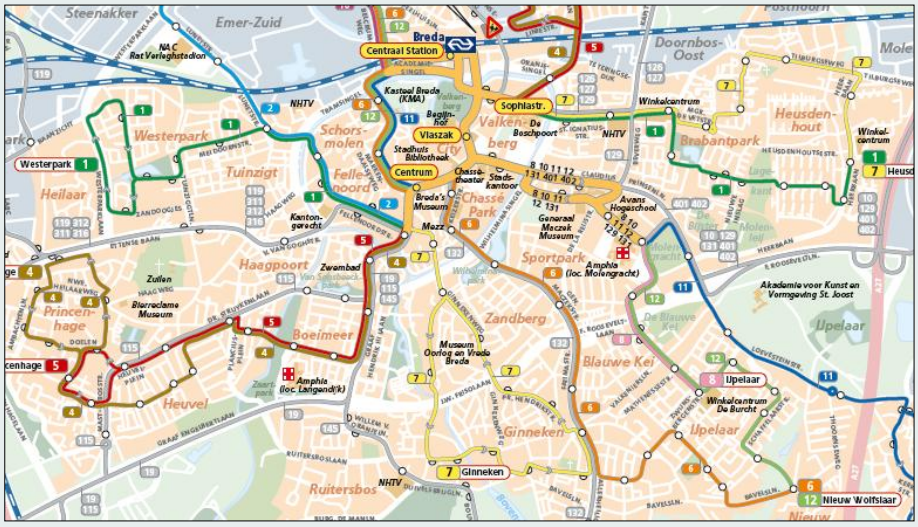


Figure 4.2 - Example of PT Network in Breda *(Veolia-Transport, 2014)*

Stops

If the destinations are cleared and a network with lines is created, stops and terminals can be placed. These elements partly determine the demand of the PT in the future. If the distance to the stops is too long, the PT (network) will not be attractive for the customer.

In the Netherlands, there are basic figures for the maximum distance to stops. These are no obliged rules but these distances showing the distance that people are willing to walk to a stop. This number can deviate due to circumstances (for example: when the quality of the route to the bus stop is not sufficient). In table 4.7 there is a list of these distances.

Maximum walking distance to a stop	
(City)bus	300-400 meter
(Urban/Intercity)bus	400-500 meter
City Tram	400-500 meter
Fast Tram	500-750 meter
Metro / Lightrail	1000 meter

Table 4.7 - Maximum walking distance to a stop *(CROW Kennisbank, 2014)*

Feedering

The network is not complete without the stations where passengers can change between the different lines and public transport modes. These stations expand the list of destinations that are reachable from a single point within the network.

In the Netherlands, the main "feedering" stations and terminals are located nearby the train station. This caused by the mostly radial structure and the interaction between the bus, tram, metro network and the train lines. The bus, tram and metro bring train passengers from the train station to their final destination (and v.v.).

In the major cities, the (city)bus is also getting this function as a support mode for the metro and tramlines. These important connections expand the operating/coverage area of the public transport. In figure 4.3, the situation with the connection between train <> metro/ tram/bus and metro/tram <> bus is viewed.

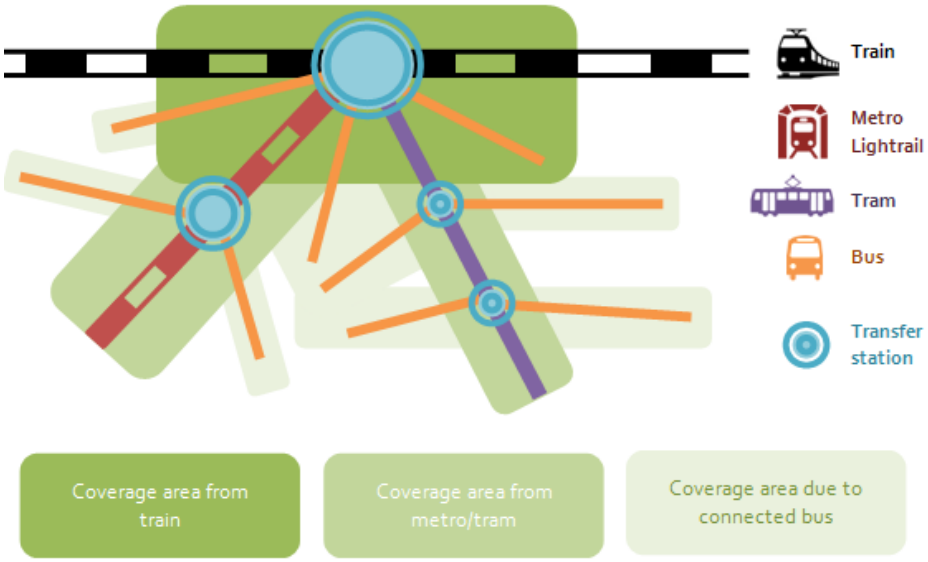


Figure 4.3 - Network with Feedering

It is important that the transfer time is limited (waiting time is factor 1,5 from a total journey) (CROW Kennisbank, 2014). The way how these stations are equipped with facilities and how these stops are designed will be described in chapter 5.

4.2.2 Compare and Contrast with Surabaya

In the new MRT plan and the new bus plan, there will be a lot of changes in the network. The tram and monorail are the most important changes because they don't exist in any way at this moment. The new bus plan (Dishub Surabaya, 2014) will replace the old "Angkot" system with city busses ("Trunk") and little busses for the residential areas ("Feeder").

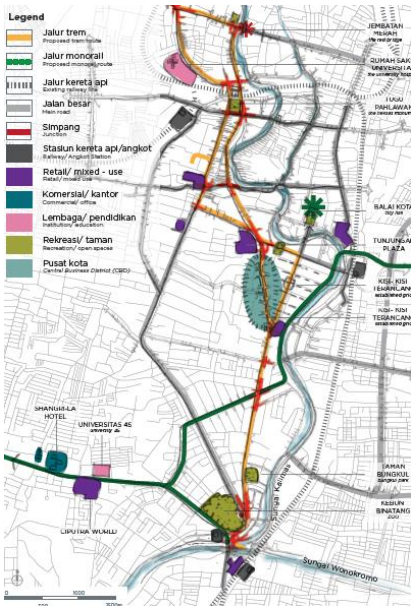
Both plans are combined in the network development to one new integrated PT network. If the situation from the Netherlands will be compared with Surabaya, it looks like Surabaya will choose for a combination between an "open network" and a "connected network" with every district connected. The feeder will connect the residential areas with the major bus lines, these major bus lines are connected with the tram and monorail. With this way of creating an integrated network, the

coverage of the tram and monorail will be expanded. The reason why it is not a full "open network", some districts have walking distances that are more than 800 meters (the double of the maximum distance to be attractive for passengers in the Netherlands) (figure 4.4).

If the monorail and tram lines will be analyzed separately from the bus network, these two modes will function as a full "connecting network" because of their longer distances, large distances between the stops and the higher average speed. The bus network alone is still operating like a combination between a "connecting network" and an "open network".

< Figure 4.4 - Situation at Surabaya Selat: the coverage area of the bus line is ± 400 meter in the Netherlands, if you apply this on the new bus route in Surabaya;
-> Green area is the coverage area
-> Red area is the not covered area
(walking distance is in some cases > 800-1000 meters)
(Openstreetmaps / Dishub, 2014)

The types of lines (lay-out of every separate line) are different on the whole network, there are connections that are radial, transversal or have an end loop. These choices for these lines are mostly based on the possibilities from the infrastructure in combination with the interesting points besides these routes. Because there are too many individual lines, it is not possible to get into more details about every line in this report.

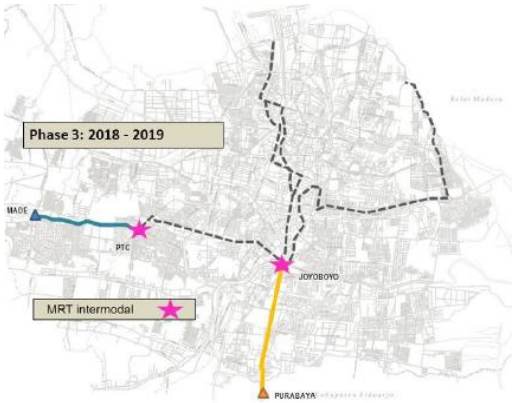


The choices for the routes are based on analyses to the interesting areas. The tram route is moving through the city centre and major CBD. The stops are also located nearby attractive points where the place function is high (more about the locations of stops in chapter 5).

In the research studies to the corridors and surroundings of the public transport, there is also been a study to develop TOD (Transit oriented development). This is especially interesting for the new tram and monorail. So, in the future plans from Surabaya, spatial planning and mobility is getting more integrated in their plans.

< Figure 4.5 - Example of a corridor analyses with the locations of the interesting points
(source: World Bank, 2014)

The MRT plan is on some parts already combined with the bus network. In the south (Joyoboyo - Purabaya) and the west of Surabaya (PTC - Made) the bus will extend the monorail/tram connection (figure 4.6).These extensions are examples of a feedering system (like in figure 4.3).



> Figure 4.6- Extension with bus to Purabaya (from Joyoboyo) and Made (from PTC)

(The World Bank, 2014)

4.2.3 Results

Conclusions

The new network from Surabaya is getting more similar with the networks in the Netherlands. The integration from more modes to one network is more looking like the public transport system in the Netherlands. The tram and monorail are more based on the connecting network idea and the busses (Trunk and Feeder) are more based on an open network system.

Still, the open network of the busses is not connecting every spot from Surabaya with the public transport network. This is also difficult in the beginning stage of a new network, in the Netherlands the current public transport system exists for many years. For Surabaya, the MRT + bus plan will be their first experience with public transport like the existing system in the Netherlands. Because of this, the bus network can be called a combination between an open and connecting network.

The new network is based on interesting points as CBDs, malls and hospitals. Besides the affiliation with the current interesting points, the government is also starting (in cooperation with the World Bank) to stimulate the integration between spatial planning and mobility by supporting the development of TODs around the new PT lines.

Recommendations

The most important recommendation for the new public transport network is to stay focused on the integration between the different modes so the coverage area of the public transport can increase in the future (as in figure 4.3). The transfer points between the different modes have to be located at smart places in the network; these points can be combined with train stations or other interesting points.

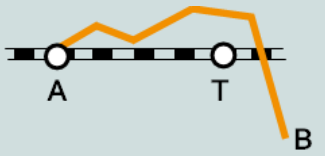
Visgraatmodel Zuid-Limburg ("Intermodal-model South Limburg")

South Limburg is a province in the south of the Netherlands, since the new (tender) contract in 2006 this province has a multimodal public transport system that is operated by one Transport Company. This transport company (Veolia-Transport) take care about the local train connection, the city and urban busses, the local busses and the region taxi (this taxi is similar as the "travel" system in Indonesia, you have to share the taxi with other passengers).

The advantage of the multimodal PT system is that one company can optimize the integration between the different modes. This system resulted in an "intermodal-model" ("visgraatmodel") for the train and bus in South Limburg. The main point of this model is that train and bus are connected on a high level. The timetables are connected to each other, which mean the transfer time between the modes is short and the complete journey times will be short.

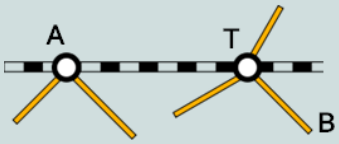
The following example will describe this situation.

A passenger is travelling from A to B



Old situation:

- Bus company + Train company is separate
- Bad interaction between train + bus (no interaction in station T)
- Different fare system
- Long travel time with the bus: 75 min



New situation with "intermodal-model"

- Bus company + Train company is one company
- Timetables are integrated (bus wait on train)
- One fare system (one price)
- A -> T 10 minutes with the train
  Transfer T 5 minutes
  T -> B 15 minutes with the bus
  Total time 30 minutes (45 minutes faster)

Besides the advantage for the passenger (short journey time, one price etc.), there are also advantages for the government and transport company:

- No parallel double connections = Busses can be used for other routes
- More cost-efficiency
- More attractive PT product = More passengers

The change to this model has lead to an increase of 40% in amount of passengers within the first 2,5 years of this contract (Verkeerskunde, 2012).

The stimulation of the integration between mobility and spatial planning has to be continued, in the vision (or future policy) the relation between those two worlds has to have to be described. It is important that future expansion from facilities as malls and workplaces will be located around the PT lines (prefer nearby the tram and monorail corridors).

Supporting and connecting local transport in the residential areas to the new Trunk and Feeder system so the coverage area of the PT network can increase. In the Netherlands there are examples of local transport that is specialized in a small number of passengers, it looks like the old Angkot system but it's operated by one transport company with sub-contracts to taxi owners and companies.

5

Operational Stage

Chapter 5
Operational stage: Creating PT Facilities

In this report there will be no specific chapter about the investment stage because this stage is already in full progress in Surabaya. This decision has been made in cooperation with the local government (client of this report).

The operational stage is the almost the last stage after the policy, research and investment stage has been completed. In this stage, the focus is on operational matters like timetables and facilities as stops and P+R. In this report the focus in the operational stage is on the facilities, specifically: stops and P+R. The local government needs information about these subjects for their new PT plan.

5.1 Stops

Essential for a good working PT network are stops. Stops can make the difference between an attractive and a non-attractive PT network. In this paragraph, the situation about stops in the Netherlands is described first; afterwards the comparison with the plans of Surabaya is viewed.

5.1.1 Stops in the Netherlands

Location

If the network has been created in the previous stage, there is already an idea about the surroundings and the interesting points nearby the PT route. In this step, the exactly location of the PT stops will be chosen. The earlier presented information about the distances between the stops and the coverage area should be kept in mind.

Tram+Metro+Lightrail	(City)bus
Distances between stops: 1-3 km	Distances between stops: 500m - 1 km
Coverage area: 400-1000 meter	Coverage area: 300-400 meter

Table 5.1 - Distances between stops + Coverage area
(Proper, Netwerken OV (Cursus PV-lj2), 2013)

Locations of stops are mostly situated nearby interesting points like:

- Hospitals
- Schools
- Libraries
- Malls
- City Centres
- Tram stops (connection)
- Metro and Train stations (connection)

Places where people want to do their (daily) **Activities**

In cases to choose the specific locations for stops (and to search for the matching facilities for the stops), the node-/place- model is used in the Netherlands. This model is allowing the user to analyse the current network and to check where the interesting locations to expand the network are. With the information from this model it is possible to work out strategies and planning for land-using in the future. This node/place model is viewed in figure 5.1.

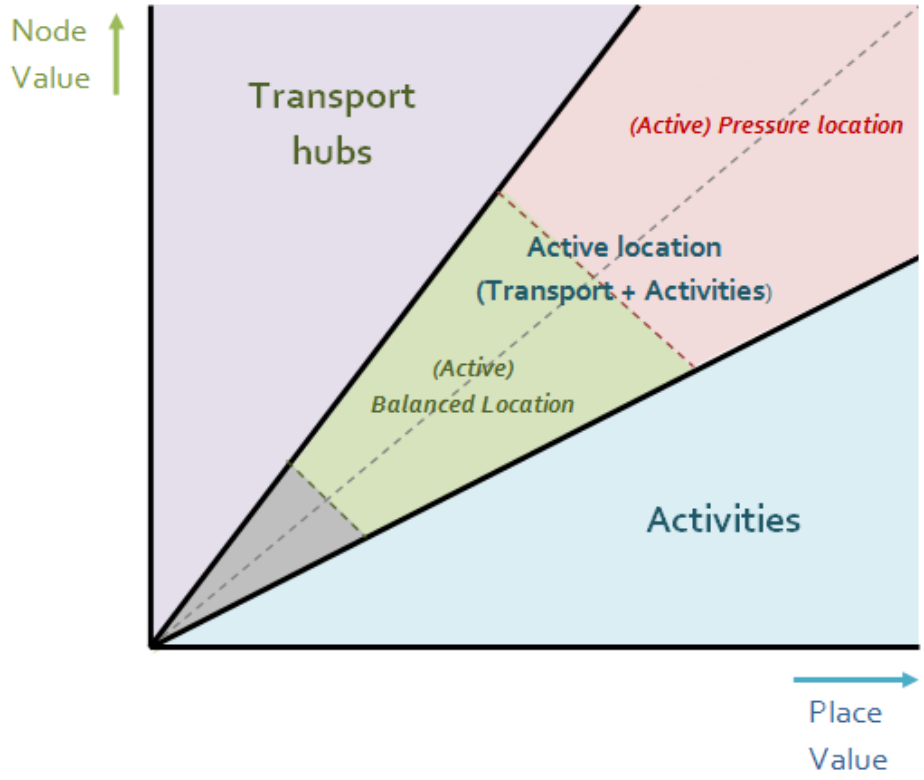


Figure 5.1 - Bertolini's Node-/Placement model (*Bakel, 2001*)

The model is based on the node and the place value of a specific point. These two functions having the following characterises (Eijk, Yr. 2012-2013):

- **Node value**
  - Physically point where transport connections are coming together (transport hubs)
  - Changing possibilities between different modes (train/metro/tram/bus)
- **Place value**
  - Activities around the node (malls, hospitals, bank)
  - Urban dynamics around the node

The model is split up in three areas: the transport hubs, the active location and the activities. If the point in the network has a high place value and a low node value, it will be an activity place only. If the opposite values are applied, the specific point is only good accessible but doesn't provide any activity. Luca Bertolini (Urban Planner) explains (Bertolini & Chorus, 2011) (Bakel, 2001) that the best situation will be when every node is on the middle line (active locations), so that means that the node and place value are in balance. A balanced point will be good accessible and there are interesting activities around the point for the traveller. TOD is making use of the middle line in its development, while the functions are located nearby good public transport.

If the urban level will be presented on the same model, it will look like figure 5.2. The low urban areas are having a low node-/place- value and the high urban areas having both on high level. That high level is causing the pressure on these areas while the transport hubs and activities are fighting for space (to expand due to the high demand). These last locations are in the Netherlands mostly located at the Central Station where the demand to free space is high.

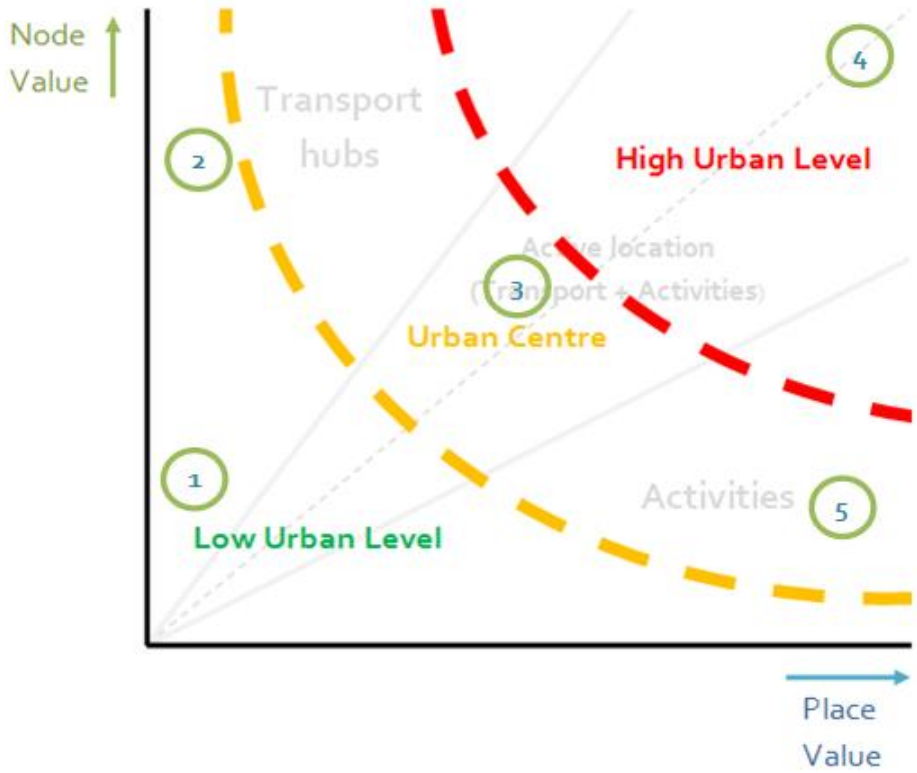


Figure 5.2 - Bertolini's Node-/Placement model including urban levels *(Eijk, Yr. 2012-2013)*

In appendix II, there are some example locations (signed with numbers) in the Netherlands that are explaining the specific given spot from the figure 5.2.

Integration with activities

At a range of stops, the stops are integrated with the destination. Mostly these are the stops that are located on the middle line of the node-/place-model and are named as active locations.

On these locations the activities are nearby the stops. It is important to integrate the design of the activities with the stop to improve the using of the PT (Remi Kok, 2006). In the city centre of Rotterdam, there is a good example of an active location which has integrated the mobility in the activity.

Metro station (and tram/bus stop) Rotterdam Beurs

Metro station Rotterdam Beurs is integrated in a unique shopping street ("de Koopgoot") and is giving directly access to the street and the major department store. At the floor above the shopping-tunnel, there is a tram/bus stop located. This is an example of a city hotspot that is connected with tram, bus and metro (see figure 5.3). Changing between the different modes and the activities are important on this location. This means that the location has a high node-/place-value.

Figure 5.3 - Station Rotterdam Beurs *(Duurzaam ontwikkelen Rotterdam,2012)*

Basic facilities

The demand to basic facilities as benches, an abri (waiting room), a clock and ticket machines depends on the specific situation. A list is included in appendix III and provides more information about the different facilities. In the list, there will be referred to "low urban level", "urban centre" and "high urban level". These levels are the same as in the node-/place model (figure 5.2).

Travel information (dynamic and static)

Information of the PT network is one of the essential elements of a good working PT network (Proper, 1 - Reader OV - Inleiding OV, 2013).Travel information can be divided in to a couple of types:

- *Info before the trip (internet/folders/newspapers)*
  Information about planning the journey, not relevant for this chapter.

- *Info during the trip (on the stop/station and in the vehicles/mobile apps)*
  Delays, disruptions or just the expected arrival time. Information that can be displayed to passengers during their trip. Basically the static departure information is required at every stop to provide everyone of the basic departure information. A map of the area with the PT network, a clock with the actual time or real time information can be additional.
  The using of new technology with real-time information gives more possibilities and is popular in the Netherlands, so the user can participate on the actual situation. Passengers prefer to get clarity and certainty during their trip. A

special note has to make on this point, the real time information has to be accurate because travellers may not lose their faith in the information system. If passengers don't trust the system anymore, it will be very difficult to get this trust again.

Besides the physically static and dynamic systems, mobiles and tablets can also be used as information channel (via apps and mobile websites).

Available channels: Maps, information boards, screens, apps on mobiles/tablets, information screens in the train

Figure 5.4 - Real time-information at a metro and tram stop in Amsterdam/Utrecht *(source: GVB + U-OV)*

- *Info after the trip (on the stop/stations)*
  The stop or station is in the most cases not the final destination of the passenger. The passenger is mostly travelling to a specific activity. Especially on locations where the activity level (place value) is high, it is important to provide information after the trip. This information can contain signs to the activities so the passenger knows how they reach their final destination. This can be information about walking routes but also information about connections on the train/metro/tram or bus can be useful in these cases.

  Available channels: Signs, maps, information boards, screen

Figure 5.5 - Sign at an exit of Amsterdam Central (metro) *(GVB, 2014)*

5.1.2 Compare and contrast in Surabaya

In this paragraph, the plans about the stops will be compared with the situation in the Netherlands from 5.1.1. Based on this comparison, there will be a list of conclusions and recommendations in the next paragraph (5.1.3).

In the new plans for the PT network the distances between the stops is as followed:

- **Monorail**: 500-2000 meter
- **Tram**: 500-1000 meter

The density of the stops is a little bit higher than in the Netherlands, but the density and total population is also (much) higher, so this difference in distances can be explained.

Population	Density	Total Population
City area - Surabaya (2012)	8,300/km^2	3.114.700
City area - Amsterdam (2014)*	4,892/km^2	810.909

Figure 5.2 - Distances between stops + Coverage area
(Municipality Amsterdam + Surabaya, 2012-2014)
*Choice for Amsterdam: It is the biggest city (population) of the Netherlands to compare with Surabaya

In the environmental scan of the route (paragraph 4.2.1 - figure 4.5) the activities around the corridors is already determined. These activities are kept in mind while the government decided to place the stops. A model like the model from Bertolini to determine the potential locations of stops is not used in the planning process to the new PT network. The associated lay-out of the stops is also not used in the current planning. That means every stop is designed the same (within its own mode).

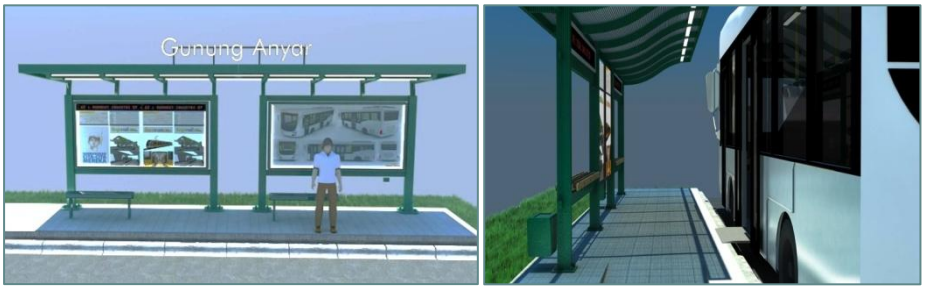


Figure 5.6 - Design new bus stops Surabaya *(Dishub Surabaya, 2014)*

The intermodal stations where passengers can change between the different modes are also located in the current plan. For several stations, there has been made a specific design of the way how the stations are connected to each other. These designs are only created for the large intermodal stations. There is no special design or plan for basic bus and tram stops

The integration between the new PT lines and the surrounded activities is not defined yet. The stations will operate independent from the activities (in the current plan). At some detailed designs of important stations, there are limited signs to the surroundings activities.

Furthermore, at the moment of writing this report, there are plans to start studies to the detailed design of the new stops. These studies are not available yet for further comparison.

5.1.3 Results

Conclusions

Stops are indispensable for a PT network, in the current plans of Surabaya there is only limited attention to the specific design of the stop in the context of the environment. The Netherlands uses models and experience to develop new and (re)develop old stops in their PT network.

The most important conclusion is that the stop has to be integrated with the environment. The activities and mobility (stops) have to work together to transport the passengers from and to the activities. After the deciding the exactly location (and the interaction with the environment), the Netherlands checks which basic facilities the stop need to operate well. Travel information is one of these essential elements that are needed on a stop.

Recommendations

Integrate the stops in the spatial environment and stimulate the interaction between the activities and the mobility via the PT network. Examples like Rotterdam Beurs can be used for this kind of integration. In figure 5.7 there are some other examples of integrated stops in the city centre.

To determine which locations have potential to be successful, the use of a model like the model of Bertolini can support. With this model it is possible to classify the new locations and to check which basic facilities (including which type of travel information) this stop need, so it is also possible to create a uniform appearance of the stops.

Improve the City Centre with stops

Using PT stops can also improve the spatial environment. In the first example, the stop is used to support the walking path between two districts. In the second example, the stop is designed as a sight (landmark) in a shopping area. These two examples also support the integration between PT and the activities around the lines and this stimulates the using of the PT network.

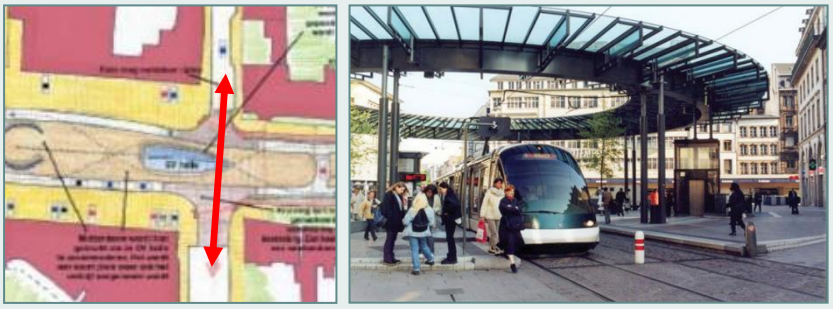


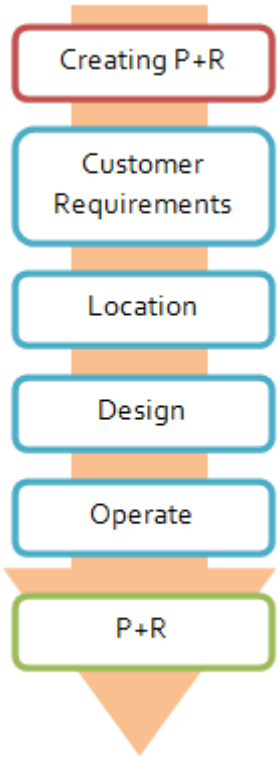
Figure 5.7 - Distances between stops + Coverage area *(CROW Kennisbank, 2014)*

5.2 P+R Facilities

Park and ride systems are a hot item in the Netherlands, many cities decides to built these transfer points where travellers can leave their car and change to the PT. It sounds simple but there are different types of P+R systems. In this paragraph the focus will be on the way of developing a P+R facility in the Netherlands and how this can be implemented in Surabaya.

5.1.1 P+R in the Netherlands

The central transport and traffic knowledge institute (CROW) has set up a plan (figure 5.8) to develop a P+R (based on experiences with P+R systems in the past). In this subparagraph, this information will be used with other literature to get a closer look into the P+R systems in the Netherlands.



Customer Requirements

The goal of a P+R system is to get people out of their cars and stimulate them to use another mode to reach their destination. To create a successful P+R system, the system has to answer the demand of the travellers. If it is not responding on this demand, it means that the P+R system will be not used and the P+R is not working.

There are three elements that are used to determine these customer requirements:

1. Type customer (customer group)
2. Type P+R system
3. Basic requirements of customers

These elements have an impact on the location and the type of PT; it has no impact on the design because the requirements to the design are the same for almost everyone.

< Figure 5.8 - Steps to create an P+R *(CROW Kennisbank, 2014)*

Type customer (customer group)

Every customer group has their own special wishes for an attractive P+R system. These wishes are different from each other because the following elements can be different:

- Type of their activity (work, school or leisure)
- Frequency of using the P+R
- Willingness to pay and to spend time
- Knowledge and experience about PT

Examples of customer groups are: commuters, business travellers, leisure travellers (visitors) & event visitors. It is important to know for which customer groups you are creating P+R facility.

In this stage, there has to be a choice for which customer group the P+R will be created.

Type P+R

P + R is often successful when there is strong bundled flows of traffic, mostly these flows are going to city centre (including CBD) where the highest economic activity is situated at one spot.

There are a couple P+R systems that exist at this moment. The systems are available on international (Schiphol Airport) to the rural small areas. To avoid useless information about P+R systems that are not interesting for Surabaya, in this report there is only a focus on two types:

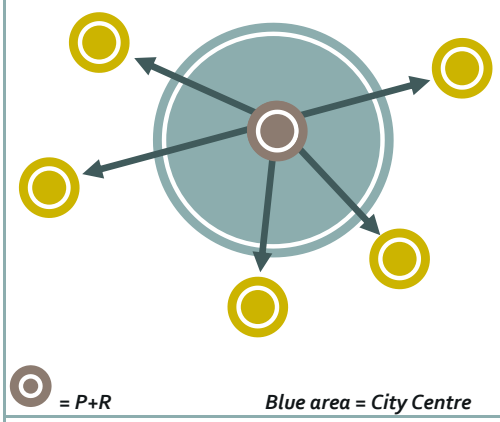
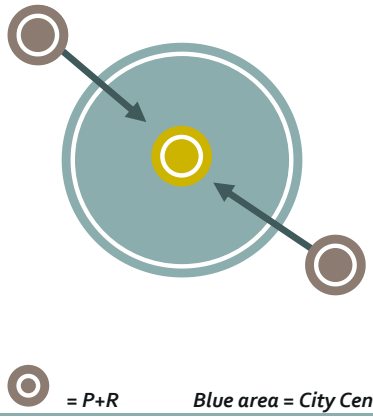
P+R types	
	
P+R at major (train) stations Central starting point	**P+R at the border of the city (centre)** Central destination point
Attractive for: • Business travellers (work related) • Commuters (to other cities or urban area)	**Attractive for:** • Commuters (to city centre/CBD) • Leisure / Visitors of the city (shopping)

Table 5.3 - Distances between stops + Coverage area *(CROW Kennisbank, 2014)*

The two types have similarities in their list of requirements but there are also differences. More about these requirements in the design phase.

Depending on the choice for the customer group, there will be choice for a P+R type. In table 5.3 there is also listed for which group the P+R type can be attractive.

Basic requirements of travellers

These are almost similar to the requirements travellers have when they choose for public transport. These requirements or elements have to be on a good level to convince these passengers to use the public transport. The basic requirement is: reliable and safe transport. Other elements that may differ for each group: speed, convenience, experience, comfort, safety (Hagen, 2013).

Location

The choice for a P+R location depends on the customer group and the type of P+R:

P+R at major (train) stations = Central starting point

For this type of P+R the choices are mostly limited. The most important stations with lot connections only apply for the choice. The central station or the biggest

intermodal stations are attractive for these P+R systems. These are often located in the busiest part of the city.

P+R at the border of the city (centre) = Central destination point
The most convenient and economic choice is choosing an existing stop or station to use for the P+R system. It prefers to have the P+R area connected to a highway or an important primary road so the traveler can reach the parking space easy and fast. This stimulates the using of the P+R.

If the main purpose from the P+R is for leisure travellers, the parking space can combined with a parking space from a working place (that works during office hours). The parking space can be used during office hours for the companies and organizations around the parking. After office hours (after 17:00) and in the weekend it can be used for travellers to the city centre. With combining these functions, the parking space will be used during the whole day which is cheaper and it improve the "social safety".

Design

The design is based on the requirements from the user. In case of the design, the requirements are almost the same for every customer group. The requirements are listed in table 5.4.

Design requirements P+R areas			
	Easy and fast entrance; no traffic congestion on the routes from/to the P+R	Social safety; atmosphere for passengers has to be good	
	Enough capacity, P+R guarantees free spaces	Clean, beautiful and maintained	
	Safe environment (prevent criminal activities)	Clear information about PT (including return journey)	
	Comfortable waiting room (waiting for PT)	Additional facilities (Kiosk, toilet)	

Table 5.4 - Design requirements P+R areas *(CROW Kennisbank, 2014)*

Operation

The operation can be organized on different ways. Especially the way how the financial system will work is important for the organization behind the P+R but also for the costumers.

The transportation can be organized specially for the P+R but it is more common to use existing PT systems to transport the passengers to their final destination. The last option is cheaper and there is no extra handling or investment needed (except for possible extension of the current PT due to higher demand that is created by the

P+R). Transportation that is exclusive for the P+R organized is of course better tuned on the P+R (system).

Besides the transportation, another choice has to been made. The choice for the ticketing system of the P+R. There are a couple of options:

1. **Parking is free & Normal PT-ticket**
   Advantage: No extra administration or additional installation is needed for the ticketing of the parking area, possibility to communicate about "free" parking
   Disadvantages: Parking space is public and can be used for other purposes (pressure on guaranty of enough space for P+R) no parking revenue for operator
2. **Parking and PT ticket combined in "Combi-ticket"**
   Advantage: Easy for customer (one ticket for both services), attractive fares for costumers, parking area only used for P+R users (closed system).
   Disadvantages: More administration (payment to transport company), special ticket machines and facilities for payment at parking area.
3. **Parking ticket (includes free transport)**
   Advantage: Easy for customer (one ticket for both services), attractive fares for costumers, parking area only used for P+R users (closed system), possibility to communicate about "free" transport
   Disadvantages: More administration (payment to transport company), special ticket machines and facilities for payment at parking area.

In figure 5.9 the costs and income options are listed in one figure. Besides the ticket revenue, there are also two other ways of getting income for the operation of the P+R.

1. **Income from Rent**
   If the parking space is large enough (above the guarantee level that there is enough space for the P+R system), the other spaces can be rent to companies and organizations. These companies can be companies that are located in the city centre but don't have enough parking space and don't have the opportunity to extend, another reason can be that the companies want to invest in their connectivity. These rental contracts can also include subscriptions for the transportation between the P+R and the location of their company.

   The places can also be rented for commercial activities like a kiosk or restaurant (this stimulates also the use of the P+R).
2. **Subsidy**
   To stimulate the using of the P+R, the fares have to be lower than normal. Otherwise, the P+R cannot compete with the parking facilities at the destination. The government wants to improve their mobility (policy) and is mostly a partner in P+R projects. They can provide subsidy to make the P+R financial stable and keep the fares down for travellers.

The government can also choose to stimulate the P+R in the starting phase and can try to decrease their subsidy when it becomes more a success (more revenues from the ticketing).

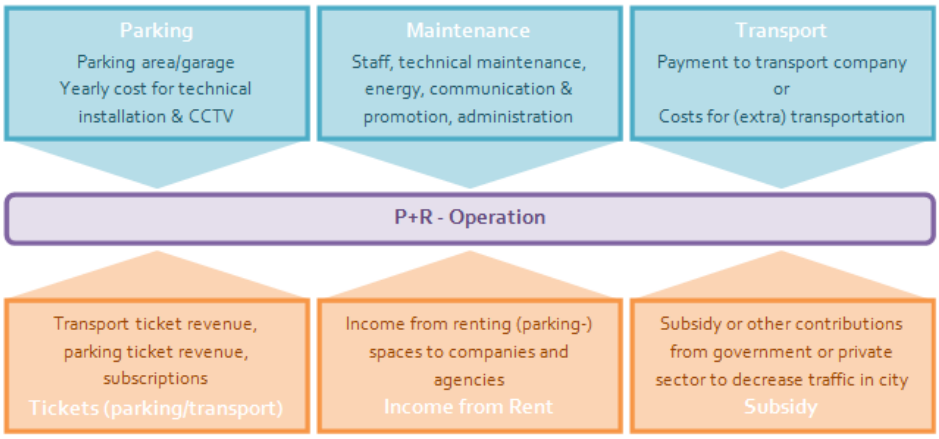


Figure 5.9 Operate a P+R area (data from *CROW Kennisbank, 2014*)

5.1.2 Compare and Contrast with Surabaya

In the current situation a P+R system does not exist. In the MRT plans there are options for adding P+R areas to the PT system. These areas are not definitely located but are globally placed on the map. These locations are including: Joyoboyo (the central intermodal station), JL. Ahmad Yani (outside the city centre, Pasar Tunjungan (downtown). The P+R locations are mostly situated in the city centre (except JL. Ahmad Yani). Further details about the P+R areas are not known at this moment (June, 2014).

5.1.3 Results

Conclusions

The way of creating in P+R in the Netherlands is created to provide failures in the planning process of creating a P+R. It is important to check the requirements that customers have before this group wants to travel with PT.

In the current plans of Surabaya, the idea of P+R systems is named but the details are not worked out to a detailed plan.

Recommendations

If the (local) government finally decides to built P+R areas in Surabaya, the government has to think about the customer group. The choice of this group in relation with the location and transportation has a major influence on the success of a P + R.

Choosing locations in the city centre will still lead to congestion and traffic jams in the city centre. The strength of the P+R will disappear if all these locations will be chosen. It would be useful to create one P+R area at the train station (Guebeng) so it can be used as P+R to other cities (with change to train) or to the city centre (with local PT).

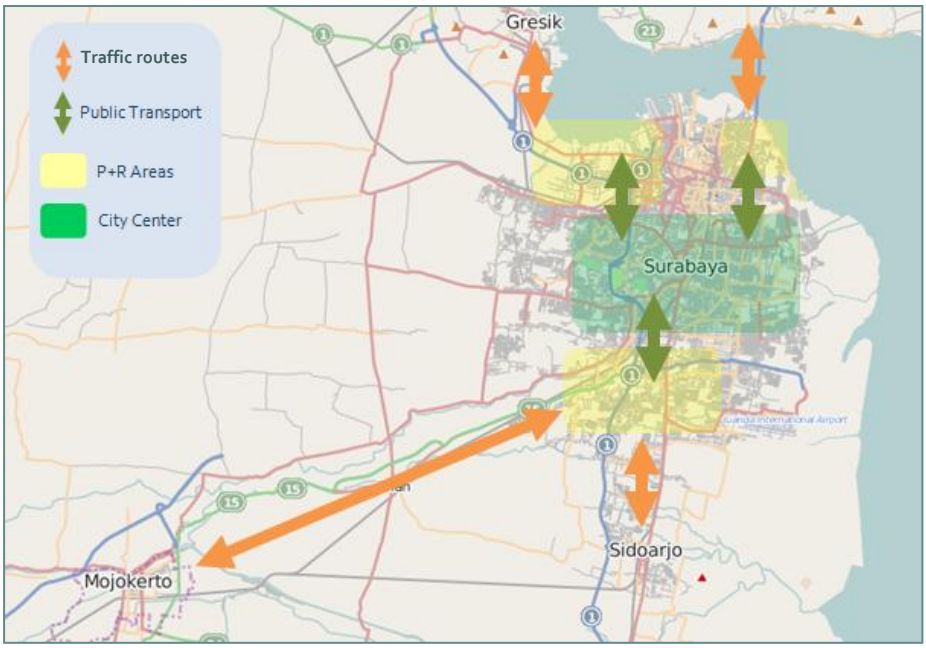


Figure 5.10 - Possible areas for P+R areas

Surabaya has a population of 3.1 million in the city, in the urban area it is around 5.1 million. Many residents from the urban area and the cities around Surabaya are daily travelling to Surabaya. Statistics claims that the city of Surabaya has 5.1 million residents in the morning rush hour due to large flows of traffic from outside the city. The trip generation shows many trips are made from outside Surabaya to the heart of the city centre (Dishub Surabaya, 2014). P+R system can be part of the solution to decrease these extreme flows to and from the city. P+R have to be located on the places where the "new" residents are entering Surabaya. Advantages of these locations:

- Collecting traffic at the borders of the city to decrease traffic in the city (centre).
- Close to highway (Jalan Tol) or primary roads
- Access to the bus network (feeder system) towards the monorail/tram is possible
- In the Southern part (from Mojokerto-Sidoarjo) possibility to create P+R around terminal Purabaya (large existing busterminal)

The choice of the ticketing system depends also on the way how the normal tickets will be explicated. The choice of the ticketing system depends also on the strategy of the government. The options are listed in paragraph 5.1.1.

Furthermore can be advised to follow the basic requirements for P+R areas from table 5.4.

6

Promotional Stage

Chapter 6

Promotional stage: Promote the PT system

Starting this stage, the PT system is already ready for business. The planning and operational tasks are completed and there is a PT system. If the system is working or finished as planned, the system can be promoted. If promotion will take place earlier, there is a risk that the system does not meet the high expectations. In this worst case it means that passengers are disappointed in the system while it just started and it is difficult to change the image of the PT system. Experiences in the Netherlands show that if projects that are not finished already were launched (with a large communication plan) are being poorly received by the people.

In this paragraph the way of promoting a PT system is magnified. The focus will be on projects around fares and tickets that are promoting the using of the PT system. The local government asked for this focus on these subjects to get a better view on implementing ticketing systems on their new PT network.

6.1 Tickets in the Netherlands

Unique for the whole world is our ticketing system for the PT network. Since 2002 the national government started with enrolling the "OV-Chipkaart" (PT-chipcard). The plastic chipcard will be the only (national) ticket for bus, tram, metro and trains. All paper tickets and the old "strippenkaart" (old paper system) will be replaced by the chipcard. The chipcard is working contactless and can include credit or a product (subscription, day pass etc.). The OV-Chipkaart (starting from here: OVC) is since 2011 on every PT mode accepted and implemented.

OVC: Two main types

Basically, there are two types of chipcards available. One is personal and will include the passenger's name and picture, so it can be used for subscriptions and age-discount (≤ 11 years ≥ 65 years). The other card is anonymous and can only used while travelling on credit ("reizen op saldo") without subscription or discount options. The last card is also convenient for tourists who will be temporarily in the Netherlands.

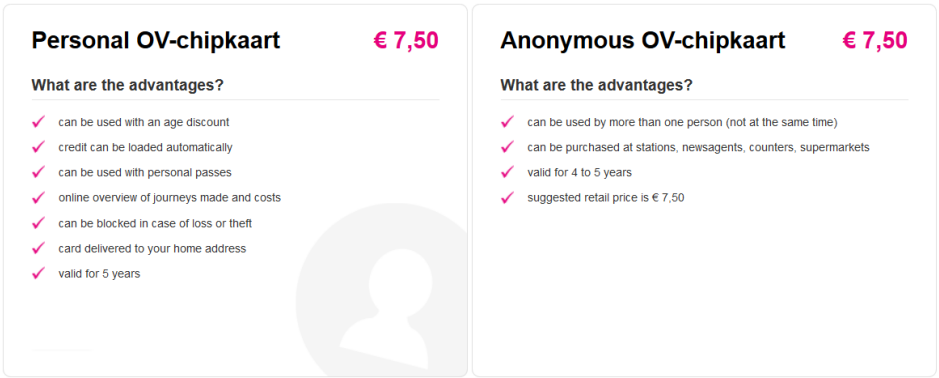


Figure 6.1 - Information about two major OV-Chipkaart types *(OV-Chipkaart.nl, 2014)*

As earlier noticed, the personal chipcard can include a subscription. Subscriptions are handful for commuters, scholar kids or other frequent travellers. In the Netherlands there are a lot of subscriptions for PT systems, starting with national subscriptions which give passengers discount on the whole network until local subscriptions which give you unlimited access to the local bus. In appendix IV, there is a list with possible subscriptions. The off-peak hours and weekend subscription stimulates the using of the PT in quiet periods (outside rush hours).

Both passes are suitable for travelling on credit. This system works like a prepaid card. The passenger load credit on his card and can travel until the credit is empty.

A useful addition to frequent travellers is that if they travel with a personal chipcard, they can apply for "automatic reload". In this case, the system will take credit from their bank balance if the credit is almost empty. So the passenger has always enough credit on his chipcard.

OVC: Using the card

The using of the card is easy, the passenger hold his card against the card reader or on a gate. The system checks if there is a valid product (subscription) or sufficient credit and gives a green signal. The passenger checked into the system. After he complete his journey with this PT mode, he checks out of the system by making the same handling like at the check-in.

If the passenger makes a transfer to another mode of transport, the passenger needs to check out and then check in again on the next mode of transport.

If the passengers are not travelling with a product, the travel pay a basic + kilometre fare for their journey. The basic fare is a flat fare for every way of transport (0,86 eurocent, in 2014). The kilometre fare is different in every city and mode (around 0,10-0,35 eurocent per kilometre). A total journey from 20 kilometres with the bus in region X will cost (20*0,10) + 0,86 = € 2,86. If the passenger is continuing travelling with another mode within 35 minutes, the basic fare will not be charged again. For a complete example of this situation, see figure 6.1.

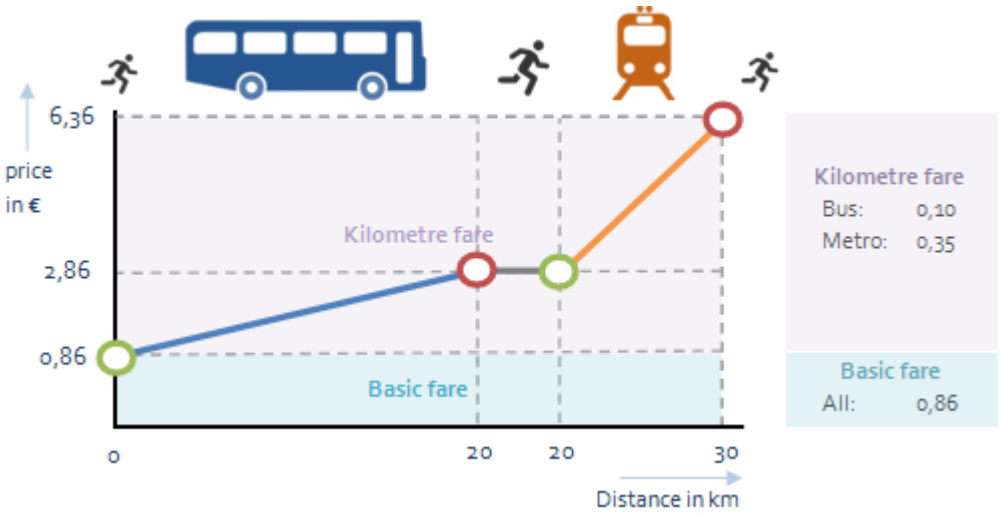


Figure 6.1 - Fare system OV-Chipkaart (with two modals)
(source fares: OV-Chipkaart.nl / 9292OV)

To charge the right fare for a journey, the passenger pays a deposit when they are checking into a mode. This deposit is needed to force the passenger to check out; otherwise the right fare cannot be calculated. This situation is explained in figure 6.2 (with the bus journey from figure 6.1).

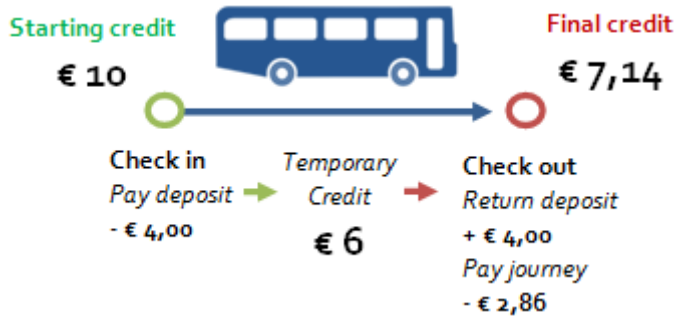


Figure 6.2 - Deposit / Credit system OV-Chipkaart
(source fares: OV-Chipkaart.nl)

If the passenger forgets to check out, he loses his deposit. He can apply for a refund at the transport company by giving the right journey details.

In cases where passengers having a valid product (subscription) for their journey, the system will allow to check in and check out with the message that the passenger travelling for "free" on their travel product.

Because everyone is checking in and out into the system, the organization and operators behind the OVC can see all transactions. The trips made by travellers can be analysed for an efficient logistic planning. The data is anonymous and the operators cannot see which travel pattern belongs to which traveller. The traveller can see their own data on the website OV-Chipkaart.nl (see appendix V)

OVC: Technical instruments and organization

The OVC started in 2001 when the major transport companies have went into a joint venture to develop the OVC. This joint venture (Trans Link Systems: TLS) is responsible for producing the cards (anonymous and personal) and for the back office. The back office is the system where all check-ins and check-outs are handled. The technical instruments to provide chipcards like the ticket vending machines and the card readers are not supplied by TLS. This responsibility is for the transport companies self. The machines and card readers require having a connection with the TLS network. In figure 6.3 there are examples of these card readers and gates.

Figure 6.3 - Card readers (at train station + in the bus) & Gates with readers (at stations)
(flickrhivemin, wikipedia, 2012-2013)

Passengers can load their cards with credit at special machines or the loket of the transport companies. The vending machines are placed in (mini-)supermarkets, tobacconists, post offices, libraries and of course at the stations.

Besides buying credit, at these machines passengers can pick up their (online) orders. Travellers can buy credit or products (subscriptions) online for their chipcard and pick these up at these machines.

Examples of these machines are in appendix VI.

OVC: Dispensable cards

There are also dispensable chipcards for people who are not frequent travellers in the PT system of the Netherlands or tourists. These dispensable cards including a travel product (like day pass or single journey) which will be activated when the passenger is checking in.

In Amsterdam, the transport company selling 1, 2, 3, 4, 5, 6, 7-day(s) dispensable cards for tourists or people without an OVC. These cards are made of cardboard/paper and can be disposed after the cards expire. These cards are also including a chip and works at the same way as the plastic personal or anonymous cards.

OVC: More than travelling only...

The PT operators are trying to convince the travellers to use the OVC. The ultimate goal is to integrate the OVC with other functions than travelling only. In several stations, the OVC has been tested as a payment card for the station stores. At this moment (June, 2014) there are some problems with the official regulation in the Netherlands because the OVC is not an official bank card, so it is not allowed to use the card as payment card (Willems, 2011).

Besides paying at the stations stores, the card can also be used to rent a bike, a car or pay the parking ticket at the station. These advantages will increase the attractiveness of the OVC (and the PT).

Figure 6.4 - Pay terminal (reader) at store in station Amersfoort *(Wikipedia, 2012)*

In the future, the OVC can also be integrated with other (bank) cards. So, the traveller only has one card for everything. Mobile phones are going to be important too while the new phones include the NFC-technology which can be used for contactless payments (similar to the OVC).

The backside of the card can also be designed by the PT operator or a company that wants to promote his name or products. At this moment, there are only cards that are printed with the design of the PT operators or with the general lay-out.

6.2 Compare and Contrast with Surabaya

At this moment, it is not clear what kind of ticketing system will be used in Surabaya. The current research concludes only the willingness to pay (including possible fares) for the bus (trunk and feeder). The estimated price for the monorail and tram will be between 8.000 - 10.000 rupiah/IDR (Dishub Surabaya, 2014). These fares are flat-fares and are not based on the travel distance of the journey.

In the current PT (Angkot) system, there are no tickets but only flat fares for a range of kilometres. The ultimate decision will made by the driver, when the passenger pays the price, the passenger doesn't receive a ticket.

At this moment, the using of the current PT (Angkot) is not being promoted. In the upcoming PT network, the local government wants to improve this.

In the bank world, there is a new trend in Indonesia to attract people to their "card" (and company). The using of bank/credit cards is getting extremely popular (Bellman, 2013) this moment; one of reason is that many banks giving special discount in restaurants, stores or other places to attract more customers (Living in Indonesia: Banking, 2014). In this case, the bank card is more than a payment card but it also a card that give you access to discount.

6.3 Results

Conclusions

The OV-Chipkaart (OVC) is an easy ticketing system that gives a lot of advantages to the customer and the operator/government. The implementation of the OVC took a long time in the Netherlands because it has to be based on the existing fare system. Surabaya doesn't have to think about the change from the existing fare system to a new system because the complete PT system will change.

The technique of the OVC is already available; the administration behind the OVC is in the Netherland under control from one organization (TLS).

Using the OVC for more than travelling will stimulate the using of the card. Giving discounts or special promotions in stores and restaurants can be attractive to take an OVC.

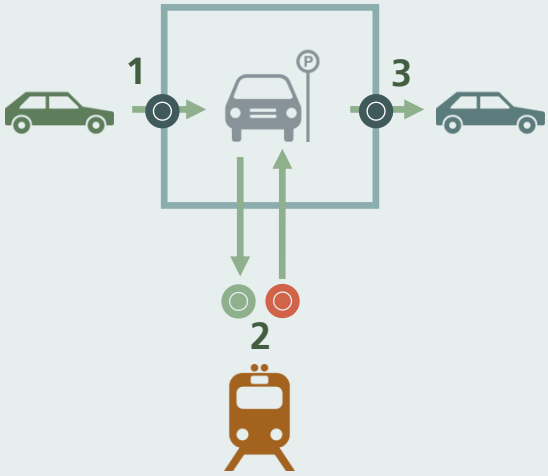
Recommendations

To stimulate the using of the OVC, the card has to be more than a travel card. This is important for Surabaya because the population has no experience with the PT. To involve discounts on other (existing) stores and restaurants, people try to buy the card and try the PT system.

If a system like the OVC will be implemented, the choice for no check-out can be made. This caused by the flat-fare system that will be introduced. This is making the system easier and cheaper in maintenance (fewer devices are needed because check-out handling is not needed).

To improve the connection between the modes of transport, the system can provide discount when a passenger is changing to another vehicle. For example, a traveller that travels with the tram and change to a bus gets a discount of X% on his second journey because he already paid the full price on the first journey with the tram. With this combination of fares, it becomes more attractive to use the PT system from door-to-door.

The P+R systems (chapter 5.2) can be combined with the implementation of a chipcard. The traveller can pay for their parking fare with the chipcard so it is easier to use the P+R (figure 6.5). It stimulates the using of the P+R (and indirect the using of the PT network). This combination can also be made with bicycle storages, in the Utrecht (Netherlands), the train company just opened a secured bicycle storage that can be used with the OVC only.



1. At the parking gate; use the OVC to enter the Parking

2. Check in and out with your OVC to travel with the train/metro or bus

3. While leaving the parking; use the OVC* to leave the parking (system will check if the OVC is really been used for travelling with public transport, if not; the parking fare will be higher).

Figure 6.5 - Example of P+R system that is combined with OVC
**In the Netherlands the P+R system (with Q-park) is working this way but while leaving the parking, the traveller (still) needs to pay with a bank card because the National Bank didn't gave permission yet for using the OVC as a official payment card (Willems, 2011).*

7

Conclusions & Recommendations

CHAPTER 7
CONCLUSIONS & RECOMMENDATIONS

In this chapter the conclusions and recommendations from the research will be summarized and the final conclusions have been made. The conclusions and recommendations in this chapter are the **most important ones**, a more detailed view on each subject can be found at the end of **every paragraph in this research**.

7.1 CONCLUSIONS

The implementation of a new public transport system in Surabaya will be one of the most challenging operations within the transportation system of Surabaya because:

- Movement from barely any PT (except the current Angkot) to a new PT system with two major lines (tram + monorail) in combination with a complete bus network.
- The current Angkot system with ± 4500-5000 angkots will stop, the current drivers will be replaced to the new bus network.
- Introducing an inexperienced mode of PT in Indonesia: Monorail. The tram has a history in Surabaya (while the Dutch people built this line in the past).
- In the current culture there is no PT system available, it is not easy to change the (travel) patterns to use and operating the new system.

The following stages are shortly highlighted in the research and the major conclusions are:

Basic stages

- If the situation of Surabaya is compared to the situation in the Netherlands, there are some differences in the way how the government works to a solution.

Policy Stage

- The major different with the Netherlands is that the policy stage does not exist in Surabaya. The integration between spatial development (city planning) and mobility does not exist in Surabaya; this is causing pressure on the traffic network on different spots.

The chosen elements from the research, operational and promotional stage are here listed, the choice for these specific elements is explained in chapter 1 (Introduction):

Choosing the Type/Mode (PT)

- The decision to decide for the monorail is based on political preference instead of a decision that is based on research in the different ways of transport. This does not mean that the monorail is technically impossible, but the investment and operational costs are extremely expensive in contrast to other PT modes.

Network

- The tram and monorail are more based on the connecting network idea and the busses (Trunk and Feeder) are more based on an open network.
- The plan is to create an integrated network with tram/monorail and bus. Actually, the major stations are the only stations that are working with the intermodal system.

Stops

- The most important conclusion is that the stop has to be integrated with the environment.
- After the deciding the exactly location (and the interaction with the environment), the Netherlands checks which basic facilities the stop need to operate well.
- Travel information is one of these essential elements that are needed on a stop.

Park and Ride

- The way of creating in P+R in the Netherlands is created to provide failures in the planning process of creating a P+R.
- It is important to check the requirements that customers have before this group wants to travel with PT.
- The P+R plan is focused on the busiest stations in the city centre in Surabaya.

Promote (with ticketing)

- There is not much clear about the ticketing system at this moment, only the willingness to pay is clear, so in this stage there is no conclusion about integration.
- The OV-Chipkaart (OVC) is an easy ticketing system that gives a lot of advantages to the customer and the operator/government.
- Using the OVC for more than travelling will stimulate the using of the card. Giving discounts or special promotions in stores and restaurants can be attractive to take an OVC.

7.2 Recommendations

Based on the conclusions from 7.1 there are made a list of recommendations for the implementation of the new PT system in Surabaya:

Choosing the Type/Mode (PT)

- Reconsider the decision of the realization of the monorail; there are other options for the west-east corridor that are available. Even if the investment stage is arranged and completed, the operational part will be challenging due to high costs and complexity of the system.
- Consider about a combination of materiel for the east-west corridor and the north-south corridor. A combination lead to less investment and operational costs but lead also to a better product (for example: concentrated knowledge for maintenance, flexibility and sharing materiel)

Network

- Focus on an integrated network that increases the coverage area of the major PT lines. Connecting the bus network on more stations to the tram/monorail will lead to a larger coverage area of the two major PT lines.
- Spatial planning (City planning) and Mobility have to work together so that future expansions or creations like malls and other functions will directly be connected to the PT network. TOD can support in this process.

Stops

- There has to be interaction between the stops and the environment. The stops can be integrated in buildings or the walking routes have to be clear.
- The location of the stops is important and can be chosen by using the node-/place- model to pick the balanced location for a successful stop.
- While using this model, it is also recommended to give different facilities to every stop because every stop is not the same.

Park and Ride

- Choose more locations outside the city centre, focus more on the commuter groups that are (daily) travelling from the cities and villages around Surabaya (± 2 million residents living outside the city).

Promote (with ticketing):

- Using an electronic way of ticketing can promote the using of the PT network. Working together with stores, restaurants and other facilities to make the card more attractive with providing discounts or other privileges.
- In the future, the using of mobile phones with a NFC chip can be used for travelling on the PT system.

Finally, the implementation of the PT plans for the future will have a big impact on the people that are using but also facilitate the system; it is recommended to keep in mind that the new system will have a big impact on the daily lives of people. Information, communication and education can support people to change their daily pattern/behavior. This is really important for the drivers that will be transferred from the Angkot to the new bus system.

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Figure 1.2 - Different ways of transport in Indonesia. *Informal Public Transportation networks in three Indonesian Cities.* Cities Development Intiative for Asia, Surabaya.

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Figure 4.2 - PT Network Breda. *Lijnnetwerkkaart Breda (Noord-Brabant).* Veolia-Transport, Breda.

Figure 4.5/4.6 - Corridor and Feedering analysis. *Corridor and Feedering analysis.* World Bank , Surabaya.

Figure 5.4/5.5 - Real time information GVB. *Real time information GVB.* GVB, Amsterdam.

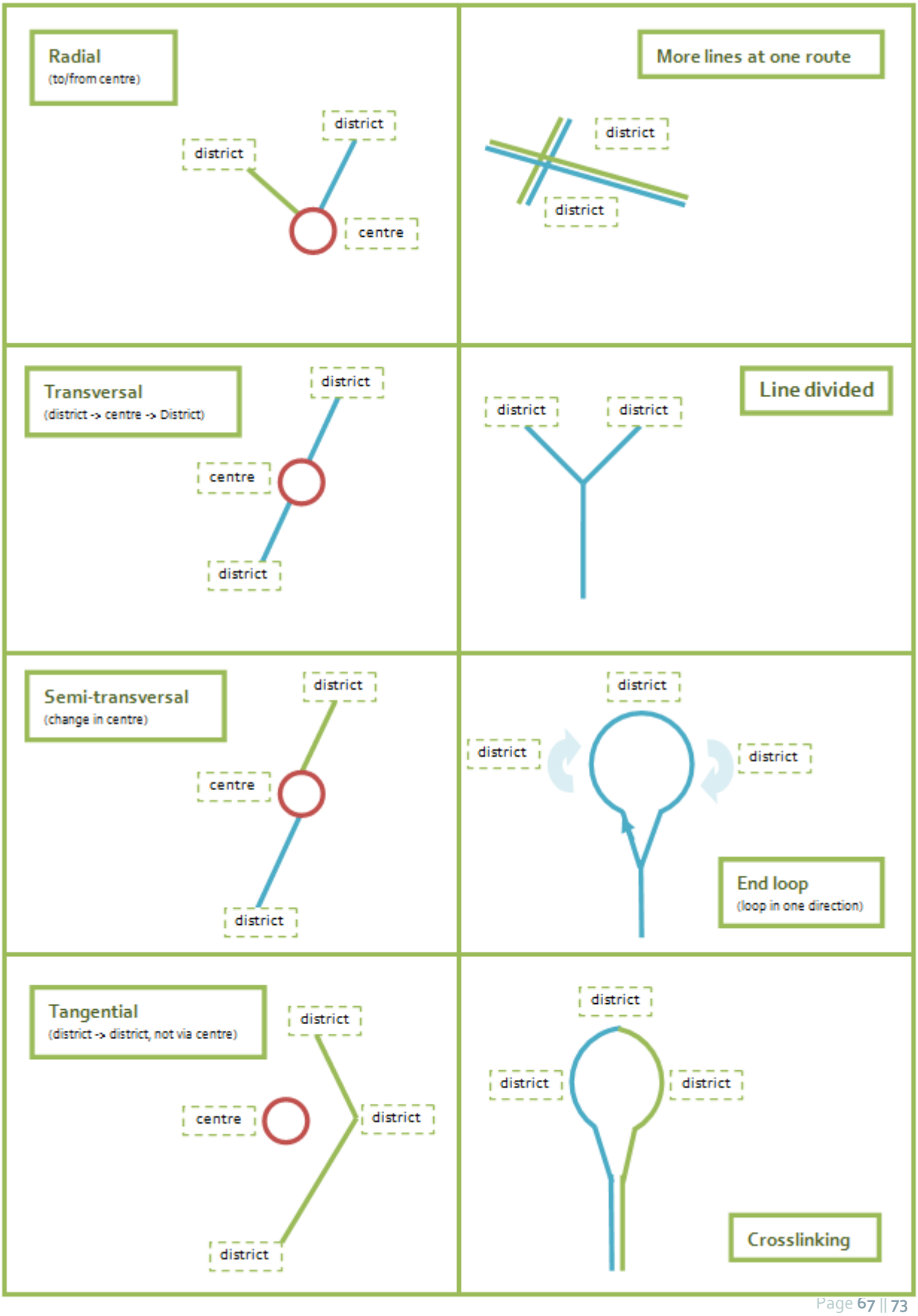
Figure 5.7 - Halte in city center (integrated). *Integrated tram/bus stop in city center.* CROW Kennisbank.

Figure 6.3/6.4 - OV-Chipkaart machines. *OV-Chipkaart.* Wikipedia.

APPENDIX I

10 TYPES OF PT LINES (PARAGRAPH 4.2.1)

Source data: (Proper, Netwerken OV (Cursus PV-lj2), 2013)



APPENDIX II

EXAMPLES NODE-/PLACE-MODEL (PARAGRAPH 5.1.1)

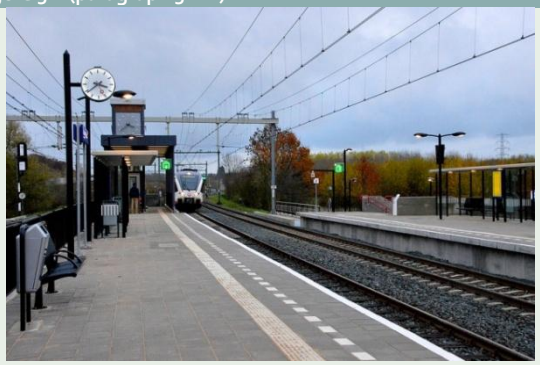
The numbers are placed in the model of figure 5.2 (paragraph 5.1.1)

1) Heerlenseweg, Landgraaf

Low urban level

This is an example of a simple bus stop in a residential area.

Around the stops are no activities, the only function of this stop is to connect the residents with the PT network.



2) P+R Maastricht Noord

Low urban level

Park and Ride station with parking facilities to transfer passengers from the car to the train and shuttle bus v.v.

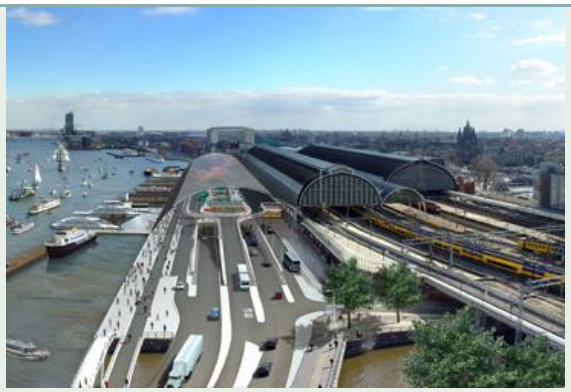
No activities in the surrounding area.
(more about P+R systems in paragraph 5.2)

3) Amsterdam Bijlmer ArenA

Urban centre

Example of a TOD. Activities like football stadium, music dome and shopping mall are situated around the station/stop.

There are lot of changing possibilities between metro, bus and train.



4) Amsterdam Centraal

High urban level

Central station of Amsterdam which is located in the centre of Amsterdam (with a lot of activities on an around the station). High pressure on free space in this area.

Changing possibilities between train, metro, trams, bus, ferry.

5) Bus stop NHTV University, Breda

Urban centre

University at a single bus line with no changing possibilities between lines.

This stop has only the function to connect the activity (education) with the PT network.

APPENDIX III

DESIGN STOPS (PARAGRAPH 5.1.2)

Source data: CROW Kennisbank, 2014

DESIGN BUS-TRAM STOPS

		Low Urban Level	Urban Centre	High Urban Level
Platform	Platform	N	N	N
	Accessibility to platform	N	N	N
	Markings	N	N	N
Facilities	Stop bord/pole	N	N	N
	Railing (fence)	S	S	S
	Lighting	N	N	N
	Bin (container)	N	N	N
	Abri	D	N	N
	Seating element	D	D	D
	Emergency button	D	D	D
	Bike storage	S	S	D
	Advertising display	S	S	S
	Toilet	U	U	S
	Vending machine	U	U	S
	Kiosk (newspapers)	U	U	S
	Information	N	N	N
Travel information	Static travel information	N	N	N
	Information about environment	N	N	N
	Clock	S	D	N
	Real-time travel information	S	D	N
	Information for disabled travellers	N	N	N

Symbols

N = Necessary

S = Depends on the local situation

D = Desirable

U = Unnecessary

Source data: CROW Kennisbank, 2014

Low Urban Level	Urban Centre
	

High Urban Level

Source data: CROW Kennisbank, 2014

APPENDIX IV

SUBSCRIPTIONS (PARAGRAPH 6.1)

Name subscription	Description
Off-Peak hours pass	Valid on the complete network Valid in the off-peak hours (9:00-16:00 + 18:30-02:00/04:00)
Weekend pass	Valid on the complete network Valid in the weekend (Friday after 18:30 + Saturday, Sunday)
Zone pass	Valid in one zone (area) of the network Mostly valid every day
City pass	Valid in the city area (not the urban area)
Regional pass (urban area)	Valid in the urban area (for example Surabaya + Sidoarjo)
Discount pass	Provides discount on the whole network against paying a monthly/yearly fare
Kids pass (≤ 11 yr)	Valid for kids on the complete network (≤ 11 years)
Scholar pass (≤ 17 yr)	Valid for scholar kids on the complete network (≤ 17 years)
Student pass (≥ 18 yr)	Valid for students on the complete network (≥ 18 years)
Train pass + PT supplement	A train subscription including a supplement that is valid on the PT network

These passes are examples based on real passes from NS (National Rail), GVB (PT Amsterdam) and National PT-authority.

APPENDIX V

OV-CHIPKAART TRAVELDATA (PARAGRAPH 6.1)

Date	Check-in	Departure	Check-out	Destination	Amount	Transaction	Class	Product	Comments
21-03-2014		Busstation stoparea	18:13	Maastrichterlaan/Kerk	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
21-03-2014		Breda	17:53	Heerlen	0,00	Trip	2	Studenten weekabonnement Vrij Reizen	
21-03-2014		Breda, Centrum	15:50	Centraal Station	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
21-03-2014		Breda, Tuinzigtlaan	14:49	Breda, Centrum	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
21-03-2014		Breda, Vlaszak	13:46	Breda, Tuinzigtlaan	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
21-03-2014		Centraal Station	10:45	Claudius Prinsenlaan	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
21-03-2014		Heerlen	10:37	Breda	0,00	Trip	2	Studenten weekabonnement Vrij Reizen	
21-03-2014		Station Landgraaf	08:43	Station Heerlen	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
19-03-2014		Busstation stoparea	23:39	Maastrichterlaan/Kerk	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
19-03-2014		Tilburg	23:16	Heerlen	0,00	Trip	2	Studenten weekabonnement Vrij Reizen	
19-03-2014		Claudius Prinsenlaan	17:49	Mathildastraat	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
19-03-2014		Centraal Station	11:27	Claudius Prinsenlaan	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
19-03-2014		Heerlen	11:16	Breda	0,00	Trip	2	Studenten weekabonnement Vrij Reizen	
19-03-2014		MaastrichterIn	09:08	Busstation stoparea	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
17-03-2014		Busstation stoparea	16:44	MaastrichterIn	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
17-03-2014		Stadsschouwburg	16:05	Schaesbergerweg	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
17-03-2014		Breda	15:42	Heerlen	0,00	Trip	2	Studenten weekabonnement Vrij Reizen	
17-03-2014		Breda, Vlaszak	13:42	Centraal Station	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
17-03-2014		Centraal Station	09:45	Breda, Vlaszak	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
17-03-2014		Station Landgraaf	07:43	Station Heerlen	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
12-03-2014		Busstation stoparea	19:10	Maastrichterlaan/Kerk	0,00	Trip	2	Studenten Weekabon Vrij Reizen	
12-03-2014		Breda	18:54	Heerlen	0,00	Trip	2	Studenten weekabonnement Vrij Reizen	
12-03-2014		Claudius Prinsenlaan	16:45	Centraal Station	0,00	Trip	2	Studenten Weekabon Vrij Reizen	

Appendix V - Example list of travel data of personal chipcard (OV-Chipkaart.nl)
This information is also visible for the transport companies but the companies are not able to see the matching name + personal information.

APPENDIX VI

OV CHIPKAART: VENDING MACHINES (PARAGRAPH 6.1)

Vending machine in stores

Vending machines at stations / terminals