

Written Exam Public Transport

TENTAMEN
BANK

Written Exam	Public Transport (2012-195421200-1A)
Teacher	van Berkum
Course code	195421200
Date and time	8-11-2011, 8:45-12:15
Location	OH112
Remarks	Closed book, calculator allowed, English dictionary allowed Formulas and tables are, when necessary, part of the question.

Table of contents: Questions and points per question

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Calculation of the marks:

- The maximum number of points of this written exam, P_{max} , is 80
- The maximum number of points of the essay Noordtunnel, N_{max} , is 20 points
- The marks for the written exam, C , is calculated by the sum of points, $P + N$, times ten divided by the maximum number of points:

$$C = 10 \cdot \frac{P + N}{P_{max} + N_{max}}$$

- Available time is 210 minutes

Question 1 (15 points) – Crossing borders with line 99

Line 99 (Uden-Nijmegen) is a regional bus line with 1400 passengers on a regular working day. Most passengers are commuters and scholars who live in Uden and have their destination in Nijmegen. The province of Noord Brabant and the Stadsregio Arnhem-Nijmegen are both responsible for line 99. The border between the concessions is in Grave. From way back this line is exploited by two bus companies. Nowadays by Arriva (concession Noord-Brabant) and Novio (concession Stadsregio). The trips are alternately driven by the two bus companies. The number of timetable hours and the revenues are equally divided.

With the recent introduction of the OV-chipcard it became evident that there was a problem due to the different passenger tariffs and bus company specific OV-chipcards. Passengers with regional Brabant bus passes are not (always) accepted by the OV-chipcard equipment from Novio. And vice versa: passenger with regional Stadsregio passes are not (always) accepted by the OV-chipcard equipment from Arriva. This seems to be a very complex technical problem, which apparently cannot be solved easily by the bus companies. This leads to a lot of complaints by passengers and bus drivers. This raises a more fundamental issue whether it is wise to run one bus line by two companies under the responsibility of two PT-authorities.

Describe five possible solutions to solve this problem. Give insight in the advantages and disadvantages from the perspective of the passenger, the bus companies and the PT authorities. You are also asked to present your best solution to the (political) representative of Noord Brabant (based on arguments).



Figure 1 Uden - Nijmegen

Question 2 (10 Points) – The Swedish model

Beneath you will find a schematic picture of contract models and roles in PT (from the Swedish government). The Swedish government aims for deregulation according to the new Transport Act (2012). One of the new opportunities is to allow PT-companies to exploit new non-subsidized bus connections.

Describe - for the Dutch situation - how the introduction of deregulation will work out for two kind of passengers: the ones who are living in rural areas and the ones who are living in the center of a big city. Describe at least three sorts of effects.

Contract models and roles

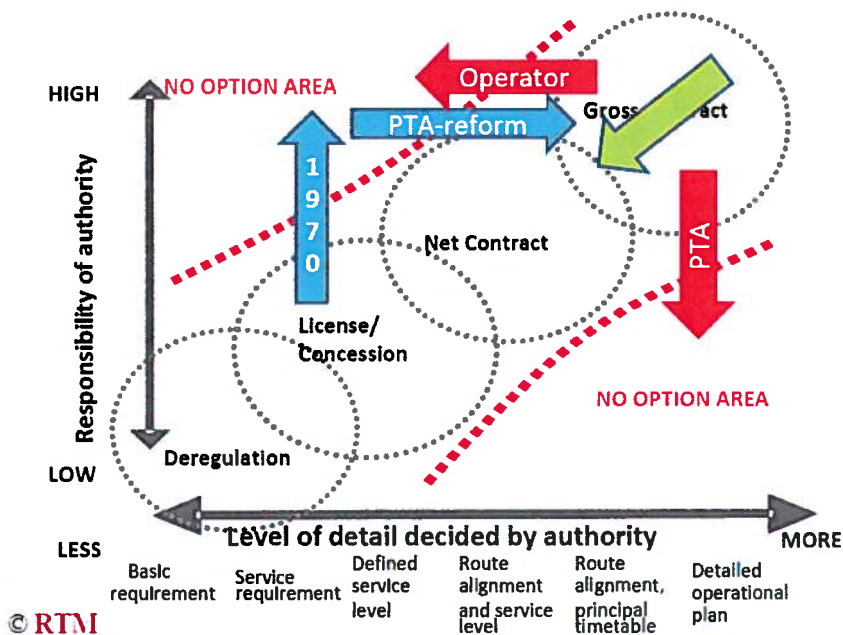


Figure 2 Contract models and roles

Question 3 (10 Points) – Marketing

Describe/draw the 'customer value equation' and the 'customer needs pyramid' and point out two main differences between the two concepts.

Explain the NPS (Net Promotor Score) and describe where this tool belongs in the 'customer needs pyramid'.

Question 4 (20 Points) – Business case Drienerlo - University

For many years the municipality of Enschede has pleaded for intercity trains (two times per hour) to stop at Drienerlo Station. Finally NS has decided to give in, mainly because the development of the innovative 'kennispark' with about 10.000 new jobs in 2025, is speeding up. In the current situation 1500 passengers make use of the station (in and out of the train). About 15% use the bus to travel further to their destination.



Figure 3 Station Drienerlo 2013



Figure 4 Bus lines near Drienerlo Station

The University of Twente, Enschede and 'Regio Twente' are considering a highly innovative PT-system between station Drienerlo, Kennispark and the University. One of the arguments for this innovative system is to make the area more distinctive from other regions in the country. One could think of PRT-systems, monorail systems or others. The University of Twente, Enschede and 'Regio Twente' believe it will attract more passengers than a conventional PT-system.

You – as an external advisor – are asked to make a first business case for two scenario's:

- A highly innovative PT-system
- An upgrading of the current bus system

For this task you have to take the necessary steps in building the exploitation (including concept timetables and vehicle circulations, excluding the planning of bus drivers). Provide a rough (calculated) estimation for the cost cover for those two scenario's.

You are also:

- asked to give insight in the effects compared to the current bus system.
- supposed to make some expert judgments for the missing data
- invited to make some, out-of-the-box, suggestions which will strengthen the business case

The provided data:

- | | |
|---|--------------------|
| • Estimated infrastructural investments innovative system | 12 million per km |
| • Estimated infrastructural investments bus system | 1 million in total |
| • Price per service hour innovative system | 180 euro |
| • Price per service hour bus system: | 110 euro |
| • Revenues for both systems per pass.km: | 0,15 euro |
| • Current bus travel time Drienerlo – University (Langekampweg) | 12 minutes |

The infrastructural investments for both systems will not have to be 'paid back' by the passenger revenues.

Question 5 (10 points) – Lines and networks

1. What line types can be observed in the following figure (for the lines with numbers 1, 4, 5 and 11)? Mention one main property of each type. (6 points)



2. Suppose a transit system contains only two types of transit lines: one with short headways and one with long headways. What is important for a traveler in the four possible transfer possibilities between these line types (short-short, short-long, long-short, long-long)? (4 points)

Question 6 (15 points) – Public transport assignment

Consider the following PT network, consisting of 1 origin, 1 destination, 2 access links, 1 egress link, 3 nodes / stops (A, B and C), 2 transit links and 2 transit lines (I and II). Transit line I calls at stop A, B and C and has frequency (F) 4 per hour. Transit line II only calls at stop B and C and has frequency 8 per hour.

The travel times T of (access, egress and transit) links are given in the network (in minutes). Assume the dwell time (for line I) at stop B to be equal to 0. Both stops A and B are within the search radius from the origin. Assume that transferring from transit line I to transit line II at stop B involves such a high transfer penalty, that it is not a choice option for the traveler.

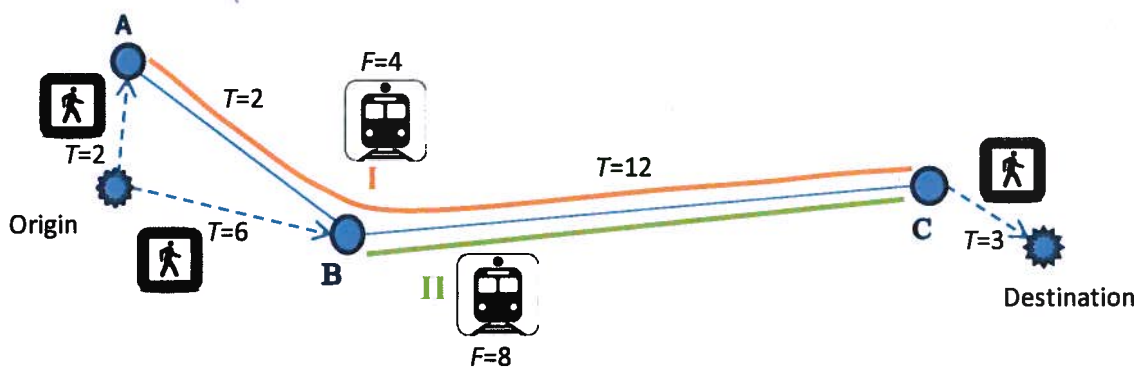


Figure 5 The PT network

This transit network results in 3 routes being used by the travelers (when a different line is used this is considered as a separate route). Calculate the fractions for the use of those routes for this OD pair. For that, take the following into account:

- Calculate the generalized costs in time units (minutes), assuming that waiting time has a 50% higher weight than in-vehicle travel time (factor 1.5) and that access / egress travel time has a 20% higher weight than in vehicle time (factor 1.2). Other cost components (like distance or fare) are not considered in this question.
- Calculate the waiting time at stops by assuming that passengers arrive completely random at the stop and that the transit services run completely reliable with equal headways.
- Use the choice models within the Zenith algorithm: the formulas are given below. The stop choice parameter (θ) is 0.2 and the access service choice parameter (λ) is 0.1.

All formulas necessary for this question you will find on the next page.

Formula for stop choice:

$$P_s = \frac{e^{-\theta C_s}}{\sum_{x \in S} e^{-\theta C_x}}$$

Where:

P_s : fraction for stop s

C_s : generalized costs when using stop s

S : set of candidate stops at the origin

θ : stop choice parameter

Formula for service choice (= line choice):

$$P_l = \frac{F_l e^{-\lambda C_l}}{\sum_{x \in T} F_x e^{-\lambda C_x}}$$

Where:

P_l : fraction for line l

F_l : frequency of line l

C_l : generalized costs when using line l

T : set of candidate lines at the stop

λ : service choice parameter

