Effects of different planning strategies in local public transport.

Sjöstrand, Helena

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LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

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Helena Sjöstrand
MSc, PhD-student
Traffic Planning
Department of Technology and society
Lund University
SE-221 00 Lund, Sweden
Tel.: +46-46-2229125, Fax.: +46-46-123272
E-mail: Helena.Sjostrand@TFT.LTH.SE

1 Introduction

Public transport route networks should be planned to best meet the passengers' needs. Passengers constitute a heterogeneous group, in which some people primarily want short walking distances, while others prefer frequent buses, etc. However, all passenger preferences cannot be fulfilled because the traffic planners work with budget constraints. The desired goal often is to maximise total travel utility experienced by the passengers under the given cost constraints. The present route networks consequently fit some passengers better than others. More knowledge about passenger preferences, and how they relate to generalised times in networks, enables more cost efficient planning of bus routes and the possibility to prioritise specific groups of passengers.

Previous studies have shown how value of travel time and value of other travel quality elements, such as waiting time, transfers and bus stop comfort, vary among segments of passengers (e.g. Widlert (1989), Blomquist and Jansson (1994), Algers *et al.* (1995), Gunn *et al.* (1998), Wardman (1998 a and b)) and Kjörstad and Renolen (1996)). The results have mostly been used in assessments based on cost benefit analyses.

Yet other authors have focused on describing assignment models (e.g. Nielsen (2000) and Chien *et al.* (2000)). Assignment models for car traffic have been used to estimate street flow and are traditionally based on travel times only. To assign passengers to different competing public transport routes, however, knowledge about how different attributes are combined into generalised cost has proven to be essential (Jansson and Ridderstolpe, 1992).

Others, as Lundberg (1977), have investigated how different kinds of bus routes (radial, tangential, ring routes) work in different kinds of cities. Reneland and Hagson (1994) discuss the treatment of public transportation issues in urban land use planning, in terms of central bus routes, direct bus routes and location of new dwelling areas in a way so that they can be served by prolonging of an existing bus route, etc. Probably, and if so unfortunately, much work contributing in this area remains unpublished because it is being made at local authorities or private consultants.

Olsson *et al.* (2001) have used information about assessments of comfort attributes in an existing forecasting model. They showed that demand for public transport is significantly affected by the standard of both subways, buses, stations and bus stops as well as by congestion on vehicles. But, otherwise literature is not as developed when it comes to combining the above mentioned specialities, to use the knowledge about preference differences to support planning of route networks.

The aim of this study is to use results from stated preference studies as input data in an assignment model (VIPS). Three kinds of analysis will be done:

a) compare the generalised times for different traveller groups between two route networks with different planning strategies: a trunk route network and a traditional radial network.
b) compare the generalised times for using public transport for two different types of trips: On one hand trips for which public transport is actually being used, and on the other hand trips (OD-relations) that are now being made by car. The latter are interesting because trips made by car can be seen as being a potential market for public transport.
c) compare the generalised times for passengers from different traveller groups (work commuters, students, elderly, leisure traveller) in the same route network.

2 On different planning strategies

The local public transport network in a city consists of a number of routes. The routes can mainly be divided into radial routes (between outlying areas and the town centre) and tangential (from one outlying area to another without passing the town centre). In a differentiated network, the routes have different tasks, which might require special policies when planning the route, special bus stops or vehicles. The primary benefit of having different types of routes is that different routes can meet different passengers' demands, like e.g. elderly passengers' need for the driver's help or reach work commuters' specific destinations in industrial areas (Makrí and Rystam, 1991). Disadvantages are the more complicated planning and larger difficulty in informing the travellers.

In addition to radial routes and tangential routes, trunk routes now form a popular part of bus route planning that is reaching success. Trunk routes often have high priority in intersections, short headway, longer distances between bus stops and large vehicles, all to the aim of minimising travel time between important destinations.

One example of a city with trunk routes is Jönköping with approximately 100 000 inhabitants in the south of Sweden. The trunk route system was introduced in June 1996, replacing the old bus route network. The old system consisted of a large number of routes covering the city area very well, but with in-frequent services. The new system was planned to attract more passengers and to increase level of service for those travelling by bus, by shorter travelling times and new vehicles. The trunk route system is based on two highly prioritised trunk routes supported by local routes and feeder routes. The two trunk routes are operated every 10 minutes during peak hours. Both route networks and the change of systems are fully described in Svensson (2001).

3 Method

3.1 Stated Preference studies in Göteborg

Extensive Stated Preference studies among bus passengers in Göteborg (Sjöstrand, 2001) have shown how the ratio between values of walking time, in-vehicle time and waiting time varies with respect to personal and travel characteristics. Personal characteristics studied are gender, age, occupation, and number of conducted trips per month. Travel characteristics studied are trip purpose, trip length (to the bus and in the bus), headway, if there is an interchange or not, and availability of seats.

From the Stated Preference studies, four traveller groups were chosen to be further investigated in this study. Those were workers on work trip, young students on their way to school, elderly passengers and travellers on leisure trips, that is with trip purpose shopping, visits, sports, etc. Estimated preferences, for respective group, are shown in table 1. In-vehicle time has in each case been assigned the weight 1.0 and the weights of other time elements are related to the in-vehicle time. The larger weights of time spent outside the vehicle express the lesser convenience experienced compared to time spent in-vehicle.

Table 1. Estimated weights of waiting time, walking time, transfer waiting time; and transfer penalty for work trips, students, elderly and leisure trips.

	waiting time weight	walking time weight	transfer time weight	transfer penalty (minutes)
work trips	2.2	1.0	1.3	13
students	2.0	1.0	1.7	3
elderly	3.8	1.5	4.0	20
leisure trips	3.0	1.5	2.6	16

In Sjöstrand (2001) the assessment for timetable headway is presented (as headway was presented as one of the attributes in the SP-experiments). That figure was multiplied by two before being presented in table 1 as a weight for waiting time. This is congruent with how waiting time is defined in VIPS, that is half the headway.

Time spent inside the bus is assessed as most comfortable, and all other parts of the trip are to a varying degree assessed as being more demanding. One exception is that on work trips and school trips, the walking time to bus stop is considered as just as comfortable as time spent on the bus. The waiting time, on the other hand, is considered as twice as burdensome as the in-vehicle time. For elderly and on leisure trips the waiting time is even more burdensome, with weights of 3-4. The transfer penalty, i.e. how many more in-vehicle time minutes that is accepted on a direct trip without a transfer, varies significantly between groups. A student has small resistance against changing buses. Nevertheless, for other groups the estimated transfer penalties are 13-20 minutes, with elderly having the highest assessment.

The weights used in this study differ to some extent from the frequently used travel time weights presented by Vägverket (1992). The assessments presented there are most often based on travellers' choice of travel mode for trips to work in Stockholm. For example, the walking time weight is suggested to be 2.0, but none of the groups used in this study has that high a walking weight. On the other hand, the newly estimated transfer penalties are considerably higher than those often used. Vägverket (1992) proposes a transfer penalty of 5 minutes, while three of the groups discussed in this study state a transfer penalty of over 10 minutes. The waiting time weights both for the first bus and during a transfer, if present, are in correspondence between previous studies and the current study.

The advantages of using the results from the recent Göteborg study are that

- they involve different kinds of passengers (commuters, students, elderly, leisure, etc)
- actual local public transport passengers showed their preferences, i.e. the category of people who are most investigated in this study

The use of stated preference techniques, including their use in direct forecasting, has proved to be reliable by for instance Smyth and Harron (1997). Therefore, the results from Sjöstrand (2001) can be considered as useful contribution in estimation of effects for different traveller groups when introducing a new public transport system.

3.2 Network analysis in Jönköping

Different settings of relative preferences will be the input in a network assignment model to compare the influence on generalised travel times and costs in two bus networks with different planning strategies.

3.2.1 Assignment model VIPS

In the route network analysis by the assignment model VIPS the generalised time is calculated for trips between all OD-pairs (VIPS/3, 2000). The generalised time is a measure of standard, estimated as the sum of the various time components multiplied with their appropriate perceptual weights plus the transfer penalty, i.e. an extra number of minutes every transfer corresponds to in inconvenience. The generalised time, also called weighted time, builds on the fact that at a passenger perceives different parts of a trip as more or less convenient. Compared to the actual riding time, walking time to the bus stop, waiting there and spending time for transfer to another vehicle are usually perceived more exhaustive.

A trip from home to work will be used here to illustrate the calculation of generalised time. The weights for a work trip in table 1 above are used, with walking time weight 1.0, waiting time weight 2.2, transfer time weight 1.3, and transfer penalty 13 minutes. Assume a man's work trip looks like in figure 1, with a walking time to bus stop 5 minutes, he waits there for 3 minutes, rides on a bus for 15 minutes, then he has to transfer to another bus. He has to wait for 4 minutes before the second bus leaves, then he rides for 10 minutes, and finally he reaches the work place after 2 minutes walk.

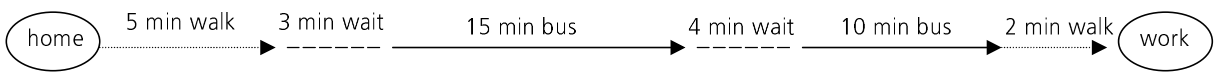

Figure 1. A trip from home to work with walking time, waiting time, transfer and riding on the bus.

Table 2 shows the estimation of the generalised time for the assumed trip. The real total time for the trip is 39 minutes, but if the weights of different trip elements are considered, the generalised travel time is found to be 56.8 minutes.

Table 2. Estimation of total travel time and generalised travel time (minutes) corresponding to the trip described in figure 1.

	time	weight	penalty	weighted time
walking to bus stop	5	1.0		5.0
waiting for the bus	3	2.2		6.6
riding in the bus	15	1.0		15.0
transfer penalty	-	-	13	13.0
transfer waiting time	4	1.3		5.2
riding in the bus	10	1.0		10.0
walking from bus stop	2	1.0		2.0
total	39	-		56.8

When then generalised times are known for all possible travel paths between the origin and destination, the travellers are assigned accordingly to the routes in the network, assuming that each traveller minimises the generalised time (Jansson and Ridderstolpe, 1992). In addition it is assumed that the travellers know the riding times, the headways and departure times associated with all routes. It implies that passengers do not always catch the first bus that comes when they are waiting on the bus stop, if they know their total generalised time will get smaller if catching a later bus. Another assumption is that bus departures are uncoordinated, i.e. buses arrive independently of each other. Both these assumptions are also involved during transfer waiting time.

In this study two route networks were used, the bus networks before respective after the introduction of trunk routes in Jönköping. The information about the networks that is used in VIPS when assigning passengers on routes is distance and speed of each link, how the links are connected to routes, headway of each route, walking distances between bus stops and trip matrix centroids, etc.

According to Jansson (1997) results from simulations in VIPS are in accordance with real travelling. Therefore the use of VIPS was considered valid for the aim of this study. However, the quality of the results is, of course, entirely dependent of the quality of input data.

3.2.2 Input data

The choice of using Jönköping as a test site in this study depended on accessible data from a large travel survey conducted in 1996 and 1998. This travel survey was part of an evaluation programme consisting of several surveys during 1996-1998. The aim then was to study effects of the trunk bus system for both bus passengers and other inhabitants.

The travel matrices used are results of a longitudinal travel survey conducted via telephone with people living in the municipality of Jönköping. The same persons were interviewed both before and after the new bus system was introduced. On both occasions all the person's performed trips during one specific day should be reported. These trips are then weighted with respect to non-response, age groups, gender, etc to obtain an estimated total OD-matrix. The number of interviewed persons, reported trips, weighted trips and modal split for both parts of the survey are shown in table 3.

Table 3. Number of persons and trips in the travel survey in Jönköping in 1996 and 1998.

	before-study, March 1996	after-study, March 1998
interviewed persons (response rate)	2472 (84%)	2060 (90%)
reported trips	7961	6006
number of trips after weighting	303 000	274000
share of trips made by bus	9%	9%
share of trips made by car as a driver	51%	52%
share of trips made by car as a passenger	12%	12%

More about the study can be read in Johansson and Svensson (1999) and in Holmberg *et al.* (1999).

From the total OD-matrices, sixteen segments were chosen. One of the segmentations was made with respect to the four traveller groups. When work trips were to be analysed with the work trip weights presented in section 3.1, only work trips from the OD-matrices were used, while when elderly passengers were studied with their weights only the elderly passengers' trips in the matrices were used, etc. This segmentation was made as each studied traveller group to a certain extent has different origins and destinations, and the preferences for a certain group should be applied to the trips made by the same group.

The other segmentation from the total OD-matrices was done with respect to travel mode used. Current bus trips and current car trips, respectively, were studied separately. For current car trips the generalised time was estimated as were the trips made by bus. The car trips are more spread over the city area than are the bus trips, both because many goals are more easily reached by car than by bus, and because the car trips are more numerous than the bus trips.

The OD-matrices constitute of trips for all days (Monday-Sunday) during the whole day (00-24 hours). However, the bus route networks used in this study are only valid during peak hours on workdays (Monday-Friday). This disagreement is of course a weakness, but as this study mainly is an example of how results from a Stated Preference-survey can be used in an assignment model, the analyses were considered interesting anyway.

The public transport route network in Jönköping is so large and complex that there is a possibility to choose between different bus routes for many local trips. Some passengers will prefer to walk to a bus stop further away to catch a bus with direct connection to the aimed destination, while others will choose the closest bus stop even if the bus trip includes a transfer to another bus or the bus leaves less frequent. The possibility to choose between routes is a prerequisite for the VIPS estimation to be interesting, as depending on a traveller group's preferences, different shares of the groups will choose separate travel routes. Otherwise, all passengers had been forced to use the same route when travelling between the same destinations, irrespective of preferences.

Using real networks and real OD-matrices is preferred to choosing "typical trips" or examples like the one presented in figure 1 above. The OD-matrices are authentically compounded, such that the kinds of trips that are common are more represented, and trips that are unusual are present in the matrix, but are few. Both networks are also authentic, with true speeds and bus stops that have functioned or are functioning in reality.

3.2.3 Analyses

As mentioned above sixteen OD-matrices (4 traveller groups * 2 current modes * 2 travel surveys (1996 and 1998)) are applied to two different networks. The OD-matrix from 1998 was however not applied to the old network. The results of these 24 route network analyses are compared in three ways. The first comparison considers passengers' average perceived generalised time in the old network and in the new trunk route network, respectively. The comparisons are made for each of the four traveller groups separately.

The second comparison considers the average generalised time for people who currently are using public transport and people who are potential users. All car trips, as a driver as well as as a passenger, were considered as potential bus trips. It is likely that many of those who are not using the bus do not use it because of the high generalised time they then would get as a result of infrequent bus service or long distance to bus stop. The car trips' origins and destinations are more wide spread over the city area, than are the bus trips' origins and destinations. Thus, the measurable qualities of the networks are more relevant if not only bus passengers are investigated.

The third comparison considers the different OD-matrices that are used, the one from before and after the network was changed, respectively.

3.2.4 Method summary

To summarise the method used, figure 2 shows the input data in assignment model VIPS, and which result from VIPS that is interesting in this study.

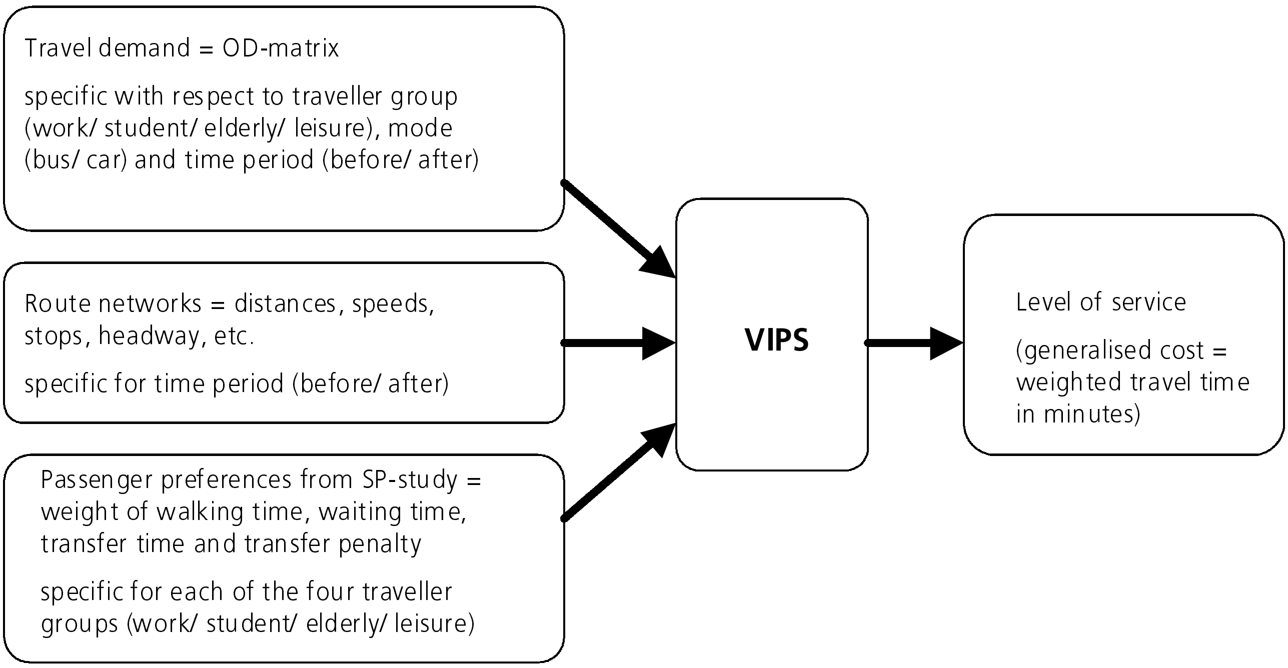

Figure 2. Overview of input and outcome of VIPS in this study.

4 Results

This section shows the results from the VIPS calculations under three headings. First the comparison between the old and the new network is made for trips made; then the comparison between current and potential public transport users, and last both OD-matrices from 1996 and 1998 are used in the new network to explain some of the other results.

4.1 Comparison between the old and the new network

The new network gives lower generalised times for all kinds of travellers, table 4, assuming that the travelling has not changed in 1996, i.e. using the old OD-matrix in both networks. The reduction depends to a large extent on an increased share of direct trips, i.e., the new network is planned so that many bus transfers can be avoided. As the transfer penalty is as large as 13 minutes and more for most of the passengers, also the generalised time is positively affected. The importance of the transfer penalty is also shown in that students' generalised travel times are lower than other groups' generalised travel times. Elderly passengers have the highest generalised times in both networks, depending on the high relative weights of all time components for that group, compared to their value of in-vehicle time.

Table 4. Average generalised time minutes for respective traveller group in the old and in the new network, current bus trips.

traveller group	generalised time in the old network in Jönköping	generalised time in the new network in Jönköping	change in percent (new-old)/old
work trips	54	47	-13%
students	49	43	-12%
elderly	67	53	-21%
leisure trips	56	47	-16%

The relative positive change is largest for the elderly passengers, with a decrease of generalised time of 21%. All reductions are of considerable size, showing that various kinds of public transport passengers in Jönköping have reached a higher travel quality.

Since transfer penalties play such an important role in the estimation of generalised time, the shares of direct trips for the chosen traveller groups are most important for the changes estimated in table 4. Therefore, those shares are shown specifically in table 5. Most trips can be made without changing buses. On more than two thirds of the performed bus trips, no bus transfer has to be made to bring the passenger to the destination. Further, the share of direct trips has increased for all studied traveller groups. As a result, the level of service has grown, because fewer travellers are exposed to transfer penalty and waiting time by the transfer. This was an unexpected result, since trunk route systems are known to often induce more transfers, than a radial network.

Table 5. Share of direct trips for respective traveller group in the old and in the new network, current bus trips.

traveller group	share of direct trips old network in Jönköping	share of direct trips new network in Jönköping
work trips	67%	71%
students	66%	68%
elderly	82%	87%
leisure trips	84%	86%

So far in this study, generalised time has been used as a measure of perceived travel quality expressed in minutes. Another measure is to estimate generalised cost, expressed in e.g. Swedish Crowns (SEK). Normally generalised cost only becomes interesting if ticket fares differ between available bus routes. In this case, however, as the value of time also differs between the groups, comparisons of average generalised costs may give other conclusions than comparisons of generalised times in this study. The value of time shows the relationship, the exchange rate, between generalised time and generalised cost. Corresponding generalised costs are presented in table 6. The applied values of time were estimated by Sjöstrand (2001). The values are well in line with values of time in another study with public transport users (Widlert *et al.*, 1989), but significantly lower than the ones estimated from the Swedish National Value of time study (Algers *et al.*, 1995). The discrepancy stems from the fact that the National Value of time study does not concern local trips, but regional and long-distance trips.

Table 6. Average generalised cost (SEK) for respective traveller group in the old and in the new network, current bus trips.

traveller group	value of time (SEK per hour)	generalised cost in the old network in Jönköping	generalised cost in the new network in Jönköping
work trips	19	17	15
students	18	15	13
elderly	7	8	6
leisure trips	12	11	9

Because of elderly passengers' low assessment of time in money terms, their generalised cost is the lowest, both in the old network, and the new network, even though they had the largest generalised travel time. Instead, work commuters show the largest dis-utility of travelling, when comparing generalised costs among groups.

4.2 Comparison between current and potential bus users

In the analysis presented here, generalised times on actual bus trips are compared with the generalised times that would have resulted, if the current car trips would have been made by bus. All car trips in the OD-matrices were thus assumed to being made by bus instead, to enable a comparison between generalised times between "current bus trips" and "potential bus trips".

It is clear that the potential users' generalised times are, for most of the presented groups, higher than the current users', both in the old and the new network, table 7. The students constitute the only exception by giving lower generalised times among potential bus trips, than among current bus trips.

Table 7. Average generalised time minutes for respective traveller group in the old and in the new network, actual bus trips and potential bus trips recorded.

	old network in Jönköping			new network in Jönköping		
traveller group	current bus trips	potential bus trips	index potential/ current	current bus trips	potential bus trips	index potential/ current
work trips	54	60	1.11	47	48	1.02
students	49	48	0.98	43	38	0.88
elderly	67	83	1.24	53	64	1.21
leisure trips	56	69	1.23	47	56	1.19

The gap between the users' generalised times and the potential users' generalised times, i.e. the index, has decreased. The new network thus fits also the potential users better, than the old network did.

4.3 Comparison between OD-matrices from 1996 and 1998 in the new network

So far, the OD-matrix from 1996, before the system change, has been used in all analyses. In this section also the new matrix, from 1998, will be used. The reason for that is that the travelling in Jönköping has changed and partly been adapted to the new public transport system, which was introduced in 1996. There are more bus trips on connections where it is now possible to use a direct trunk route, and less bus trips on connections where quality has decreased (Johansson *et al.*, 1999).

Both sections 4.1 and 4.2 showed that generalised times have decreased in the new network for trips that were actually made before the trunk route system was introduced. But, still we do not know anything about the generalised times perceived by the passengers who are actually using the new network. Table 8 shows how the VIPS-estimations of generalised times vary depending on which OD-matrices and which bus route networks that are used.

Table 8. Generalised times for current bus trips estimated with different combinations of OD-matrices and bus route networks.

	old matrix + old network	old matrix + new network	new matrix + new network
work trips	54	47	48
students	49	43	45
elderly	67	53	59
leisure trips	56	47	48

The table shows that the new network gives lower generalised times for all traveller groups irrespective of if the old (1996) or the new (1998) OD-matrix is used. Comparing the two first columns, one can see that the new network is adapted to the trips made before the change (as previously mentioned in section 4.1). One may assume that, in the new matrix, some new trips have been added, that in the old network were too burdensome to perform by bus. In the new network, these trips have been considered comfortable enough for bus to be a competitive mode alternative. These added trips were presumably among the "potential trips" previously and within that group the trips with the lowest generalised times for bus travel have switched over to bus.

5 Discussion

This study has involved comparisons of generalised times for different traveller groups in two public transport systems. The analyses were made in assignment model VIPS with real OD-matrices in real bus route networks applying passenger preferences estimated from recent Stated Preference studies.

The new trunk route system was planned to satisfy the travel demand shown before 1996. Therefore, it was not surprising that the generalised travel times were lower in the new network for all studied traveller groups. Previous studies in Jönköping (Johansson and Svensson, 1998) also showed that most of the bus passengers found the new bus system better than the old system. The improvements depend to a large extent on shorter waiting times due to more frequent services of buses.

It may also have been believed that certain groups would have become losers and some winners, from the introduction of trunk routes. On the contrary, however, this study showed, by using different settings of preferences for four traveller groups, that all types of bus passengers studied were winners.

The clearest improvement was shown for elderly passengers' bus trips. This may be an unexpected result, because a trunk route system often is known as not being planned from elderly people's perspectives (Svensson, 2001), since a trunk route system is known to give more bus transfers. But, as both this study and previous reports about Jönköping show, the share of direct trips can not be shown to have changed significantly. Even after the trunk routes were introduced, almost all bus routes pass the city centre, and only few passengers are forced to change buses. Instead, the elderly passengers' generalised time was reduced the most because of improved headway combined with elderly passengers' high weight for waiting time.

One indication of the reliability of results is that, the recent Stated Preference results applied in VIPS gave shares of direct trips which are very much the same as the shares found in other studies, table 9. A counter-indication may be that, the share of direct trips has increased in the new network according to the VIPS study, while it has decreased according to the travel survey. The differences are however small, all shares, simulated as well as observed, are around 70%.

Table 9. Share of direct trips without transfers on bus trips according to this study, and other studies in Jönköping.

trip purpose	study	old network in Jönköping	new network in Jönköping
work trips	VIPS	67%	71%
work trips	travel survey 1996 and 1998[1]	72%	69%
all trips	on board survey 1997[2]	-	64%

1) Johansson and Svensson, 1999

2) Johansson and Svensson, 1998

In reality, however, a bus transfer is less inconvenient in the new network than before 1996 because of more frequent services, low floor buses and real time information systems on bus stops.

In this study this fact was not considered. If other, lower, transfer penalties were used for the 1998 network, the generalised times would have decreased even further.

The trips now being made by car partly have other origins and destinations, which are more spread over the city area, than the trips made by bus. Therefore, the average generalised time for actual bus trips is lower than for the assumed potential bus trips, which are now being made by car. That is one reason for not choosing public transport for these trips. It should also be noticed that current bus users and potential users differ in other aspects, than the ones investigated here. For instance, the public transport users do probably to a lesser degree hold driving licenses and have lower availability of a car. This concerns students especially and could be a reasonable explanation to why the students' current bus trips give a somewhat higher generalised time than the potential users'. In addition, current bus passengers' assessments of walking time, waiting time, etc. have been used for the potential users too, despite the fact in reality that potential users are likely to have other preferences, than the actual users. However, comparisons of generalised times between groups are interesting despite the problems with uncertain assumptions.

A public transport system gets, to some extent, the trips that the system is planned for. Thus, the travel pattern by public transport in Jönköping has changed slightly, as a consequence of the introduction of the trunk routes. Trips made by bus do not have the same origins and destinations before and after the change of networks. Earlier studies in Jönköping (Johansson and Svensson, 1998) showed e.g. that people who do not have to transfer during their trip appreciate the new system more and travel more often by bus, than people who have to change buses. This study has shown, by using OD-matrices from both before and after the traffic change, that some of the potential users probably can be made to shift mode from car to bus, if the public transport alternative is improved.

To summarise:

- VIPS-estimates of generalised travel times are useful for comparing the overall quality experienced by the passengers, both between networks and between groups.
- In this case, Jönköping, a trunk route system gives smaller generalised travel times, i.e. better service, than a traditional radial network, not only for the population as a whole, but also for all studied traveller groups.
- The improvement is a consequence of more frequent bus services, in combination with the fact that there was no increase in the number of trips that needed transfer.

- The average generalised time for accomplished bus trips is lower than the average generalised time would have been for car trips, had they been made by bus.

The use of a network assignment model together with knowledge of different traveller groups' assessments of travel quality elements may be an important tool in public transport network planning. This makes it possible to study effects for specific groups when e.g. changing routes or moving bus stops.

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