

Summary:

Combined evaluation of public transport packages of measures in urban areas - 1996/97

Background to the Ministry of Transport and Communications' support for the measures

In 1991, the Ministry of Transport and Communications initiated a pilot project for developing rational and environmentally friendly transport to strengthen public transport. The results of the evaluations of the project show, amongst other things, that a number of measures together complement each other and increase the effect of the measures. This recognition of how the measures affect a system and the connections between the effects of one measure and the effects of another measure, led to the Ministry of Transport and Communications to changing its policy from dealing largely with individual measures to financing packages of measures, from 1996 onwards. As a result, the various schemes for cities and districts are not individual measures, but a combination of different measures appropriate for achieving targets connected with increasing the proportion of public transport, more effective traffic flow and improved public transport.

Packages of measures 1996 and 1997

In the period 1996-97, the Ministry of Transport and Communications allocated a total of NOK 32.2 million for packages of measures for both districts and cities. The packages of measures differ with regard to size, scope, the nature of the measure and combinations of measures which are to be implemented.

The subsidy scheme is organised and administered by the Ministry of Transport and Communications, which invites county councils to apply for funds for long-term projects based in politically adopted plans. A minimum of 50 per cent local finance is required to obtain financial support.

This report contains analyses of four packages of measures which have been carried out in the following city areas:

- **Rogaland county 1996/97: Hundvåg scheme**
Comprehensive reorganisation and up-grading of public transport routes in the Hundvåg area of the city of Stavanger were carried out, in order to make it easier for passengers to use. The frequency has been increased from around 10 to 5 minutes in daytime, supplemented by feeder buses. In addition, bus stops have been upgraded, accessibility measures have been implemented and there has been heavy emphasis on information and marketing in this part of the city.

The target is an increased proportion of public transport in this area to reduce the anticipated increase in traffic over the city bridge in the years to come. Hundvåg has some 9000 inhabitants.

- Vestfold county 1996: **Continued emphasis on the development of resource- and environmentally-friendly transport in the Tønsberg area**
This scheme comprises, for the most part, improvements to facilities for the combination of bicycles and public transport, inter-changes between train and bus, expanding routes, refurbishing bus stops and attitude-awareness work. Major changes in routes were implemented during the pilot period, but the principles in the new route concept were maintained. The area covered by the scheme contains three municipalities. In total there are almost 60,000 inhabitants in the area.
- Buskerud county 1997: **New deal for public transport in the Drammen region**
This package of measures is characterised by the fact that a three-year project has already been carried out and that the scheme is a continuation of phase two. The scheme contains various individual measures spread across four areas: product development, information/marketing, accessibility and bus stops. Four municipalities are involved in the project. In total, the area covered by the measures has in excess of 110,000 inhabitants.
- Østfold county 1997: **Package of measures for Nedre Glomma**
Nedre Glomma includes the cities of Fredrikstad and Sarpsborg. These two cities have some 40,000 inhabitants, while the region has more than 111,000 inhabitants. The target is to increase the number of journeys by public transport from around 50 per inhabitant per year (1995) to around 70 per inhabitant per year by 2007. The scheme emphasises information, accessibility, the standard of bus stops, fares/ticketing systems and an improved adaptation of available routes according to the market.

Combined evaluations have transfer value to other areas

Implementing packages of measures can form the basis for evaluating the effects of implementing a number of measures simultaneously. By carrying out homogenous evaluations for several test areas, comparisons can also be made between different areas which have implemented packages of measures. This report is an analysis of the data material which has been collected through studies of the four packages of measures, and where the studies have followed a common plan for evaluation measures. This evaluation does not describe in detail the results from the individual urban areas. The main aim of the report is to present results which may be of use in areas other than the areas involved.

The analyses which are presented here will form part of a larger analysis, when the packages of measures from 1996-2000 will be included. The findings which appear in this report will be analysed further when we have a greater spread of packages of measures in the analyses.

Problems

The aim of the majority of the packages of measures for cities is more effective public transport for passengers and companies, as well as getting more people to use public transport. Packages of measures for cities and packages of measures in sparsely populated areas are evaluated in different ways. The city packages have a common pattern which is used as a basis for a joint analysis. In this evaluation, focus is placed on the following problem situations:

- Have the measures resulted in more public transport passengers?
- Who are the new passengers, and how have their travel patterns changed?
- Have the external conditions for public transport changed during the pilot period?
- Have the public's knowledge of and attitudes to public transport changed?
- What do passengers think about the new public transport services?
- What can be gained from larger packages of measures?

The evaluation task

In order to get the full benefits of the evaluation, it is necessary to follow a common pattern. *Basis evaluations*, consisting of *travel surveys with panel selection* amongst a representative sample of the population in the areas where the measures are implemented, and a *user survey* among passengers. Both types of study must be carried out before and after that measures are implemented. The basis evaluation further contains a *registration of area data* (zonal data), as well as *passenger counts* before and after the measures.

The travel survey shows changes in the choice of transport amongst the population, as well as attitudes to and knowledge of public transport.

The user survey is directed towards public transport users, and is carried out using questionnaires given to passengers on buses and trains.

The area data describes the characteristics of the different transport alternatives from home (zones within the area) to the centre of the municipality, in the before-and-after situations.

In addition to the basis evaluation, TØI carries out *process evaluations* which cover the background of the package and the political/administrative implementation of the package of measures.

In addition to this report which evaluates packages of measures for cities, a report has been compiled which summarises the rural packages of measures (TØI-report 494/2000). These schemes have not been evaluated according to a common pattern and they are also very different in character.

The packages of measures were implemented in a "turbulent" period

There are a number of conditions which have influenced the use of public transport in the period during which the packages of measures were implemented. This applies both to changes for the individual, such as family situations, employment, financial situations etc. In addition, there are certain conditions within the transport area, such as fuel prices, parking conditions, investments and other elements of public transport which are not connected with these packages of measures. The latter are by no means insignificant for the conclusions we have drawn from this public transport initiative. Here it is important to distinguish between the total change in the use of collective transport and the change which, taken by itself, is due to the measures which have been implemented.

This means that for some areas, a number of external conditions may have influenced public transport *more* in a negative direction than the packages of measures have been able to rectify, and the effect on these cases has been to weaken a negative development. This tendency has been particularly strong in recent years, with increased economic growth and tight county council finances. This has made the evaluation of the package of measures a special challenge, where the task has been to define the isolated effects of the measures, corrected for external conditions, see figure S.1. Our analyses show that the "external" conditions, i.e. factors which are not connected with the concrete measures, have affected the use of public transport in a negative direction in all areas affected by the measures, while the packages of measures have moderated this development.

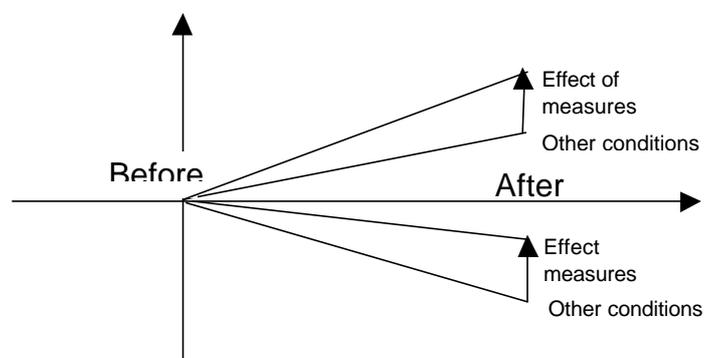


Figure S.1: Illustration of the isolated effects of the packages of measures and the effect of other conditions on increased or reduced market potential.

The packages of measures have resulted in more passengers

An expressed goal with all the packages of measures has been to increase the modal share of public transport. Of the four packages which are discussed in this report, only the Hundvåg package has really succeeded in increasing the amount of public transport in this period. Nonetheless, all the areas have demonstrated a growth in the number of passengers.

Public transport users' evaluations of the changes

For the most part, public transport users were satisfied with the availability of public transport in their areas. Most dissatisfaction was shown regarding changing buses and changing between bus and train, as well as a lack of information at bus stops.

In the Tønsberg area, at Hundvåg and in the Drammen region, around 70 to 80 per cent of public transport users knew that there had been changes in public transport schedules. In Nedre Glomma, the proportion is less than 40 per cent. The changes which users have appreciated most are changes in frequency, route, journey time and information.

Public transport users' evaluations in the individual areas can be summarised as follows:

- **The Tønsberg area** had more dissatisfied users of public transport. 28 per cent of passengers thought that public transport *as a whole* was better, while 42 per cent thought it had become worse. 30 per cent thought that public transport as a whole was unchanged.
- **Hundvåg** had a large increase in the proportion of satisfied passengers. This concerned a large number of aspects of public transport, but particularly in relation to information/standards at bus stops and frequency of public transport. Almost 90 per cent of passengers thought that the frequency of public transport had improved.
- In **Nedre Glomma**, only 40 per cent of passengers knew that changes had been made. However, a large portion of these were very positive and thought that many aspects of public transport had improved.
- In the **Drammen** region, there was very little change in the degree of satisfaction with public transport.

Close connections between satisfaction with the measures and changes in travel patterns

There is a strong connection between how satisfied customers are with changes and to what extent these changes affect their use of public transport use. 50 per cent of those who thought public transport had *improved*, travel more often. And 50 per cent of those who think public transport had become *worse*, travel less often. If we turn the problem upside down and look at those who have changed their travel habits, we find that about 90 per cent of those who *travel more often* also feel that public transport has improved, and about 90 per cent of those *who travel less often* think that public transport services have become worse. At the same time, there are a great number of people who think that public transport services have improved, but who nonetheless have not changed their bus use. A number of them already travel frequently using public transport, and have therefore reached a saturation level for public transport journeys. Nonetheless, achieving more satisfied customers is an important goal in itself.

Table S.1: Changes in bus use according to the judgement of changes in public transport. User surveys at Hundvåg and in the Tønsberg area. Percentages

Have changes to the bus routes led you to change your use of buses?	On the whole – do you think that public transport has become better, worse or has not changed as a result of alterations to services ...?		
	Better	Worse	Unchanged
Yes, I use buses more often	49	6	11
Yes, I use buses less often	1	53	5
No change	50	41	85
No, change	50	41	85
Total	100	100	101
N	1345	366	218

About half of those who think that public transport has improved, state that they travel on public transport more often. This is illustrated in table S.2. The effect of poorer public transport is less in Tønsberg, but here the proportion who feel that public transport has become worse is much higher (42 per cent) than in Hundvåg (13 per cent).

Table S.2: The connection between the proportion who state that public transport has become better/worse and the proportion who increase/reduce their bus use. Percentage and relative proportion in the two areas.

	Better	Increases	Worse	Reduces
Hundvåg	80	41	13	10
Tønsberg area	28	16	42	18

We have concentrated our analyses on the factors which affect the probability of the users of public transport increasing or reducing their travel activities through an analysis in four steps:

- Step 1: the connections between changed bus use, the evaluation of the new public transport and framework conditions for travellers.
- Step 2: analyse which factors have shown the greatest variation in their evaluation of public transport.
- Step 3: the connections between passenger evaluations of different improvements and the actual improvements.
- Step 4: which changes have been most significant for passenger development?

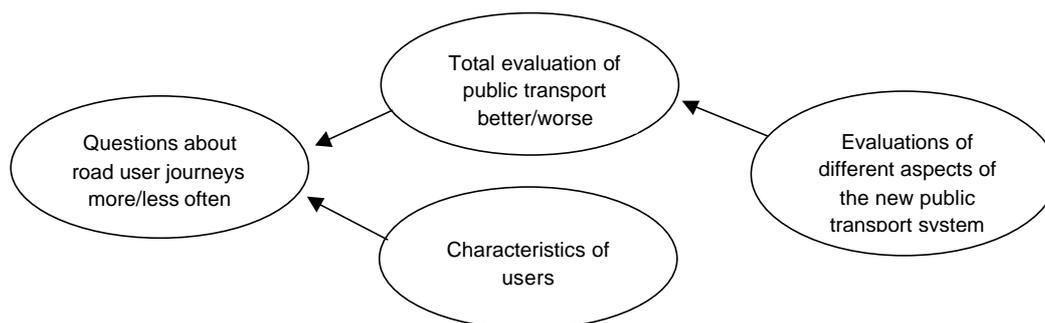


Figure S.2: Illustration of the analyses for changed bus use in different areas where the measures are implemented

Improvements in public transport affect the use of public transport

There is a clear connection between the changes which have been adopted in the different areas and passenger evaluations of public transport. This means that increased bus use in the areas where the measures have been implemented can be traced directly back to the improvements which have been carried out, and, in the first instance, to an increase in frequency. In total, the different improvements in public transport have contributed to explaining three-quarters of public transport users' increased bus use in these areas (table S.3).

Far fewer people reduce their bus use in the areas where the measures have been implemented. For these groups, about 80 per cent of the changes can be accounted for by the fact that they had poorer public transport as a result of changes in the bus schedules. Even though reduced frequency of departures also plays an important role here, there are many more factors which have contributed to explaining this decrease.

Table S.3. The degree to which the different changes in bus schedules contribute to explaining increased or reduced bus use. Percentages. Analyses of user surveys at Hundvåg and in Tønsberg. $N = 1233$

Changed standard:	Increased bus use	Reduced bus use
Frequency of departures	54,9	37,2
Route	7,3	18,6
Regularity	3,4	12,2
Journey time	2,1	10,2
Interchange	1,6	0,9
Information	1,0	0,8
Walking time to bus stop	-0,9	-0,5
Interactions	6,5	0,0
Remainder/External factors	24,3	20,7
Total	100,0	100,0

It is easy to "lose" passengers by making public transport worse

Regarding public transport users who have reduced their bus use, there are a number of factors which are involved. Frequencies, routes, regularity and journey times have all been important factors. Taken together, these factors contribute to explaining almost 80 per cent of the reduced bus use.

Even though there are far more people who have increased their bus use in these areas as a whole, our analyses show that it is easier to "lose" passengers than to gain new ones. This means that dissatisfied passengers have a greater tendency to stop using public transport than satisfied customers have of increasing their bus use. This is partly due to the fact that many public transport users are daily users, with few possibilities for further increases, but even where we correct for this, we find a similar asymmetry.

Isolated effects of the packages of measures on car use and public transport use

Seen in isolation, the packages of measures have had a considerable effect on the distribution of transport resources taken as a whole, and in relation to journeys to work. This effect is most noticeable at Hundvåg, and has been more marginal in the other areas.

Table S.4. Isolated effects of the packages of measures on the bus use. Relative changes. Percentages

	Tønsberg area	Hundvåg	Drammen region	Nedre Glomma
Relative change buses	1,3%	9,4%	1,5%	1,1%
Relative change cars	-0,3%	-3,0%	-0,2%	-0,3%

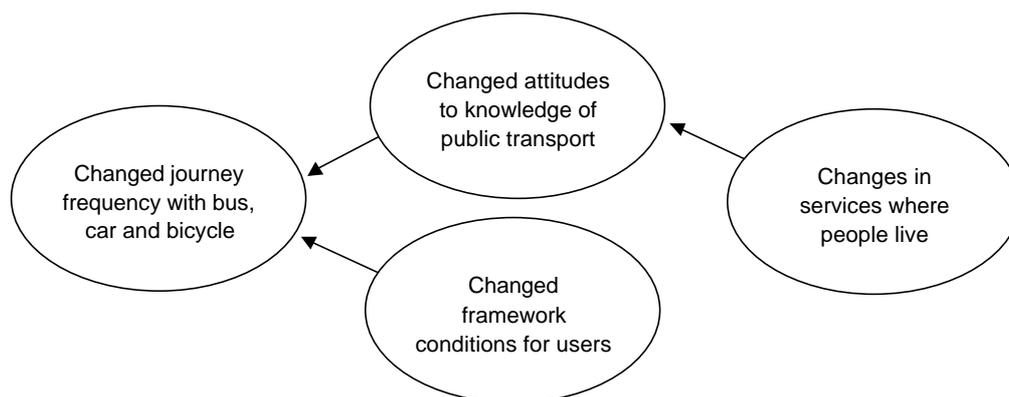


Figure S.3: Schematic portrayal of the analyses for changed travel activity

Even though there is uncertainty in the figures, it is in fact a reduction in negative attitudes in the population, and not additionally positive attitudes, which make the greatest effect on changing travel modes. This is particularly important because we register an increasingly negative attitude to public transport in these areas. These results contradict our findings amongst users of public transport. This increasingly

negative attitude is an external "trend" and is not connected with the measures which have been implemented.

The model showed that the packages of measures have contributed to slowing a negative development in public transport use.

The significance of attitudes to and knowledge of public transport

The analyses have revealed a clear connection between attitudes and knowledge regarding public transport and use of different forms of public transport. At the same time the direction of causation is unclear in these analyses. The last part of the analysis, therefore, starts with each individual's change in travel activity, in order to study whether changes in attitudes and knowledge affect changes in behaviour.

It is interesting to note that *people's initial attitude* can contribute to a large extent to explaining the potential for changes in attitudes when such packages of measures are implemented. These analyses show that people who were initially positive towards public transport increased their knowledge to a greater degree and stated that public transport had become simpler and more attractive to use.

These analyses show that, initially, improved knowledge of public transport options have affected the use of cars and buses. Seen in isolation, these analyses show that a 10 per cent increase in the proportion who know about public transport options where they live has contributed to 3 per cent more bus journeys and 0.6 per cent fewer journeys by car. The relatively low effect on the use of cars is due primarily to the fact that there are many types of journeys where public transport is not really an alternative, and that changing from cars to buses occurs primarily in connection with journeys to the city centre and journeys to school or to work.

Economic evaluation of the packages of measures

We have carried out a cost-benefit analysis, which estimates the economic benefit produced by the schemes, in terms of user benefits, producer benefits and external effects. The benefits are set in relation to the costs involved.

In calculating the external marginal effects, we have looked at effects on the environment and on accidents and congestion costs. These have been influenced by changes in bus kilometres and by modal shifts. Our calculations show that the effects of the great increase in bus usage in Hundvåg and the Tønsberg area were not offset by the effects of reduced car use.

In total, the environmental effects of the schemes, measured in exhaust discharge and noise, were negative. This means that the packages of measures have not succeeded in producing more environmentally friendly transport. This is largely due to major increases in bus kilometres, which are not sufficiently outweighed by the positive effects of reduced car usage.

In total, the measures have resulted an annual increase in benefits of between NOK 16.7 and 18.5 million. Table S.6 summarises the annual benefits of the packages of measures.

Table S.6: Total annual benefits of the packages of measures, NOK 1000 (1998-prices)

	Hundvåg	Tønsberg area	Drammen region	All areas
User benefit	2 842	320	2 966	6 128
User benefit, corrected for package effects	1 989	224	2 076	4 289
Gross producer benefit	3 738	2 396	7 582	13 716
External effects	- 1 130	- 846	659	- 1 318
Total benefits, upper bound	5 450	1 869	11 207	18 526
Total benefits, lower bound	4 598	1 773	10 317	16 689

In order to evaluate whether the measures have been beneficial for society, we have calculated benefit-cost ratios. The numerator is the benefit calculation from table S.6. The denominator is the annual operating costs plus annual capital costs of investments. A benefit-cost ratio above unity indicates that benefits have exceeded the costs.

Table S.7: First year's benefit-cost ratio for the measures, upper and lower bounds

	Hundvåg	Tønsberg area	Drammen region	All areas
Benefit-cost ratio	0,86	0,34	2,63	1,15
Benefit-cost ratio, lower bound	0,72	0,32	2,42	1,03

We see from table S.7 that the packages of measures taken together have provided benefit-cost ratio of between 1.03 and 1.15.

Nonetheless, only the package of measures in the Drammen region has provided a benefit-cost ratio above unity. Each NOK that has gone into the project has given a benefit to society of between NOK 2.42 and 2.63.

In the other two regions, the gains of the measures have not outweighed the costs. In economic terms, and given the assumptions for the analysis, these schemes have been wasteful.

In the Drammen region, the high benefit-cost ratio is due both to the fact that the sum of the benefits is large and that the costs are relatively low. The benefits are first and foremost due to the positive effects of reduced waiting times, measures at bus stops, gross producer benefit, together with the marginal external benefits. Because of the Drammen region, the cost ratio for all the areas is greater than unity. In total, therefore, the packages of measures have been profitable.

Even though user benefits of the measures at Hundvåg are high, there is much to indicate that the already high use of public transport and the already high quality of public transport have contributed to reducing the benefit-cost ratio. This means that it is relatively cost- and- resource demanding to increase the frequency from 10 to 5 minutes and this has not provided correspondingly large benefit for users. We have carried out a simple test where we looked at the effects of the Hundvåg package with only half the increase in frequency. This would give a benefit-cost ratio of respectively 1.25 and 1.42 with and without correction for package effects. In other words, the Hundvåg package would have been good social economy if public transport had not increased quite as much as it did.

We have not looked at the long-term effects of the measures in these analyses. There will always be passengers who take longer to adjust to new public transport services than the time-span we have considered here. In addition, there are effects which we have not included in our analyses, such as land use, regional effects and barrier effects.

Summary

Our analyses show that there are a number of conditions which have affected the use of public transport during the period in which the packages of measures were implemented. In addition to changes for the individual passenger, there are conditions which are not connected with these packages of measures.

These conditions are of no little significance for the conclusions we have drawn from this public transport initiative. It is important to distinguish between the total change in the use of public transport and the change which, seen in isolation, is due to the measures which have been implemented. The analyses show that the "external" conditions, i.e. factors which are not connected with the concrete measures, have affected the use of public transport in a negative direction in all areas covered by the measures, but the packages of measures have dampened this development, and for Hundvåg, a strong decrease has turned to growth.

- The packages of measures have resulted in more passengers. Correcting for fare increases in the test period, the passenger growth in the other areas would have been considerably larger.
- The packages of measures have also reduced the car use. This effect has primarily been noticed in Hundvåg, and has been more marginal in the other areas.
- There is a strong connection between satisfaction with the measures and changed travel activity. Increased bus use can be traced directly back to the improvements which have been carried out, and in the first instance to increased frequency which alone explains over half of the passenger growth.
- However, it is easier to "lose" passengers by making public transport worse than it is to gain new passengers by improving public transport.
- The analyses show that increased knowledge and positive changes in attitude are associated with increased use of public transport and less car use. It is in fact a reduction in negative attitudes in the population, and not additionally positive attitudes, which make the greatest effect on changing travel modes.
- There is much to indicate that synergy effects can be obtained by combining several measures into a package. The total gain in demand is thus greater with packages of measures than with individual measures, but it decreases with increasing proportions of public transport. This is a finding which will be analysed more closely once we have a greater spread of packages of measures in the analyses.
- In the short term, and for all the areas combined, the economic benefits of the packages of measures have been regarded as positive.

- The benefit-cost ratio must be seen in relation to the aims of the package of measures. The cost of alternative measures, for example expanding the bridge at Hundvåg, would raise the benefit-cost ratio significantly. Similarly, long-term effects of the measures will improve the ratio.