Institute of Transport Economics
Norwegian Centre for Transport Research

**Summary**

# Valuation of active transport factors – infrastructure and health

## Technical report, the Norwegian valuation study 2018-2020

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*This report presents results and documents analyses conducted with respect to factors related to cycling and walking for transport. We have estimated the value of travel time for different types of infrastructure, which might reflect variations in perceived comfort and safety for cyclists and pedestrians. This part also included the valuation of avoiding intersections with roads/streets; and willingness to pay for remodelling of intersections has also been estimated. Individuals' valuation of health effects, as well as how it affects valuation of travel time, has been estimated too. Various innovative approaches were tested for the valuation of health effects. Additionally, two groups of transport users have responded to surveys before and after the development/upgrading of pedestrian/bicycle infrastructure.*

## Background and objectives of study

This report is part of the new Norwegian valuation study on personal travel. The main purpose of the study was to estimate new unit value for economic appraisal of transport projects in Norway. This report focuses on factors related to active transport, that is, infrastructure for cycling and walking and the health gains from active transport.

Our client's main elements for this part of the valuation study were:

- to estimate "insecurity costs" related to infrastructure measures for pedestrians and cyclists; estimates that vary with the type of infrastructure (sections and crossings);
- to assess the extent to which health effects are part of the behaviourally-influenced costs (internal costs), as well as assessing its impact on the valuation of time; and
- to estimate the proportion of the new cyclists/pedestrians (new km cycled/walked), resulting from infrastructure measures, who obtains a (net) positive health effect.

Walking and cycling infrastructure is a key factor that can affect perceived comfort and safety. The level of perceived comfort and security affects the generalized travel costs, and can thus be measured via the travel time valuation. One can expect that the value of travel time changes will be lower the higher the perceived comfort and safety. One main purpose for the studies of cycling and walking has been to estimate the travel time value on different types of infrastructure.

When the walking and cycling infrastructure crosses roads with cars, travel time can be affected but also perceived comfort and safety. Valuation of intersections with roads, or intersection elimination, has also been part of our task. In addition to estimating the willingness to pay for removal of crossings in general, we have tested whether there is a difference in the valuation of traffic light junctions versus other junctions. We have also estimated willingness to pay for various modifications of junctions.

If walking and cycling infrastructure yields increased active transport, and if this also results in a net increase in physical activity, it can produce positive socio-economic effects. The

question is how such positive effects should be handled in economic analysis of infrastructure projects. Some of the economic health effects will be external, such as changes in absenteeism and in the treatment of sedentary-related illness. However, the main part of total economic value of improved health is likely to accrue to the individuals themselves. If the individuals are informed about the health effects, these will be expected to affect the generalized costs of active travel. We have tried to quantify this internalised health effect in the travel time valuation.

Our assignment has also included an assessment of the relationship between walking and cycling infrastructure measures, the effect on active travel, and the effect on physical activity levels. This might be considered as a combination of demand analysis and public health analysis. However, the issue has an underlying impact on how the valuation of health effects is carried within cost-benefit analyses of walking and cycling measures.

## Methods and data

Economic valuation estimates in the present report are based on data from surveys in which respondents face hypothetical choice situations, so-called stated preferences (SP). The primary SP method applied is a type of stated choice in which respondents select between travel alternatives, described by several characteristics (attributes) that vary between the alternatives. The levels of these attributes are fluctuating around the levels on an actual trip that the respondent has reported. Another SP method applied is based on asking whether the respondent would be willing to pay more for a specific improvement in one characteristic or a composition. The data are analysed using various discrete choice models (logit models), for the selection among alternatives, as well as between "yes" and "no" to an increased cost.

To analyse the effect of walking and cycling infrastructure on active travel and physical activity, a pre-post study has been set up. This method is based on data from samples of individuals that are collected before measures are initiated and collected after the measures have been implemented. A group of individuals who have not received any measure has also responded to surveys before and after the implementation period, a so-called control group. As the same individuals who answered the pre-surveys also are passed on to the post-survey, our data are panel data.

The report combines results based on data collections carried out in 2018, 2019, and 2020. Respondents were recruited partly from an internet panel (Norstat), partly from an alternative email register owned by the Postal service (Bring) and partly on-site (intercepted on the street).

## Summary of results

### "Insecurity costs"

The results of the travel time valuation on different infrastructure are consistent with the expectations. Facilities for cycling and walking contribute to reducing the travel time values; an effect that can be interpreted as an expression of increased comfort and lower insecurity. Separate infrastructure yields the lowest travel time value, for cyclists as well as pedestrians. The valuations for cycling were statistically more reliable than the valuations

for walking. We provide several value estimates for various infrastructure facilities and also aggregated valuations, as well as estimates that implicitly control for variations in the accident risk. The following tables summarise the main results for, respectively, cycling and walking, where the estimates include a control for accident risk (which implies a down-scaling compared to estimates not controlled for accident risk).

*Table S1.3: Estimated values of travel time savings for cycling (for transport), on roads with no cycle facilities versus different types of cycle facilities (Norwegian krone per hour, 2018) – controlled for accident risk.*

| Type of cycle facility | All travel purposes | Commuting | Leisure |
|---|---|---|---|
| No cycle facilities | 121 | 132 | 73 |
| On-road cycle lane or off-road cycle/walk path | 110 | 120 | 66 |
| Off-road cycle path | 96 | 101 | 60 |
| All types of cycle facilities | 109 | 110 | 62 |
| All types of infrastructure | 113 | 115 | 64 |

Remark: Estimates for all types of cycle facilities and for all types of infrastructure are based on weighted averages; where the weights are based on the shares of respondents reporting the particular infrastructure as the predominant infrastructure for their reported cycle trip (reference trip).

*Table S1.4: Estimated values of travel time savings for walking (for transport), on roads with no walk facilities versus different types of walk facilities (Norwegian krone per hour, 2018) – controlled for accident risk.*

| Type of walk facility | All travel purposes | Commuting | Leisure |
|---|---|---|---|
| No walk facilities | 121 | 132 | 73 |
| All types of walk facilities | 109 | 110 | 62 |
| All types of infrastructure | 113 | 115 | 64 |

Remark: Estimates for all types of walk facilities (pavement, separated cycle/walk path, separated walk path) and for all types of infrastructure are based on weighted averages; where the weights are based on the shares of respondents reporting the particular infrastructure as the predominant infrastructure for their reported walking trip (reference trip).

The valuation of intersections was part of the same stated choice that included various infrastructure types; thus also for this factor the statistical reliability is stronger for cycling. There was no statistically significant difference between the valuation of removing traffic light junctions and the valuation of removing other types of junctions. We therefore propose one common value for cycling and walking and all types of junctions.

For the estimated willingness to pay for remodelling junctions, we find a slight preference for grade-separated crossings, especially tunnels, but the statistical significance is relatively weak (and in this stated choice there was no control for travel time variations). We therefore find no basis for differentiating the value for different reconstructions of junctions between walking and cycling infrastructure and infrastructure for cars.

## Health effects and the valuation of travel time savings

Regarding the individuals' health effects of choosing cycle or walk as a means of transport, we find that those who state physical activity as a main motivation for their transport mode choice also indicate lower valuation of active travel time change. In another stated choice we tried to include physical effort variables as a kind of counterweight to the positive health effects, in shorter and longer terms, but apart from sweating, most people will consider increased breathing and heart beat or some fatigue and muscle soreness as "non-negative" efforts. Still, this sub-experiment also indicated that active travel time values

decrease when the individuals achieve greater health effects, but the relationship was statistically stronger for cycling than for walking.

In the stated choice that had a stronger focus on the long-term health effects, improved health towards the end of life and extended lifetime, we tested a stated choice experiment that included time spent on cycling and walking during a longer period as an attribute. This does not seem to have worked sufficiently well. Notwithstanding, all types of health effect valuation that we have tested have provided some ground for further elaboration. One possible development involves the selection and description of "effort" or "input" in a discrete choice setting, be it physical effort or a payment or some other element of the generalised cost of travel, against which the positive health effects can be assessed.

Based on our findings related to the health effect valuations, we have proposed specific inputs to the assessment of health effects in projects that may affect cycling or walking. There are two types of changes in existing practice that could be considered:

a) Given that internal (individual) positive health effects are still to be treated as external effects in cost-benefit analysis, a valuation of time that is controlled for health effects (i.e., a higher valuation) could be more correct for application.
b) With a limitation of external effects to only the "pure" external health effects, those that are inflicted to others than the individual himself/herself (health sector, employers, etc.), the internal effects could be considered as fully internalised in the valuation of travel times such that increased health gains would lead to lower valuation of travel time.

We emphasize that the particular adjustments of the estimated valuation of travel time savings, due to health effects, will depend on the what is the estimate of "uncontrolled" time valuation at the outset.

## The proportion of new cyclists/pedestrians obtaining net health effect

In our pre-post study, we have not found any measurable positive effect of developing/ upgrading walking and cycling infrastructure on active travel and physical activity. This may indicate that the effect of infrastructure measures on cycling, walking and physical activity is fairly minuscule. But we cannot rule out that shortcomings in the study design, particularly the challenges in allocating respondents correctly to treatment areas and control areas, may have affected the estimations.

Implementation of before-after (pre-post) studies of cycling/walking infrastructure and other measures remains crucial for obtaining more knowledge about policy impacts. Such pre-post studies ought to be designed in such a way that not only route choice changes for those already cycling/walking are measured. This is a major challenge. Increased bicycle /pedestrian traffic on a new/upgraded infrastructure facility can comprise both cycle/ pedestrian route switchers and new active travellers. It is indeed possible to obtain estimates on the net increase in cycling/walking from measures, including the share obtaining a net positive health effect, but it will require relatively large surveys, large samples of all types of transport users. Such pre-post studies must necessarily go on for some time, allowing for a comprehensive registration of the situation before development/ upgrading and then another comprehensive registration after completion of infrastructure works. Preferably there should be more than one pre-registrations and (even more important) more than one post-investigations; and possibly the registration of active travel before and after can be enhanced if carried out in coordination with the infrastructure developer(s).