

Summary:

Values of time, safety and the environment in Norwegian passenger transport - Summary Report

The purpose of the Norwegian Valuation Study, carried out jointly by TØI and Sweco for the transport authorities, has been to recommend new unit values for cost-benefit analysis in the following fields:

1. The value of travel time savings, including the value of reducing travel time variability and delays and spending less time in congested conditions
2. The value of comfort factors and their relation to trip length, transport modes, delays and time use
3. The cost of loss of life and limb caused by accidents in transport
4. The cost of loss of life, health and wellbeing caused by air pollution
5. The cost of loss of quality of life (life and health) caused by noise
6. The value of improved health and wellbeing through the physical activity of walking and cycling
7. The cost of insecurity, as when driving where there is danger of landslides and avalanches or when walking and cycling in mixed traffic conditions

English summaries in the seven documentation reports from the project provide short descriptions of data and the methods applied, as well as further results. This summary report sums up the recommended new values in tables. For some of them, there is obviously a need to consider further issues of consistency, equity and practicability before adopting them in manuals. These issues have been outside our project.

The unit values of time, comfort and reliability are estimated for two different definitions of short and long trips. Originally, the dividing point was 100 kilometres, but supplementary analyses have been carried out with 50 kilometres as the dividing point. The results of the supplementary analysis are presented apart in the section "Trips over and under 50 kilometres". All other tables where results are presented for short and long trips use 100 kilometres as the dividing point.

The value of travel time savings

Short motorised trips

Table 1: In-vehicle values of time (2009 NOK/hour) for short trips by mode and trip purpose.

	Car driver	Public transport	Ferry	Speed boat
Trips to and from work	90	60		
Other private trips	77	46		
All private trips*	80	51	126	82
Business trips	380	380	380	380
All trips*	88	60		

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*Aggregated using shares from the Norwegian Travel Survey 2005. For ferries and speed boat, the sample sizes in the travel survey are too small to allow disaggregated values.

Table 2: Recommended weights for waiting time*, access and egress time, and transfers. Short public transport trips.

Short public transport trips	
Weight factor for waiting time 0 - 5 min	2,30
Weight factor for additional waiting time 6 – 15 min	1,88
Weight factor for additional waiting time 16 – 30 min	0,92
Weight factor for additional waiting time 31 – 60 min	0,56
Weight factor for additional waiting time over 60 min	0,28
Weight factor for access/egress time	1,0
Fixed cost per transfer	2 - 10 min

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*Defined as half of headway at the start of a scheduled trip and as actual waiting time by transfers.

Long motorised trips

Table 3: In-vehicle values of time (2009 NOK/hour) for long trips by mode and trip purpose.

	Car driver	Railway	Bus	Air	Speed boat
Trips to and from work	200	156	103	288	
Other private trips	146	92	73	180	
All private trips*	150	98	74	204	138
Business trips	380	380	380	445	380
All trips*	181	146	120	305	

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* Aggregated using shares from the Norwegian Travel Survey 2005 for car, rail and bus; for air trips using the Air Travel Survey 2007, with adjustments using Air Travel Survey 2009.

Table 4: Recommended weights for waiting time*, access and egress time, and transfers.
Long public transport trips.

	Bus	Railway	Air	Ferry	Speed boat
Weight factor for waiting time 0 - 30 min	1,04	1,04	2,00	2,00	1,04
Weight for additional waiting time 31 – 240 min	0,54	0,54	1,00	1,00	0,54
Weight for additional waiting time over 240 min	0,40	0,40	0,80	0,80	0,40
Weight factor for access/egress time	1,36	1,36	1,36	1,36	1,36
Fixed cost per transfer	10 min	10 min		10 min	10 min

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*Defined as half of headway at the start of a scheduled trip and as actual waiting time by transfers.

Walking and cycling

Table 5: Values of time (2009 NOK/hour) for walking and cycling

	Walking	Cycling
All trips	146	130

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Weight factors for driving in heavily congested conditions

Table 6: Weights for driving in heavily congested conditions

	Short car trips	Long car trips
Weights	3,5	3,0

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Travel time variability

The weights in the table are to be used in the following way: We assume that information on travel time variability as measured by the standard deviation is available as input to the cost-benefit analysis. One unit's reduction of the standard deviation is to be valued by the in-vehicle value of time multiplied by the weight factors given in the table.

Table 7: Preliminary valuation of travel time variability by mode

Mode	Weight factor
Short trips	
Car	0,42
Public transport	0,69
Speed boat	1,02
Ferry	0,42
Long trips	
Car	0,25
Bus	0,42
Railway	0,54
Air	0,20
Speed boat*	0,55

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*Estimated on both short and long trips

Comfort factors

A distinction must be made between, on the one hand, quality and comfort differences between trips within the same mode, and on the other hand the average quality and comfort difference between two modes. Regarding the first kind of differences, our project has produced unit values of getting a seat on the (public transport) trip.

Table 8: The value of having a seat on short public transport trips if the base case was having to stand on the whole trip. NOK/trip.

	Short public transport trips
Seat on a quarter of the trip	5,0
Seat on half of the trip	14,3
Seat on most of the trip	24,0
Seat on the whole trip	27,5

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The *average* comfort and quality differences between modes may be derived from our analysis of factors that influence the value of time. We have succeeded in differentiating between factors due to the traveller and factors due to the mode. Since, at the moment, we have not concluded on how this knowledge is to be used in economic analyses, we do not propose adjusted unit values here.

Trips over and under 50 km

The unit values of tables 1, 3, 6, 7 and 8 have also been estimated for short trips less than 50 km long and long trips of 50 km or more. These results are shown in this section.

Table 1b: In-vehicle values of time (2009 NOK/hour) for short trips (less than 50 km) by mode and trip purpose.

	Car driver	Public transport	Ferry	Speed boat**
Trips to and from work	84	56		
Other private trips	70	44		
All private trips*	73	47	126	91
Business trips	380	380	380	380
All trips*	81	54		

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*Aggregated using shares from the Norwegian Travel Survey 2005. For ferries and speed boat, the sample sizes in the travel survey are too small to allow disaggregated values.

**Summed over both short and long trips.

Table 3b: In-vehicle values of time (2009 NOK/hour) for long trips (more than 50 km) by mode and trip purpose.

	Car driver	Railway	Bus	Air	Speed boat
Trips to and from work	151	88	56	288	
Other private trips	130	63	52	180	
All private trips*	136	76	53	204	137
Business trips	380	380	380	445	380
All trips*	157	99	70	305	

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* Aggregated using shares from the Norwegian Travel Survey 2005 for car, rail and bus; for air trips using the Air Travel Survey 2007, with adjustments using Air Travel Survey 2009.

Table 6b: Weights for driving in heavily congested conditions

	Short car trips (under 50 km)	Long car trips (50 km or more)
Weights	3,7	2,7

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Table 7b: Preliminary valuation of travel time variability by mode

Mode	Weight factor
Short trips (under 50 km)	
Car	0,45
Public transport	0,68
Speed boat	1,50
Ferry	0,46
Long trips (more than 50 km)	
Car	0,35
Bus	0,42
Railway	0,72
Air	0,20
Speed boat*	0,55

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Table 8b: The value of having a seat on short public transport trips (under 50 km) if the base case was having to stand during the whole trip. NOK/trip.

Short (under 50 km) public transport trips	
Seat on a quarter of the trip	2,6
Seat on half of the trip	8,7
Seat on most of the trip	15,3
Seat on the whole trip	17,4

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Accident costs

Table 9: Transport accident costs (2009 NOK) per injury by degree of severity

Injury severity and cost category	Costs by level of severity of the most serious injury (NOK)				
	Fatality	Severely injured	Seriously injured	Slightly injured	Material damage only
Monetary costs (ex post costs) *	4 096 000	9 571 000	4 124 000	146 000	30 000
Non-monetary costs (ex ante costs) **	26 127 000	13 363 000	4 020 000	467 000	0
Total accident costs (rounded)	30 220 000	22 930 000	8 140 000	614 000	30 000

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* Weighted average of road traffic injuries involving motor vehicles and injuries not involving motor vehicles. The monetary costs include medical, administrative and material costs as well as costs due to lost production (net loss for fatalities).

** Based on valuation of reduced risk of death, reduced risk of serious injury and reduced risk of slight injury. The valuation of serious injury is split into critical and serious injury using a formula of the relative risks based on injury data and existing injury costs.

Costs of emissions to air

Table 10. Recommended unit values for damage costs

	Damage cost, NOK per emitted kilogramme							
	PM10			NOx				
	Major city			Other larger cities	Towns of more than 15 000 inhabitants	Major cities	Other larger cities	Sparsely populated
All modes of transport	3600			1640	440	200	100	50
	Oslo	Trondheim	Bergen					
	3900	3900	2900					

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Table 11. Recommended unit values for climate gas emissions.

Source: *Etatsgruppen Klimakur 2020 (2009)*.

CO ₂ -equivalents, Euro and NOK per tonne		
2015	2020	2030
26 € per tonne (17-38)	40 € per tonne (20-60)	100 € per tonne
NOK 210 per tonne (140-310)	NOK 320 per tonne (160-360)	NOK 800 per tonne

Noise costs

Table 12: Recommended unit values of noise

Annual costs in NOK per dB(A) per person somewhat, much or very much affected.	
Road traffic	335
Rail and light rail	335
Sea transport (incl. ferry)	335
Air	460

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Health effects of walking and cycling

Table 13: Value of positive health effects of physical activity in transport (NOK 2009)

	Cycling	Walking	
Reduced costs of short spells of illness	1,10	1,10	NOK per km
Reduced costs of serious illness	0,90	0,90	NOK per km
Welfare effect	1,00	1,00	NOK per km

Compared to current guidance, the share of cyclists that obtain a positive net health effect has been reduced from 50 to 30 per cent, and the share of pedestrians that obtain a positive net health effect is reduced from 50 to 15 per

cent, based on results obtained in the Valuation Study itself. Per km values for cyclists and pedestrians are nevertheless equal, due to the speed difference.

It has not been decided whether or not the welfare effect (the individual's ex ante valuation of the reduced risk of illness) should be included in the value. If it is, the total value will be NOK 3 per km and if not, NOK 2 per km.

Insecurity costs

Table 14: Insecurity costs of walking and cycling (2009 NOK)

	Cycling	Walking	
Crossing a road	2,40	1,00	NOK per crossing
Travelling along a road	13,00	29,00	NOK per km

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Values are based on choice experiments of the first wave of the Valuation Study, in summer 2009. Variables were travel time, number of crossings with motorized traffic, and length of separate pathway/pavement for cyclists/pedestrians. The choice experiments produced values in minutes that were converted to monetary values using NOK 113 for cycling and 125 for walking (Ramjerdi et al. 2010).

Table 15: Value to motorists of eliminating the danger of landslides or avalanches (2009 NOK)

	Travellers by car in exposed areas	
Eliminating risk of landslides and avalanches	0,50	NOK per km

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Values are based on choice experiments of the second wave of the Valuation Study, in spring 2010. Variables, in addition to the elimination of the risks of landslides and avalanches from different reference levels of risk, were travel time, cost and accident risk (Veisten et al. 2010a).