

# Ferry services, service frequency and waiting time

## Implications for transport analysis and benefit calculations

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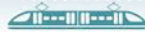
In this report, we look at how ferry services are treated in transport modeling and cost-benefit analysis, especially the importance of service frequency. A survey of current practice shows that the assumptions made about the inconvenience associated with waiting time on ferries vary between different models and tools. Results from the valuation study in 2018 show that travelers have a valuation of shorter headway that corresponds fairly well with existing literature on the disadvantage of waiting time. In a calculation example, we show that taking this into account in the benefit calculations could result in higher estimated road user benefits from an investment that replaces a ferry with a fixed connection. The same will apply to policies that increase service frequency.

Norway has many ferry connections, which play an important role in the transport system in the areas where these are located. Taking into account how the ferry service is perceived by road users is important when performing cost-benefit analyses of measures such as (1) improving ferry services, (2) replacing the ferry with a fixed connection or (3) moving traffic to or from the ferry through other changes in the transport system.

In this report, we map how the ferry service – especially departure frequency – is treated in today's transport analyses and cost-benefit analysis. Furthermore, we make recommendations based on recent empirical data and discuss the significance for estimated socio-economic profitability.

We attempt to answer the following questions:

1. How are ferry services and the inconveniences of travelling by ferry handled in the National Model for Passenger Transport (NTM), the Regional Models for Passenger Transport (RTM), the National Freight Model (NGM) and user benefit calculations?
2. How does this practice correspond with the results of the most recent Valuation study and other relevant empirical data?
3. Should one distinguish between different types of ferry connections, and if so, how?
4. What changes should be made to achieve a more uniform practice in line with the empirical basis?



5. What do changes in the methods imply for estimated user benefits from investments that replace ferries with fixed connections?

The disadvantage of a long headway, or the benefit of more frequent departures, can be divided into arrival waiting time and hidden waiting time. Arrival waiting time is the actual waiting time at the ferry quay. The hidden waiting time occurs at the point of departure. However, the concept of hidden waiting time is a bit imprecise because it does not strictly speaking have to be a matter of waiting time. It may also be that one adapts to the timetable by travelling earlier than one would prefer if one could choose the time of departure freely (and hence has to spend more time at the final destination), or experience disadvantages in e.g., adapting planned tasks.

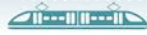
Our review of current practice shows that the assumptions one makes about the inconvenience associated with waiting time on the ferry, or the inconvenience of ferries more generally, vary. The national transport model uses a rough approach where both the travel time on board and the waiting time before departure are weighted by 1.8 compared to travel time by car. Waiting time is half the time between departures (departure interval), no matter how often the ferry departs. In the regional model, only the waiting time is given a separate weight, but a distinction is made between arrival waiting time («actual waiting time») and hidden waiting time. The arrival waiting time does not increase proportionally to the departure interval, as travelers adapt to the timetable to some extent. The hidden waiting time is the inconvenience of not being able to freely choose the time of travel and constitutes an additional inconvenience which is not captured by the arrival waiting time.

In the demand model in the regional transport model, the crossing time and arrival waiting time have the same weight as other travel time by car, but this also includes an inconvenience for ferries as a function of hidden waiting time. For work trips, this function is  $FU_A = 16,1 \cdot \sqrt{SVT}$ , where  $SVT$  is hidden latency. This implies a relatively high inconvenience. For leisure travel and other travel, the function is  $FU_F = 1,5 \cdot \sqrt{SVT}$ , which implies a significantly lower inconvenience. However, hidden waiting time is not included in the road user utility module, which calculates the benefits in NOK.

In the current version of Handbook V712 Impact Assessments, a distinction is made between ferry services close to cities and other services. Arrival waiting times are lower in urban connections given the same departure interval, based on an assumption that passengers know and adapt to the timetable to a greater extent. The handbook also states an inconvenience associated with ferries that comes in addition to the arrival waiting time.

As part of the latest Valuation Study, a comprehensive survey was conducted in 2018 in which participants answered questions about a trip and participated in a stated choice experiment with various hypothetical travel options. Part of the sample answered questions related to a ferry journey. The advantage of these data is that they provide information about both departure interval and arrival waiting time as well as travelers' valuation of changes in services, such as shorter departure intervals.

These data show that arrival waiting time increases with the departure interval, but that the relationship is decreasing, in line with previous literature. The results of the stated choice experiment show a similar decreasing relationship with regard to the valuation of shorter departure intervals. This valuation captures any inconvenience associated longer headways, both arrival waiting time and hidden waiting time, it does not distinguish between the two. The relatively high valuation implicitly indicates that arrival waiting time has a higher value than travel time on board, and that there is also an inconvenience associated with hidden waiting time.



The data from the Valuation Study do not contain information regarding on which ferry connection the ferry journey took place or the length of travel for the entire car journey. With the help of information about travel purposes and the number of people in the car, we can nevertheless distinguish between trips that are probably local and those that are probably longer journeys. When we do this, we find that local travelers have a lower valuation of travel time on board but place more emphasis on shorter departure intervals. This may be related to the fact that these have a greater inconvenience related to hidden waiting time.

Based on these results, we have inferred parameter values for arrival waiting time and hidden waiting time that can be used in user benefit calculations. A calculation example of an intervention that replaces a ferry with a fixed connection shows that these parameter values will provide a higher estimated benefit to road users than what is obtained with the current version of the user benefit module. How much this will affect the results will depend on the policy in question, for example the extent to which it also entails an improvement in travel time. Moreover, this change in practice will also imply higher estimated benefit to road users will from measures that improve ferry services.

Based on our findings, we provide recommendations for an updated text on the valuation of ferry services in Handbook V712 and development of the models in the short and long term. In the short term, we recommend that the inconvenience associated with waiting time is treated by weighting the arrival waiting time by a factor of 1.8 relative to travel time by car, and hidden waiting time by a factor of 0.8. We recommend using lower factors for business trips and freight vehicles. For the time being, we recommend that travel time on board the ferry be valued in the same way as other travel time by car. We emphasize that there is some uncertainty behind these recommendations, and that there is a need for more empirical evidence.