

Summary

Public transport passengers' valuation of universal design and comfort

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Many qualities of public transport affect the well-being of the users. Some users are willing to pay extra, in ticket costs or time spent, to achieve or maintain higher quality levels on public transport modes and their stops or stations. Many measures for strengthening the universal design of public transport will also increase the quality in general, for all users.

Most of the participants in our survey assessed the stops/stations they had used as relatively easily accessible, although they were also considered relatively secluded from other activity (businesses/residences). The lighting was considered partly deficient, and there was a lack of information about the surrounding area and lack of facilities such as a bicycle rack. Almost one in five stated special needs when traveling by public transport.

The users indicated a relatively high willingness to pay (WTP) for shelter and light on the stops/platforms and non-slippery surface and lighting on adjacent roads/sidewalks. Maintenance and cleaning, at the stops and on board, were also relatively highly valued. Seating and mobile coverage on board also achieved high willingness to pay estimates, as well as visual information about the next stop, temperature adjustment and air regulation, as well as drivers with "soft" driving style.

An updated valuation of quality factors

In this report we present an updated study of the economic valuation of quality factors related to the universal design of public transport, carried out during 2018 and 2019. Several of the factors related to universal design, that were valued economically for the first time in Norway in 2008/2009 (Fearnley et al., 2009, 2011), exist at different levels today compared to those ten years ago. Low-entry and/or low-floor buses/trams/trains have become the rule rather than the exception. The same applies to dynamic messaging signs and automated voice annunciators. However, some quality factors may represent similar challenges today as they did one decade ago, such as the (slippery) road surface conditions in winter, around (and to/from) stops/stations, as well as operation and maintenance in general. And there are still many bus stops with no shelter or other facilities.

Despite the changes in public transport, and in spite of methodological developments, we have attempted to achieve comparability against the previous valuation study of universal design factors (Fearnley et al., 2011). Moreover, it was also required a methodological consistency with the parallel valuation study for private and public transport (Halse et al., 2018; 2020). Compared to the study by Fearnley et al. (2011) we have expanded considerably the number of quality factors being valued. We have also expanded the public transport modes, from bus only to all land-based modes, that is, rapid transit (metro), light rail (tram), and conventional heavy rail (local/intercity). The "whole-journey" perspective has also been somewhat strengthened, including quality factors that relate to conditions around the stop/station and on the road to/from the stop/station.

In what is termed the Crowding Survey, carried out in late autumn of 2018, six quality factors were valued, three factors in each of two separate paths through the questionnaire. One share of the respondents assessed seat availability and mobile phone coverage on board, while the other assessed on-board information and the step/gap between vehicle and platform. The Crowding Survey retained more elements from the valuation study presented by Fearnley et al. (2011), e.g., applying illustrations showing the different factor levels.

In what we term our Main Survey, carried out in the summer of 2019, the respondents were first asked to evaluate quality factors with respect to their own last trip by public transport. All quality factors presented had three quality levels; these three levels could be graded from “low” (“worst”) via “medium” to “high” (“best”). In the subsequent choice experiments, they faced the same quality factors, together with travel or waiting time and ticket costs; first six pair-wise choices between alternatives described by four quality factors, time, and cost; and then six new pair-wise choices involving a different set of four quality factors, time, and cost. The levels of time and cost in the choice experiments were pivoted in respondents’ own travel/waiting time and ticket cost, as reported for their reference journey, but not the levels of the quality factors. While the quality factors all had three levels, the same for every respondent, the time and cost attributes had five levels adapted to each respondent (the reference, two levels below the reference, and two above). Respondents were allocated to one out of three questionnaire paths, facing different types of choice experiments with different quality factors. Thus, a total of 24 factors were valued; or rather 25, as one additional factor replaced another during the data collection. These quality factors related to the journey on board as well as to the waiting/transfer at stops/stations and the access/egress part.

The Main Survey also comprised the valuation of “packages” including several quality factors, applying the contingent valuation method. Three of the packages were assemblages of the eight quality factors from the two choice experiments. An additional package was a specific bus (and tram) stop upgrading package, comprising shelter, seating, step-less road-platform-vehicle connection, maintenance standard, and travel information.

Main results from the valuation of quality factors associated with the universal design of public transport

The following tables summarise our recommended values for the quality factors that were included in our 2018 and 2019 surveys. We have classified these into the following four groups:

- Quality factors related to journey on board and embarking/disembarking
- Quality factors related to the waiting/transfer at stops / platforms/stations
- Quality factors related to the area surrounding the stop/station (and the road to/from the stop/station)
- Quality factors related to the whole journey plus “packages” that include several quality factors

Table S.1a: Recommended valuations – quality factors on board and when embarking/ disembarking – Norwegian kroner (NOK-2019) per trip.

Factor	Low level	WTP (from low to medium)	Medium level	WTP (from medium to high)	High level	WTP (from low to high)
Driver quality	a small minority of the drivers provides a smooth ride	4.81	more or less half of the drivers provides a smooth ride	3.66	a large majority of the drivers provides a smooth ride	8.47
Temperature on board	very often too cold/warm	4.91	occasionally too cold/warm	5.12	almost always appropriate temperature	10.03
Air quality on board	very often bad air quality	6.96	occasionally bad air quality	3.59	almost always good air quality	10.55
Cleanliness on board	very often dirty/littered	7.78	occasionally dirty/littered	3.64	almost always clean	11.42
On-board dynamic messaging sign	none	5.03	sign showing next stop (no real-time information)	1.28	screen showing next stops, minutes until next stops, transfer points, messages/warnings	6.31
On-board automated voice annunciator of next stop/station	none				automated voice annunciator	3.2
On-board dynamic messaging sign and automated voice annunciator of next stop/station	none				screen showing next stops, minutes until next stops, transfer points, messages/warnings, plus automated voice annunciator	7.89
Step between platform and vehicle/wagon	≥10 cm				<10 cm	2.41 *
Gap between platform and vehicle/wagon	10-30 cm				<10 cm	5.74 **
Mobile phone coverage on board ***	none/bad	7.48	medium	6.43	good	13.91
Seat availability on board ***	none	4.71****	lower seat comfort	7.10	higher seat comfort	11.95

Note: The colour in the left column indicates in which survey or survey path the quality factors were valued. The green colour refers to the second path ("y path") of the Main Survey, and the pink colour refers to the Crowding Survey.

* Average values for metro/train, 2.78 NOK, and average values for bus/tram, 2.16 NOK.

** Apply to metro/train only (while the valuation applied to buses/trams is 0).

*** Average of different trip length intervals (respectively, 0-10, 10-30, and 30-90 minutes) – the valuation is increasing in travel length.

**** Given a assumption that the share of low sitting comfort is 60% and the share of high comfort is 40%

Table S.1b: Recommended valuations – quality factors at stop/platform – Norwegian kroner (NOK-2019) per trip.

Factor	Low level	WTP (from low to medium)	Medium level	WTP (from medium to high)	High level	WTP (from low to high)
Shelter at stop/platform	none	7.87	smaller shelter / small area with roof	2.20	larger shelter / the entire area partly/completely having a roof	10.08
Seats at stop/platform	none	3.99	smaller bench(es)	1.26	larger bench(es) with arm support	5.25
Cleanliness around stop/station	very often dirty/littered	6.14	occasionally dirty/littered	2.47	almost always clean	8.61
Maintenance	decay	5.61	destroyed elements are repaired/replaced after some time	2.57	destroyed elements are repaired/replaced fast	8.18
View from stop/platform	closed area – limited/no view	2.56	partly closed area – some view	2.87	open – view	5.43
CCTV at/around the stop/station	none	3.96	at stop/platform, not in surrounding/access area	1.92	at stop/platform and in the surrounding/access area	5.88
Access to security guards at stop/platform	no information about security guards	3.25	phone number to security guards	0.83	phone number to security guards and call point	4.08
Lighting at stop/platform	no lighting	6.93	dim lighting (not reading light)	0.58	bright lighting (reading light)	7.51
Information at stop/station about lines and itineraries	timetable	2.79	timetable plus overview of stops on the lines	0	timetable plus overview of stops on the lines plus overview of the public transport network	2.79
Information at stop/station about the surrounding area	no map	2.52	a map of the area	1.57	a map of the area plus information about routes to various places	4.09

Note: The colour in the left column indicates in which survey or survey path the quality factors were valued. The blue colour refers to the first path (“x path”) of the Main Survey, and the yellow colour refers to the third path (“z-path”) of the Main Survey.

Table S.1c: Recommended valuations – quality factors of the area surrounding the stop/ station (and of the road to/from the stop/ station) – Norwegian kroner (NOK-2019) per trip.

Factor	Low level	WTP (from low to medium)	Medium level	WTP (from medium to high)	High level	WTP (from low to high)
Road surface quality around the stop/station	larger cracks or holes/ponds	4.41	smaller cracks or holes/ponds	2.10	no cracks or holes/ponds	6.50
Gravel/sand around the stop/station (after the winter)	remains there for several weeks	0.81	remains there for maximum one week	2.59	road surface is almost always clean	3.40
Leaves around the stop/station (in autumn and afterwards)	remains there for several weeks	1.43	remains there for maximum one week	0.81	road surface is almost always clean	2.24
Lighting around the stop/station	no lighting	9.42	traditional (dim) road lighting	0.99	novel LED lighting	10.41
Road condition (in winter) around the stop/station	often slippery	10.30	occasionally slippery	2.37	almost always good foothold	12.67
Access to stop/platform	major detour	8.43	minor detour	2.28	approximately the shortest possible distance	10.71
Bicycle parking near/at the stop/station	none	1.36	simple rack	1.25	lockable rack under roof	2.61
Visible real-time information when approaching the stop/ station	none	4.40	not visible before arriving at stop/platform	1.77	visible within distance from the stop/platform	6.17
Amenities near the stop/station	none	1.22	kiosk	0	kiosk and café/shops	1.22

Note: The colour in the left column indicates in which survey or survey path the quality factors were valued. The blue colour refers to the first path (“x path”) of the Main Survey, and the green colour refers to the second path (“y-path”) of the Main Survey.

Table S.1d: Recommended valuations – quality factors related to the entire journey plus «packages» comprising various quality factors – Norwegian kroner (NOK-2019) per trip.

Factor	Low level	WTP (from low to medium)	Medium level	WTP (from medium to high)	High level	WTP (from low to high)
Availability of mobile phone charging	none	4.05	can charge on all vehicles	0.74	can charge on all vehicles and all stops/stations	4.79
Mobile phone app for defining specific needs	none	4.98	covers only main stations / hubs and surrounding areas	0	covers all stations/ stops in the public transport network	4.98
Specific bus/tram stop upgrading package (CV2)						4.00
Package “x” – eight factors related to the stop/platform and the access/egress (xCV1)						10.70
Package “y” – eight factors related to the travel on board and the surroundings of the stop/station (yCV1)						8.60
Package “z” – eight factors related to the stop/platform & the whole journey (zCV1)						5.10

Note: The colour in the left column indicates in which survey or survey path the quality factors were valued. The yellow colour refers to the third path (“z-path”) of the Main Survey, blue colour to the first path (“x-path”), and green colour to the second path (“y-path”) of the Main Survey. The specific bus/tram stop upgrading package included a specific mix of factors comprising shelter, seating, step-less road-platform-vehicle connection, maintenance standard, and travel information.

For most of the (single) quality factors, valued by choice experiments, the estimated willingness to pay is somewhat higher for a change from “low” to “medium” (or for preventing a change from “medium” to “low”) than it is for a change from “medium” to “high” (or for preventing a change from “high” to “medium”). However, for some quality factors, estimated willingness to pay for these two “steps” are almost the equal (e.g., for on board temperature and air quality, driver quality, as well as for the view from the stop/platform and for bicycle parking facility). Whether willingness to pay is decreasing, is approximately linear, or is increasing, will, of course, depend on how the levels are defined/specified. What matters is that the economic value will depend on what is the reference level, what the level of quality factor is at the outset. For similar changes in quality factors, the willingness-to-pay estimates from our study are roughly comparable to the estimates from Fearnley et al. (2011).

Regarding the fact that mean willingness to pay for the packages barely exceeds the highest valuation of single quality factors (from lowest level to highest level) can be explained by the following:

- Those who valued the packages did not necessarily have the lowest level as a reference for the quality factors; the willingness to pay for an improvement from medium to high is lower than for an improvement from low to high.
- The valuations from the attribute-based choice experiments comprise a mix of willingness to pay for improvement (when the alternative has a higher level than the respondent's reference) and “compensation claim” (when the alternative has a lower level than the respondent's reference). Valuations based on compensation claims, willingness to accept a reduction/deterioration (or willingness to pay for preventing it), are higher than valuations based on WTP for obtaining an improvement (Hanemann, 1999; Flügel et al., 2015).

- Respondents have budget constraints, so when they have “purchased” one single quality factor improvement (or a set of four quality factor improvements), they have less left to “purchase” other quality factor improvements (Randall & Hoehn, 1996). We find that our respondents in general have taken their budget restrictions into account, which is due to a compulsory payment mechanism (ticket costs) combined with a perception of the valuation scenario being credible. Respondents were then more likely to perceive that their responses could affect the implementation of the scenarios they were asked to assess/evaluate (Carson & Groves, 2007). However, while the choice experiments included four factors, the packages included eight.

For some of the quality factors, the estimated willingness to pay varies with respect to transport mode and trip length. The valuation of mobile phone coverage and seat availability/quality increases (considerably) in trip length. For the reduction of step height (between platform and vehicle), willingness to pay estimates are higher for the sub-samples of metro and train users than among bus and tram users; and only the former samples indicate a willingness to pay for reduced gap between the platform and the vehicle. In general, travellers with rail transport (train, metro, tram) had a slightly higher willingness to pay for increasing the level of quality factors.

When comes to the assessment of willingness to pay for quality factors with respect to individual characteristics, in the choice experiments there was estimated a somewhat higher mean willingness to pay for those respondents indicating challenge in travelling by public transport. Furthermore, a somewhat higher mean willingness to pay was estimated for females compared to males; as well as higher willingness to pay for respondents of age above 50.

In the contingent valuation of packages it was found a positive covariation between age and willingness to pay for the package comprising quality factors related to the waiting/transfer at stops/platforms and to the road to/from the stop/station (“x package”), which also included non-slippery roads in winter. Beyond that, we did not find any other statistically significant covariation between individual characteristics and estimated willingness to pay for the packages.