Economic appraisal of Universal Design in transport: Experiences from Norway

James Odeck[2,3], Trine Hagen[2], Nils Fearnley[1]

[1]Institute of Transport Economics, Gaustadalléen 21, 0349 Oslo-N

[2]Norwegian Public Roads Administration, Po Box 8142, 0033 Oslo-N

[3]Molde University College, P.O. Box 2110, 6402-N,

Email: james.odeck@vegvesen.no
Nils.fearnley@toi.no
trine.hagen@vegvesen.no

ABSTRACT

Economic assessment of universally designed transport projects has been lacking in the literature of transport planning. Universal Design refers to the design of transport systems in a way that they are accessible to all users, irrespectively of the users' abilities. This definition of Universal Design has not yet gained roots in transport economic literature. The conventional thinking is that Universal Design is for the few, e.g. the impaired, and given that they are few in numbers, Universal Design projects will generally be unprofitable from a socioeconomic point of view because benefits will be low while investments costs will be too high. The objective of this paper is to prove the opposite: Universal Design projects benefit all transport users whether impaired or not and the additional costs of implementing them are generally low, hence, their net present values are high and positive. We build on a collaborative work between the Norwegian Public Roads Administration (NPRA) and the Institute of Transport Economics (TOI) aimed at creating guidelines for assessing the economic merits of Universal Design projects. Hence, we (1) define how Universal Design is to be understood in the context of road and public transport, (2) describe the types of benefits and costs that accrue to users if Universal Design projects are implemented, (3) address how the benefits and cost can be valued in monetary terms and, (4) using 3 different types of projects, demonstrate that Universal Design projects are surprisingly profitable from a socioeconomic point of view. Finally, we address the implications of our findings and why governments need to be concerned with Universal Design of transport systems.

1. Introduction

In the recent years many governments have introduced the concept of Universal Design in their transportation planning systems. For Norwegian case which this paper is about, the concept was introduced into the National Transport Plan by the parliament in 2004. Universal Design (UD) refers to the design of transport systems in a way that they are accessible to all users, irrespectively of the users' abilities. Unfortunately, UD as a concept has not yet gained roots in the literature of transportation appraisal. The conventional thinking of the concept is that universally designed projects are aimed at the few e.g., the disabled. Given that such groups of people are a minority, it is generally thought that universally designing projects to accommodate them will be unprofitable from socioeconomic point of view because benefits which are proportionally to the number of users will be low as compared to the cost of realizing them. Thus, many planners have argued that Universal Design projects should not be subjected to appraisals such as benefit-cost analysis for four main reasons: (1) UD projects are aimed at the disabled and should be a must, hence no economic assessment is required, (2) UD projects are known to have low benefits while their investment costs are high hence, they will always be unprofitable, (3) there is no appropriate and established procedure for conducting benefit-cost analysis of UD projects and, (4) even if there were appropriate procedures for conducting benefit-cost analysis, benefits of UD are difficult to quantify in monetary terms and benefit-cost analysis is not possible.

The aim of this paper is to show that it is possible to conduct an economic appraisal of Universal Design projects in the road sector and that most Universal Design projects are aimed at all transport users, have relatively low investment costs and hence, are most likely to be beneficial from socioeconomic point of view. The paper builds on collaborative work between the Norwegian Public Roads Administration and the Institute of Transport Economics (TOI) aimed at creating guidelines for assessing the economic merits of Universal Design transport projects in Norway.

The rest of this paper is organised as follows. Section 2 defines Universal Design and how it is to be understood in the road transport sector. Section 3 describes the types of benefits that are expected from Universal Design projects, section 4 addresses how the benefits and costs are valued in monetary terms and the benefit-cost analysis. Section 5 uses three typical Universal Design projects to illustrate that Universal Design projects are surprisingly profitable from an economic point of view. Finally, Section 6 addresses the policy implications.

2. Understanding Universal design in transport

Universal Design refers to transport system or facility designs that accommodate the widest range of potential users, including people with mobility and visual impairments (disabilities) and other special needs. A term closely related to it and which sometimes is used interchangeable with it is *accessibility for all*. However, while accessibility for all considers all range of users it leaves out the design aspect.

Although planners and decision makers may view Universal Design as primarily directed towards the needs of people with disabilities, it is a comprehensive concept that if utilized correctly as defined, can benefit all users. For example, Parents pushing baby strollers on snow filled sidewalks are not disabled, but their needs should be considered in facility design. Increased walkway widths, low-floor buses and smooth walking surfaces improve convenience for all travelers, not just those with mobility impairments. Curb ramps are important for people using handcarts, scooters, baby strollers and bicycles, as well as wheelchair users. Automatic door openers are another example of Universal Design features that can benefit many types of users. Universal Design should be comprehensive, meaning that it results in seamless mobility options from origin to destination for the greatest possible range of potential users. It should consider all possible obstacles that may exist in buildings, transportation terminals, sidewalks, paths, roads and vehicles. It should also consider all possible obstacles for the visually impaired.

This wider view of Universal Design has been adopted by the Norwegian transport authorities and was introduced into the National Transport Plan by the Parliament in 2004. The definition of Universal Design as adopted by the Norwegian road authorities is defined as "*The design of infrastructure, transportation systems or their surroundings to accommodate the widest range of potential users regardless of their impairments or special needs*". As a consequence emphasis has been put on adjusting the transport systems in order to enable all people to travel, regardless of their impairments or special needs. This is being done by realizing the so called Universal Design projects.

The Universal Design projects that are currently being considered in the Norwegian road and public transport sector are numerous and the most typical ones today includes: (1) investment in low-floor buses, (2) elevated bus stops and smooth walking surfaces at bus stops and transport terminals, (3) construction of curb ramps at stations and terminals, (4) Maintenance and cleaning of bus stops including snow plowing both at the bus stops and walking paths, (5) Bicycle parking at buss stops, (6) Timetable route maps at bus stops, (7) Real time information at bus stops, stations and terminals, (8) lights at bus stops, stations and terminals etc. Besides all these types projects that actually are implemented to correct for lack of Universal Design, the Norwegian planning framework demands that all new infrastructure investments must be universally designed.

Like in all other forms of investments in the transport sector, a good planning practice requires that the merits of projects are evaluated such that the most profitable ones from socioeconomic point of view should be selected. Universal Design should be no exception to this requirement. In Norway as in many other Western European countries and the US, a most common approach in use for evaluating the merits of transport projects is the Benefit-Cost Analysis. However, methods for economic assessment of Universal Design projects are few, in the literature of transport economics and transport planning; see for instance Wara (2009) and Maynard (2007). One possible reason for lack of economic assessment of Universal Design in the literature is the conventional thinking that Universal Design is for the few e.g., disabled, and given that they are few in numbers, Universal Design projects will generally be unprofitable from a socioeconomic point of view because benefits will be low while investments costs will be too high. Hence, there has been no need for such evaluations. A second reason could be that BCA tailored for Universal Design are non-existent and, the third reason could be that planners and economist have had difficulties in quantifying the benefits of Universal Design projects, not the less identifying the benefits.

Following the adoption of Universal Design in the Norwegian Transport plan in 2004 as mentioned above, the Norwegian Public Roads Administration charged with impact assessment of its undertakings authorised a preliminary study called “Smaller public transport measures”. The core of that study has been to be able to conduct BCA for smaller public transport projects within the road sector; Universal Design included. In that study it emerged that BCA for Universal Design is quite possible and most of them were likely to be profitable from socioeconomic point of view. Most interestingly, the measures of benefits of Universal Design projects were in fact very similar to those of traditional road and public transport measures such that the already available values e.g., value of time could be used. Another conclusion that emerged was that besides the fact that Universal Design should be a minimum requirement for all undertakings in the transport sector, it can also be a profitable investment of additional quality of services. The study was a collaborative work between the Norwegian Public Roads Administration as the procurer and manager and the Institute of Transport Economics, Norway, as the consultant.

2. The benefits of Universal Design projects

The definition of Universal Design has been given above as well typical projects aimed at achieving it. Next is an elaboration of the types of benefits that will accrue to users if Universal Design projects are realized. It is almost impossible to describe all the benefits that Universal Design projects will have, but it will suffice to describe a few of them. An underlying rationale as described above is that Universal Design projects benefit all users while it is for necessary for some of them.

Consider first, a Universal Design project in the form of investing in a low-floor bus in a given route. In the first instance, the project may be considered to be necessary for the impaired in some e.g., wheel chair users and the elderly with walking difficulties. In the second instance, they are necessary not only for the impaired, but for the burdened users such as those with baby strollers, those with luggage on trolleys etc. The natural question to ask in this respect is what are the benefits for these users due to investments in low-floor buses in the route? The answer is quite plausible; they will save time entering and departing buses and they will obtain some comfort while doing so. These are benefits that must be taken into account. Now, consider the benefits to the non-impaired and the non-burdened on the bus route. The benefits to these users are similar to those for the impaired or burdened. First, if the impaired or the burdened save time entering and departing the bus, this implies that all the other users too will save time entering and departing the bus. Second, if all users save time entering and departing the bus, then there will be a travel time saving for all passengers on board the bus. Third, travel time saving may generate more traffic(patronage effect) on the route and fourth, the bus company operating the route may experience some efficiency gains due to time saved. Thus, it can see that such a simple project can have plenty of benefits to all users.

Consider yet a simpler Universal Design project such as light at bus stops. Installing light at a bus stop will lead to improved total overview, improved readability of information, increased sense of security and increased level of identification of approaching buses; again all these benefits will accrue to all users and not only for those with vision impairment.

A conclusion that can be drawn from the types of benefits of Universal Design is that they are many and will depend on the specific project. However, some of the benefits are similar to those that are derived from transport improvements such as travel time savings, improved comfort, and increased sense of security.

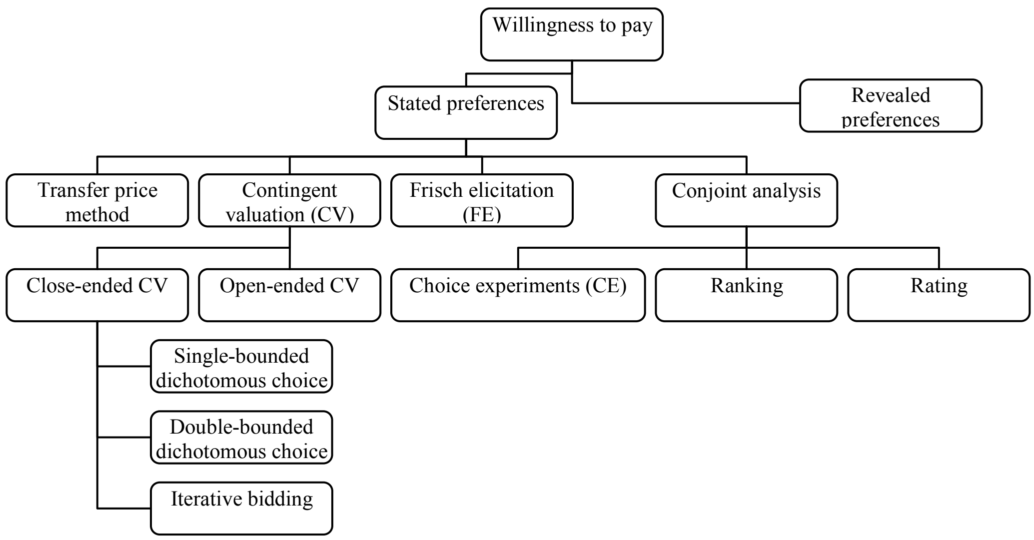
4. Valuing benefits and costs. and the benefit-cost analysis for Universal Design

Before a benefit-cost analysis can be conducted valuing benefits and costs is a prerequisite also for Universal Design projects.

4.1 valuing and calculating benefits

Valuing benefits from Universal Design impacts is quite similar to those of traditional benefits from transport investments in general. Because benefits of quality improvements cannot be observed in the market, they are evaluated in monetary terms primarily through stated preference techniques, particularly through the choice experiments method (CE) (Hensher *et al.* 1988, Wardman 1998), but there is a wide array of SP techniques available, as illustrated in figure 1.

Figure 1: Stated preference methods. (Source: Figure 1 in Fearnley et al. (2008))



As mentioned earlier, there has been little research evidence of valuations of benefits with respect to Universal Design. However, given that most benefits that accrue from Universal Design are similar to other forms of transport projects, especially smaller public transportation projects, an initial way of deriving values of benefits is a literature survey. This is the approach that has been employed in the Norwegian case while awaiting a complete valuation study tailored for Norway (Fearnley et al. 2009, forthcoming).

A broad literature search by Nossum and Killi (2006) identified a handful of international studies that have documented passengers' valuations and estimated mainly with SP data. Their recommendations for a Norwegian setting are reproduced in table 1.
Note that the table contains only a selected number of impacts; due to space value for travel saving etc, which are well known impacts to have values in transportation, are not included.

Table 1: Recommended valuations for smaller public transport measures

Measure	Nominal value per trip	Valuation in Eurocents*	Source
Bicycle parking at bus stop **	NOK 4	54.0	Vibe et al 2004
Bus shelter	NOK 0.60	13.1	Norheim 1996
Maintenance and cleaning of bus stop	11.8 pence	32.0	Steer Davies Gleave 1996
Timetable at bus stop	SEK 2.00	42.0	Blomquist og Jansson 1994
Route map at bus stop	NOK 0.40	8.8	Norheim 1996
Sign on board in bus indicating next stop	SEK 2	30.4	Persson 2000
Sign on bus indicating final destination	SEK 0.12-0.32	6.3	Widlert m fl 1989
Real time information at bus stop	NOK 1.15	26.3	Hammer og Norheim 1993
Next stop information announced by driver	NOK 1	15.3	Persson 2000
Cleanliness on board	11 pence	25.5	Accent Marketing and Research 2002
Lights at bus stop	3,1 pence	8.4	Steer Davies Gleave (1996)
Guards at bus stop	NOK 1.50	32.9	Norheim 1996
Emergency telephone at bus stop	NOK 0.80	17.5	Norheim 1996
Lowfloor bus	2.8 pence	7.6	Steer Davies Gleave (1996)

Source: Selected items from Table 8.1 in Nossum and Killi (2006)
* Year 2005 prices, using 2005 exchange rate NOK8 = €1. *** Bicyclists only

Recently, Currie and Wallis (2007) presented evidence of patronage effects and passengers' valuations of a number of "'soft' bus vehicle improvements", which are reproduced in Table 2. Although very useful, these values are currently not being used; the BCA method being in use as per today does not take account of patronage effects.

Table 2: Copy of Table 2 in Curry and Wallis (2007), "'Soft' Bus Vehicle Improvements – Value and Estimated Patronage Impacts"

'Soft' Bus Improvement		Valuation[1] (In-Vehicle Time Mins.)	Notes	Estimated Patronage Impact (%)[2]
Boarding	No Step	0.1	Difference between 2 and no steps	0.17
	No Pass Show	0.1	Two stream boarding, no show pass vs single file past driver	0.17
Driver	Attitude	0.4	Very polite helpful cheerful well presented vs businesslike and not very helpful	0.68
	Ride	0.6	Very smooth compared to jerky	1.02
Cleanliness	Litter	0.4	No litter compared to lots of litter	0.68
	Windows	0.3	Clean windows, no etchings compared with dirty windows and etchings	0.51
	Graffiti	0.2	No graffiti compared with lots	0.34
	Exterior	0.1	Completely very clean compared to some very dirty areas	0.17
	Interior	0.3		0.51
Facilities	Clock	0.1	Clearly visible digital clock with correct time vs no clock	0.17
	CCTV	0.7	CCTV, recorded, visible to driver plus driver panic alarm compared to no CCTV	1.19
Information	External	0.2	Large route number & destination sign front, side and rear plus line diagram on side vs small signs	0.34
	Interior	0.2	Easy to read route no. & diagram compared to none	0.34
	Info of next stop	0.2	Electronic next stop sign and announcements vs no information	0.34
Seating	Type/layout	0.1	Individual shaped seats with headrests all facing forward vs basic double bench some backwards	0.17
	Tip-up	0.1	Tip up sets in standing/wheelchair area compared with all standing area in central aisle	0.17
Comfort	Legroom	0.2	Space for small luggage vs restricted legroom and no space for small luggage	0.34
	Ventilation	0.1	Push open windows giving more ventilation vs slide opening windows	0.17
		1.0	Air conditioning	1.70

Source: [1] (Based on Australian Transport Council, 2006).
Note: [2]Assumes a 20 minute bus journey with 5 minute access/egress walk, 5 minute wait, a $1.50 fare and a value of time of $Aust 10.00/hr (2006). This makes a weighted generalised cost of 59mins. Forecasts are made by applying a generalised cost elasticity of -1.0 to the change each soft factor has on this base generalised time. These assumptions are based on (Booz Allen Hamilton, 2000b; Australian Transport Council, 2006).

Once values of benefits in Table 1 above have been used to calculate annual benefits from a given Universal Design project, the benefits over the project life must be estimated. To estimate benefits over a period of *t*=25 years, which is the standard appraisal period for Norwegian transport investments, the following well known formula is applied: Naming the sum of benefits *B* and the discount rate r, we have:

$$\frac{B}{(1+r)}+\frac{B}{(1+r)^2}+\frac{B}{(1+r)^3}+\cdots+\frac{B}{(1+r)^t}=\frac{B}{r}\left[1-\frac{1}{(1+r)^t}\right], \qquad (1)$$

where *B* is the sum of benefits, *r* the discount rate and; *t* the discounting period.

4.2. Calculation of costs

From economist's point of view, the costs of implementing Universal Design projects are the same as those related to other investments in the public transport system. There are capital cost, maintenance cost and cost of renewal at the end of the installation's economic life.

Additionally, a shadow price on public funds may be applicable. Finally, costs (or disbenefits) may accrue if the project reduces welfare of other agents through, e.g. increased time use. However, and this is important: once an investment is decided, the extra cost of including Universal Design specifications is normally very low. Frequently, it is only a matter of incorporating Universal Design objectives at a sufficiently early stage of the planning process, and the extra cost can be close to zero. In a similar way, the cost of transforming a conventional bus into a low floor bus is expensive whereas the cost of adding low floor specifications when a new fleet is ordered is very small (if any, as low floor buses are becoming the standard).

The calculation of costs over an appraisal period of 25 brings in the issues of the installation's economic life and of residual value in year 25.

We have,

- V is the present value of all reinvestments up to year 25
- n is the installation's economic life
- m is the largest integer which satisfies $(m-1)n \leq 25$

This is illustrated in the figure below, where -C is the investment cost in year 0 and all repeated investments up to the end of the appraisal period in year 25.

We get

$$V = -C - \frac{C}{(1+r)^{n}} - \frac{C}{(1+r)^{2n}} \cdots - \frac{C}{(1+r)^{(m-1)n}} \qquad (2)$$

Using the summation formula, we get[1]:

$$V(m) = -C \frac{1 - \left(\frac{1}{(1+r)^{n}} \right)^{m}}{1 - \frac{1}{(1+r)^{n}}} = -C \frac{1-(1+r)^{-nm}}{1-(1+r)^{-n}} \qquad (3)$$

In addition there is the residual value of the installation in year 25, which must be subtracted. Present value of the residual value, R, is:

[1] What annual fixed payment corresponds to V(m)? That is A(25):

$$V(m) = A(25) * \frac{1-(1+r)^{-25}}{r}$$

$$A(25) = \frac{r}{1-(1+r)^{-25}} * \frac{1-(1+r)^{-nm}}{1-(1+r)^{-n}} * (-C)$$

$$R = -C\frac{25-nm}{n} * \frac{1}{(1+r)^{25}} \qquad (4)$$

Adding (3) and (4) we obtain investment costs over 25 years, corrected for any residual value.

4.3 Benefit-cost analysis

Benefit-cost analysis involves comparing the discount benefits against the discount cost to determine the socioeconomic merit of a project. The difference is termed Net Present value (NPV). If NPV is equal or greater than zero then the investment is profitable from socioeconomic point of view; the benefits that accrue from the investment are equal or greater than the costs. If NPV is negative then the investment is unprofitable.
Net present value (NPV) of the investment is obtained by subtracting investment costs over 25 years (3), corrected for any residual value (4), from the present value of benefits (1):

$$NPV = \frac{N}{r}\left[1-\frac{1}{(1+r)^{t}}\right] - \beta\left[C\frac{1-(1+r)^{-nm}}{1-(1+r)^{-n}} + C\frac{25-nm}{n} * \frac{1}{(1+r)^{25}}\right]$$

Note that a factor β must be added to costs in order to reflect the marginal cost of public funds. $\beta \geq 1$ (conventional procedure in Norway is to set β=1.2 meaning that for every NOK financed through the government budget has a cost 20% of a NOK).

When projects are to be ranked against other, then a benefit-cost ratio must be used and projects ranked in a descending order according to that ratio. The benefit-cost ratio is calculated as:

$$\text{Benefit-cost ratio} = \frac{\text{NPV}}{\text{Share of finance through goverment budget}}$$

Thus, share of project finance through government budget appears as the denominator to reflect the fact that it is in fact the government budget that is the rationing factor. It should be reminded that this ratio applies only when the NPV is positive; otherwise there is no need to rank unprofitable projects.

5. Illustrating the socioeconomic profitability of Universal Design using three projects

The sections above have described the how Universal Design is to be understood, the benefits and costs that accrue from it and how benefit-cost analysis for evaluating it can be conducted. We have along the way contended that if its definitions are interpreted correctly in the sense that Universal Design Projects benefit all users and not only the impaired, then it can be proven that most Universal Design projects will be profitable investments from socioeconomic point of view. In this section we demonstrate that Universal projects are most likely to be profitable using three typical Universal projects in the case of Norway.

The three projects that use are: (1) implementation of a low-floor bus, (2) the implementation of high curbstone at a bus stop and, (3) enhanced lighting at bus stops. These three categories of projects all have in common that they lead to increased quality as well as better accessibility for all in the public transport system, regardless of personal characteristics. For the three case studies, the types of benefits and cost that will accrue to users are as in the Table 4 below.

Table 4: Types of benefits and cost for the three case projects

Universal Design Project	**Benefits**	**Costs**
Low-floor bus	Eases boarding and alighting the bus(comfort factor) for all passengers	Investment and manitenance of low floor bus
	All passengers save time boading and alighting	
	All passengers in the bus save time because boarding/alighting the bus is quicker	
	Bus company obtains an efficiency effect due to time saving(not included in the analysis)	
	Reduction of subsidies from the government due increased patronage(not included in the analysis)	
Implementation of high curbstone at a bus stop	Eases boarding/alighting the bus(comfort factor)	
	All passengers save time boarding/alighting the bus	
	Bus company obtains an efficiency effect due to time saving(not included in the analysis)	Investment and manitenance of curbstones
Enhanced lighting at bus stops	Improved total overview,	
	Improved readability of information,	
	Increased sense of security and increased level of identification of approaching buses	Investment in lighting and maintenance

For all the three projects, values of impacts used were obtained from Nossum and Killi (2006) which has now become a standard for Universal Design projects. Further, the economic assessments were conducted according Section 4 above.

The cost data used were obtained from the regional offices of the Norwegian Public roads administrations charged with building and maintaining the Universal Design facilities. Passenger related data were obtained from the bus companies that operate the routes. All the three projects are from the Oslo area.

The results of the benefit-cost analysis conducted are shown in Table 5.

Table 5: The results of benefits-cost analysis of the three illustrative projects

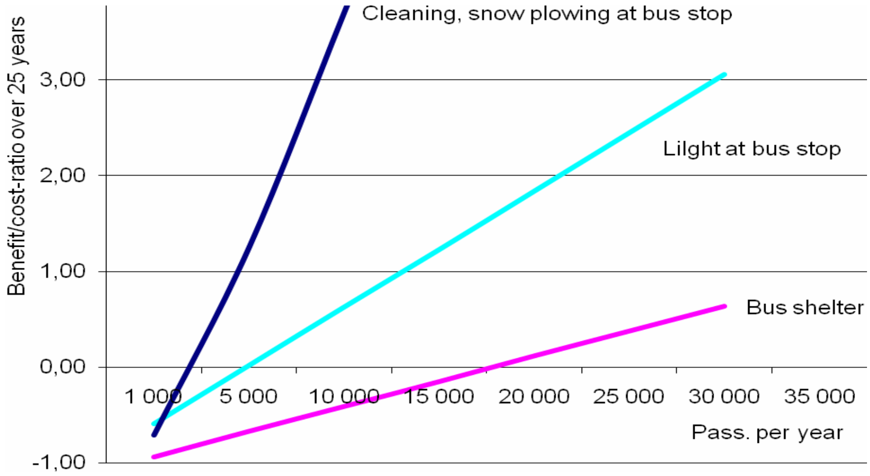
	Low-floor bus	Implementation of high curbstone at a bus stop (All values in NOK[1])	Enhanced lighting at bus stops
Initial data and assumptions:			
Investment cost of installation	65000	155000	16000
Annual operational and maintenance costs	0	7500	1000
Projects life time	18	25	15
Number of passengers using the low-floor bus per year	15000 -	-	
Average patronage(passengers per bus)	28	12 -	
Number of passengers per year at bus stop	-	71200	
Time savings per passenger due to innstallation(in minutes)	0.3	0.3	100000
		-	
Benefit-cost analysis			
Annual benefits for users	12300	24920	67000
Annual benefits for non-users	0	0	0
Annual benefits for operators	795	1887	0
Sum annual benefits	13095	26807	67000
Present value of benefits(discounted over 25 years)	194175	397497	993489
Present value of costs (investment,operational and maint.)	-81215	-271216	-37988
Socioeconomic profitability			
Net present value(NPV)	96717	72037	947903
Benefit-cost ratio	1.2	0.3	25

[1] 1 Euro = 9 NOK

The results of all the three illustrative projects are demonstrative to the effect that Universal Design projects are socioeconomically profitable. An explanation for this is that Universal Design projects have relatively low cost of implementation while the benefits accrue to all types of users.

In a similar fashion, Fearnley (2007) illustrate how benefit/cost-ratios of three minor Universal design investments depend only on the number of passengers per year at the bus stop, and that they are surprisingly profitable. Benefit/cost-ratios exceed 0 already at 5000 passengers per year (or 10-20 per day) both light and cleaning and snow plowing. See figure 2, below for an illustration of how the benefit-cost ratio varied by no of passengers per year.

Figure 2: Benefit/cost-ratios of three minor investments, with standardized cost assumptions. Source: Fearnley (2007)



6. Conclusions and Policy implications

In this paper we have argued that Universal Design of transport projects should be taken seriously as it bring about benefits in excess of investments costs. Underlying this contention is the fact that Universal Design benefits all users contrary to the traditional thinking that it only benefits the impaired. We have précised it's meaning, defined benefits that accrue from it, showed how those benefits can be valued in monetary terms, how its benefit-cost analysis can be carried out and finally used illustrative examples to prove that Universal Design projects are most probably profitable from socioeconomic point of view. In that process we have derived some conclusions and policy implications which are as follows:

(i) Universal Design should be considered seriously by governments as they benefit all users and are necessary for a group users e.g., the impaired and the burdened.

(ii) The benefits and cost of Universal Design projects are possible to measure in monetary terms such that a benefit-cost analysis can be conducted.

(iii) The benefit-cost analysis of Universal Design shows that they general are a profitable form investments characterized by high benefits and low investment costs.

(iv) Finally, benefit-cost analysis of Universal Design projects are quite possible even though it is not possible to account for all factors which if accounted for will reveal even more of their benefits e.g., the patronage factor.

Finally, this paper has shown that there are several reasons for governments to be concerned about the introduction of Universal Design. By introducing Universal Design in the transport sector, governments will carry out cost-efficient measures that are socio-economically more profitable as compared to other traditional measures. This is a reason good enough to start focusing on Universal Design in transport.

REFERENCES

Axhausen, K. W. (2003). Definitions and measurement problems. In: Axhausen, K. W et al (eds.) Capturing Long Distance Travel, *Research Science Press,* Baldock.

Bjerkan, K. Y. (2009). Funksjonshemmende kollektivtransport? Transportbruk og transportvansker blant personer med nedsatt funksjonsevne. Notat nr 2/09. Norsk institutt for oppvekst, velferd og aldring, Oslo.

Currie, G. and Wallis, I (2007). Effective Ways to Grow Urban Bus Markets – A Synthesis of Evidence. Paper presented at the Thredbo conference 2007, Workshop 1A.

Fearnley, N, S Flügel, M Killi, M Leiren, Å Nossum and F Ramjerdi (2009, forthcoming). *Passengers' valuations of accessibility of public transport*. Paper to be presented to the 12th International Conference on Travel Behaviour Research in Jaipur, Rajasthan, India, December 13-18, 2009

Fearnley, N. 2007. "Er et leskur lønnsomt?" ("Is a bus shelter profiable?") article in transport magazine *Samferdsel*, No.7/2007

Fearnley, N and Å. Nossum, 2004. Public transport packages of measures 1996-2000. Economic evaluations (in Norwegian) TØI report 738/2004. Institute of Transport Economics.

Fearnley, N, K Sælensminde and K Veisten, 2008. Combining choice experiements with contingent valuation and the Frisch elicitation method. In *International journal of transport economics* Vol. xxxv no 3 October 2008

Hensher, D.A., Barnard, P.O. and Truong, T.P., 1988. The role of stated preference methods in studies of travel choice. *Journal of Transport Economics and Policy*, 22(1), 45-58.

Madre, J. L, Axhausen, K.W., Brög, W (2007). Immobility in travel diary surveys. *Transportation.* Volume 34, no 1 2007.

Maynard, A (2007) The economic appraisal of transport projects: the incorporation of disabled access. PhD thesis, Cranfield University School of ManagementCentre for Logistics and Supply Chain Management Doctor of Business Administration Academic year 2006 – 2007

Norheim, B. and Stangeby, I. (1993). Bedre kollektivtransport. Oslo-trafikantenes verdsetting av høyere standard. TØI rapport 167/1993. Institute of Transport Economics.

Nossum, Å. and Killi, M. (2006). Trafikantenes verdsettinger av enkle kollektivtiltak ("Passengers' valuations of simple public transport measures; in Norwegian). Arbeidsdokument: PT/1851/2006. Institute of Transport Economics.

Sjøstrand, H. (1999). Värdering av kvalitet i lokal kollektivtrafikk med Stated Preferences-metoden. Lund Tekniska Högskola, Institution för Teknik och samhälle. Avdelning Trafikplanering. Bulletin 175

Stangeby, I. and Nossum, Å. (2004) Safe public transport. Public transport users? experiences of using public transport and measures to increase safety.. TØI report 704a/2004. Institute of Transport Economics.

Wardman, M., 1998. The value of time: a review of British evidence. *Journal of Transport Economics and Policy*, 32(3), 285-316.

Waara N, 2009 "Old and disabled people's need and valuation of traveller information in public transport". Forthcoming paper to be presented at the 2009 European Transport Conference