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A stated preference model to value reductions in community severance

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Abstract

This paper presents the results of a stated preference survey to assess the value of reductions in community severance (the "barrier effect" of transport infrastructure on the mobility of pedestrians). In a first exercise, participants chose between crossing a road in a place without designated facilities or walking additional minutes to a place where the road is covered over. Half of the participants never chose to cross, regardless of the road design, traffic characteristics, and length of the detour. On average, the other half would only cross the road, if the detour was at least 7.5 minutes, or higher, if the road had extra traffic lanes, no central reservation, and high traffic density. In a second exercise, participants were asked if they would cross the road if they could save money by using a shop or a bus stop on the other side of the road, instead of one on their side of the road. 38% never chose to cross. The cost saving for which the other 62% would cross depends on the scenario, especially regarding traffic volume. On average, participants would only cross a road with high traffic volume if the saving was £2.8. Overall, the study suggests that many people are not willing to trade-off pedestrian safety with shorter walking times or cost savings. People who are willing to trade-off attach greater importance to some aspects (like traffic density) than others (like traffic speed).

Keywords: Community severance, barrier effect, pedestrians, stated preference

1. Introduction

Transport systems have a number of negative effects that are not priced in the market. The economic value of these impacts is relevant for public policy, especially for informing decisions about investment in the transport system and pricing policies. Over the years, economists have developed sophisticated methods for assigning monetary values to some of those external effects, including congestion, accident risk, noise, air pollution, water pollution, and climate change (Mayeres et al. 1996, Maibach et al. 2007, CE Delft et al. 2011).

In comparison, community severance has been relatively neglected by economists and transport planners (Tate 1997, Read and Cramphorn 2001, James et al. 2005, Bradbury et al. 2007). Community severance (or the physical and psychological "barrier effect") arises when major transport infrastructure or high volumes of motorised traffic cut through communities, disrupting the walking mobility and accessibility of local residents. This impact can have major negative consequences for public health, well-being and social inclusion, but is not well captured in existing transport appraisal methods as it is poorly understood and lacks a basis for economic valuation.

In most cases, the assessment of severance still relies on ad-hoc procedures or on subjective qualitative scales. The valuation of severance is difficult because in general it is difficult to assign values to the benefits and costs associated with walking. The task is especially problematic when severance leads to trip suppression, as it requires the understanding of the complex set of psychological and social aspects that shape individual travel behaviour. These limitations may explain the fact that severance is seldom given a monetary value in transport project appraisal. For example, in the United Kingdom, severance is classified as an impact that is currently not feasible to monetise (UK DfT 2014a, p.2). Methods for the calculation of the value of severance were included in official guidance for transport appraisal in Denmark and Sweden. In Denmark, the effect was valued at 50% of the value of the noise effect (Vejdirektoratet 1992). In Sweden, the values used for the disturbance effects of crossing roads and the effects of travelling along roads depended on the age groups affected, but the value of the delays in crossing roads was assumed to be constant across all groups (Vägverket 1986). These methods were seldom used in practice and have been discontinued.

This paper develops a stated preference model to estimate the value of road schemes that improve conditions for pedestrians crossing busy roads, including changes in the road infrastructure (reducing number of traffic lanes or providing a central reservation) and how this is affected by the characteristics of motorised traffic (volume and speed). The study is a part of the Street Mobility and Network Accessibility project at University College London, which is developing tools to identify barriers to walking created by motorised transport (http://www.ucl.ac.uk/street-mobility)

The paper reports the results of two of the choice exercises that were included in the stated preference survey. In the first exercise, respondents chose between crossing the road informally with no special provision (under varying conditions of number of lanes and traffic volume and speed) and walking additional minutes to a place where the road is covered over. In the second exercise, the trade-off is between crossing the road with no pedestrian provision for a cheaper public transport fare or a reduced shopping bill on the other side of the road. Econometric models were used to derive willingness to walk further or to pay to avoid crossing the road in a point without crossing facilities.

The survey was conducted in the areas surrounding two busy roads in the United Kingdom, one in London (Seven Sisters Road) and one in Southend-on-Sea (Queensway). These roads are a major barrier to pedestrian movement due to the high traffic levels and speeds, lack of crossing facilities, and presence of physical barriers to crossing, such as guard railings. The survey consisted of 100 interviews in each area. The samples contained a balanced number of males and females and of individuals aged below and over 50 years old.

The rest of the paper proceeds as follows. Section 2 reviews the state-of-the-art on stated preference methods applied to study community severance and related issues. Section 3 briefly describes the main conclusions from a preliminary qualitative study to understand the relevant attributes and to test different possibilities for the design of the stated preference exercises. Sections 4 and 5 report the results of the main stated preference survey. Section 6 discusses the main issues arising from the analysis and concludes the paper.

2. Using stated preference methods to understand community severance

Severance is a non-marketed ‘bad’, so methods of economic valuation are usually needed to determine its value. A growing number of studies have started to assess severance using methods similar to those used to assess other negative effects of transport such as noise and air pollution. In particular, stated preference methods have been used to assess people’s preferences regarding different aspects of severance or different mitigation measures. Stated preference methods use surveys to ask people’s choices among hypothetical alternatives, in order to assess individual preferences for changes in certain attributes or packages of attributes, controlling for the participants’ characteristics and usual attitudes and behaviour. The preferences are estimated in terms of willingness to pay or to trade-off marginal changes in the attributes.

Contingent valuation is a stated preference method in which participants are asked about their willingness to pay for or accept a hypothetical policy affecting the provision of some good or service. Soguel (1995) used this method to assess the cost of severance in Neuchâtel (Switzerland). It was assumed that the effect was removed through the construction of a tunnel, assuming traffic and parking conditions were unchanged. The participants' maximum willingness to pay was determined by an open-ended question, followed by a bidding game. A valuation function was then estimated relating the bids to income, age, car ownership and level and perception of noise exposure. Grudemo et al. (2002) also used contingent valuation with binary choices to derive the willingness to pay to bury roads and railways that restrict access to recreational spaces, and Maddison and Mourato (2001) used payment cards to elicit values for changes in the layout of a road that restricts access to a site with cultural value (Stonehenge).

The popularity of contingent valuation as a method for deriving economic value of intangible goods has waned over the years due to advances in the development of more sophisticated stated preference methods such as choice modelling. This technique is based on surveys that ask participants to choose from alternatives defined by several attributes. Choices are then related with attribute levels and the characteristics of the participants using statistical models, from which trade-off values can be derived. If one of the attributes defined the payment or compensation associated with each alternative, then it is possible to calculate the willingness to pay or to accept compensation for changes in the other attributes.

In the case of the study of community severance, the choices can be between different types of mitigation measures or between the reduction of severance and other neighbourhood investments or changes. For example, Grisolía and López (2015) estimated the willingness to pay for burying a road, taking into consideration the cost of the project and the types of land use on the surface. The study found that local residents who currently walk in the area around the road are willing to pay €149 per year to finance the construction of a road tunnel, and those who do not currently walk in that area are willing to pay €73. ITS and Atkins (2011) also estimated the value of policies that give different levels of priority to pedestrians, using different valuation methods. The stated preference method yielded a willingness to pay of £64 per year for a road pedestrianisation project.

Stated preference methods can also be used to model people's perceptions and behavioural responses to different types and levels of severance. This approach assumes that the impact of the road can be reduced by a series of measures that are less radical than building a road tunnel or pedestrianisation, such as changes to the road design, traffic control (leading to a change in the characteristics of traffic at different times of the day) and the provision of crossing facilities (which reduces the walking distances to cross the road safely). A proposal was made by Read and Cramphorn (2001, Ch.4) for including this approach as a part of the official guidance for transport project assessment in New Zealand, but the proposal was never implemented. A decade later, Meltofte and Nørby (2012, 2013) used a similar method in an academic study in Denmark to derive people’s trade-off values between number of lanes; traffic volume, composition and speed; and distance to the nearest crossing facility. Cantillo et al. (2015) also considered different options for the provision of crossing facilities, and modelled the choices between crossing the road informally and using signalised crossings and footbridges, taking into account the walking distance to these two facilities, delay, and road traffic flow.

Other studies have also used a similar approach but focusing on pedestrian safety. For example, the study of Hensher et al. (2011) estimated preferences for different types of crossing facilities, delay at those crossings, number of traffic lanes, traffic speeds, and safety outcomes (measured as predicted numbers of deaths and injuries). The study assessed people’s willingness to pay for the reduction of collision risk, but did not calculate trade-offs between the different methods to achieve this reduction, and did not consider impacts other than collision risk.

The negative impact of busy roads on the ability to cross the road can also be assessed alongside broader impacts of the road on the experience of walking. For example, Kelly et al. (2011) developed a stated preference model that considered attributes related to crossing the road (traffic levels, speeds, pedestrian delay and detours, and number of road crossings) and to walking along the road (street lighting and characteristics of pavements). Garrod et al. (2002) also estimated preferences for the reduction of several impacts of road traffic, including traffic speed, noise, visual impact, and waiting time to cross the road. The reductions of the impacts were to be achieved by traffic calming measures, but these measures were not specified. Follow-up studies developed methodological questions about this experiment, finding that preferences for the improvements were polarised, with a larger group holding positive values and a smaller one with non-positive values (Scarpa and Willis 2006).

The present study builds on these previous studies, by assessing the disutility of crossing a busy road in terms of two different units: walking times and monetary values. It is also assumed that the disutility depends on the characteristics of the road (number of traffic lanes and presence of a central reservation) and of traffic (volume and speed). The trade-off values between improvements in the road and traffic and walking time or cost saving can therefore be understood as indicators of the value of those improvements in terms of reduced severance.

3. Qualitative stage

The main survey was preceded by a qualitative study, with the objective of obtaining information about the problems people faced when crossing busy roads. The study consisted of four 90-minute focus groups and seven in-depth 30-minute interviews. To obtain a broad set of views, the participants were not recruited from the study area of the main survey, but from two other areas, in London and in Birmingham, representing a more diverse geographic, demographic, and socio-economic context.

Most of the participants in the focus groups and interviews were able to spontaneously make suggestions to what would improve the situation and were willing to walk a few minutes, or to pay a small amount extra, to use designated facilities, rather than crossing the road informally. The focus groups with older participants demonstrated more tolerance for walking further to use the preferred crossings. The walking situation was also important, with choices depending on trip purpose, time of day, mobility restrictions and on whether the pedestrian is alone or is walking with other adults or with children. Most participants were able to identify and converse in detail about the number of lanes and traffic islands. Traffic density and speed were also consistently noted as a relevant attribute, but traffic composition was regarded as less important.

The focus groups also provided feedback on the design of the stated preference exercises and the ways to illustrate some of the attributes of roads in the main survey. Reasonable logic was displayed when making selections throughout the exercises. However, it was not always clear to participants whether the traffic was moving, in scenarios with higher traffic volumes. It was also pointed out that some of the images contained a traffic speed and others had a police car. In both cases, there was a connotation of a type of “danger” that is unrelated to pedestrian safety. These and several other issues were taken into consideration in the design of the main stage survey.

4. Willingness to walk to avoid crossing the road

4.1. Design of the stated preference exercise

The objective of the first stated preference exercise in the main survey was to derive willingness to walk to avoid crossing a road in a place without crossing facilities. Three options were presented in each question:

- Option A: Cross the road in a place without facilities
- Option B: Walk a given distance and cross in a place where the road is covered over
- Option C: Avoid crossing the road altogether

The exercise consisted of seven questions in the London survey and eight questions in the Southend survey. Table 1 presents the attributes and levels of the problem, that is, the characteristics of the road and traffic in Option A and the walking time in Option B. The design of this exercise assumed that the range of possible values for the traffic speed attribute depends on the values of the traffic density attribute. High traffic density is always associated with low speeds (10 mph) due to road congestion.

Figure 1 shows an example of the questions, where the road in Option A has two lanes, a central reservation, low traffic volume, and 20mph speed, and the walking time in Option B is 8 minutes.

Table 1. First stated preference exercise: attributes and levels

Attributes	Levels
Number of lanes in each direction	-1 (one less lane than now)
	0 (same as now: 3 lanes in London, 2 lanes in Southend)
Central reservation	Not Present
	Present (with no guard railings)
Traffic	Low density, speed=20mph
	Low density, speed=30mph
	Medium density, speed=20mph
	Medium density, speed=30mph
	High density, speed=10mph
Time added to journey	from 2 to 20 minutes, in 2 minute increments

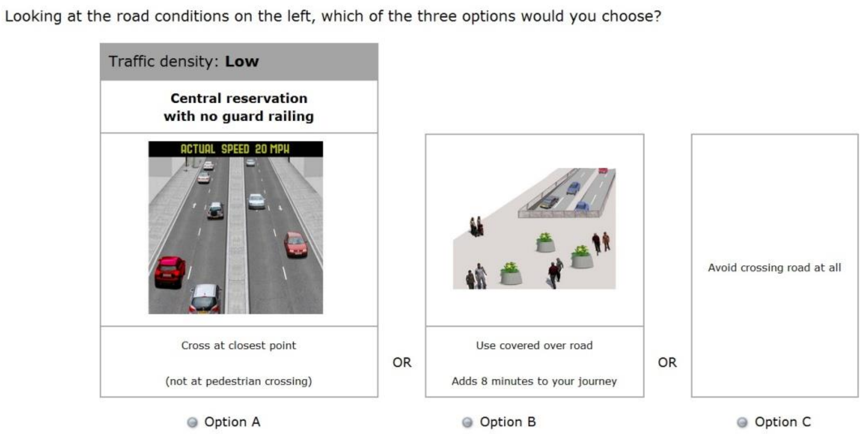

Fig.1. Example of question in the first stated preference exercise

4.2. Results: Trading behaviour

Many participants consistently chose the same option, regardless of the attribute levels presented. Figure 2 shows the proportion of participants by the number of times they chose each of the three options. Half of the participants (99) never chose Option A ("cross") and 138 never chose Option C ("don't cross"). In addition, 101 participants chose always the same option (A, B, or C).

The group that never chose to cross and the one that always chose the same option are labelled in further analysis as “non-crossers” and “non-traders” respectively. The group that chose to cross in at least one question and the one that did not always chose the same option are labelled as “crossers” and “traders”.

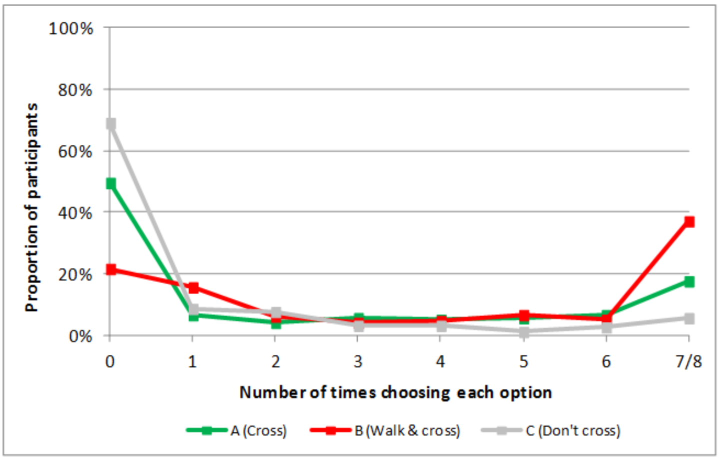

Fig.2. Proportion of all participants by the number of times they chose each option

Table 2 shows the results of a logit model explaining the probability of being a “non-crosser”. As expected, participants who cross the road most days have a lower probability and those with restricted mobility have a higher probability of always rejecting the “cross” option. The probability is also higher in the Southend case study and in the west side of the Finchley Road in the London case study. This reflects the lower need to cross the road in those areas, comparing with the east side of Finchley Road (which is mostly residential and has relatively few workplaces, shops, or other pedestrian destinations). Residents within walking distance to the road but with an obvious nearby place to cross safely also have a lower need to cross away from pedestrian facilities, as confirmed by a negative coefficient of the variable representing locations within 400m of the road but at more than 200m from the nearest crossing. The significance of spatial variables suggests that participants tend to approach the survey not as an abstract exercise but in relation to the conditions in their immediate vicinity.

Table 2. Model explaining the probability of being a “non-crosser” in the first stated preference exercise (logit)

	coeff.	p>|z|
constant	-0.94	0.05**
cross most days	-0.88	<0.01***
restricted mobility	2.14	<0.01***
London: west of road	1.40	<0.01***
Southend: west of road	1.60	0.01**
Southend: east of road	1.25	0.02**
<400m from road and >200m from crossing	-0.88	0.02**
n	200	
no coefficients log-likelihood	-139	
log-likelihood	-116	
Pseudo R^2	0.16	

Notes: Significance levels: ***1%, **5%, *10%

4.3. Results: Econometric models and trade-off values

The choices were then analysed using econometric models. The data was reshaped so that each record represents the choice regarding each of the three options presented in each of the questions. The dependent variable is a dummy variable where 1 is the case where the participant chose the option presented. The explanatory variables are walking time and a series of dummy variables. The “don’t cross” variable is equal to 1 in Option C and 0 in the other options. The “cross” variable is equal to 1 in Option A and 0 in the other options. This variable represents the option for crossing a road with no crossing facilities and the most convenient road design and traffic conditions for pedestrians (one less lane, central reservation, low traffic density, and speed lower than 30mph). Additional variables account for the less convenient scenarios for pedestrians: the existing number of lanes, no reservation, medium and high traffic density, and speed higher than 30mph.

Two specifications were tested: conditional logit and mixed logit. In the conditional logit models the coefficients of all variables are assumed to be fixed across participants. In other words, the utility of an option depends only on the attribute levels. In the mixed logit models, the coefficients of all variables except walking time are assumed to be random. The utility of an option depends on attribute levels and on the characteristics of the participants.

Two difference model specifications were tested. In the mixed logit model, the coefficients of all variables except walking time are assumed to be random (Ben Akiva and Bolduc 1996, McFadden and Train 2000). In this case, the utility of an option depends on attribute levels and on the characteristics of the participants. The utility can be specified as follows:

$$U_{i,j} = \beta_j x_{i,j} + \varepsilon_{i,j} \tag{1}$$

where $U_{i,j}$ is the utility of alternative i for individual j, $x_{i,j}$ is a vector measuring the attributes of each alternative, β_j is a vector of parameters, and ε_{ij} is an error term that follows the Extreme Value Type I distribution. The parameters β_j are assumed to be random. The probability that individual i chooses alternative j is

$$P_{i,j} = \int L_{i,j}(\beta) f(\beta|\theta) d\theta \tag{2}$$

where $L_{i,j}$ is the probability of choice for a fixed value of β, defined as

$$L_{i,j}(\beta_i) = \frac{e^{\beta_i x_{i,j}}}{\sum_k e^{\beta_i x_{i,k}}} \tag{3}$$

In the conditional logit model, the coefficients of all variables are assumed to be fixed across participants. In other words, the utility of an option depends only on the attribute levels. In the specification above, β is assumed to be fixed across all participants, and not random as in the mixed logit specification.

Table 3 shows the estimated coefficients of the two models and the values of the willingness to walk to avoid crossing the road in a place without crossing facilities. The value for each attribute is the ratio between the coefficient of that attribute and the coefficient of walking time.

All the road attributes are statistically significant, either alone or in combination with other attributes, and have the expected sign (negative). Participants prefer to avoid crossing roads with no crossing facilities, as shown by a negative coefficient of the variable for Option A ("cross"). When choosing to cross those roads, they prefer roads with one less lane, central reservation, low traffic density and speed below 30mph, rather than roads with the existing number of lanes, without central reservation, with medium or high density and with 30 mph speed. The relative magnitude of the coefficients is consistent with prior expectations, as the coefficients for high traffic density and no reservation are more negative than the ones for medium density and no reservation. The time and "don't cross" coefficients are negative, which means that participants prefer shorter walking times and to cross, rather than not to cross the road.

Table 3. Models explaining choices in the first stated preference exercise

	CONDITIONAL LOGIT		MIXED LOGIT	
	coeff.	wtw	coeff.	wtw
time	-0.09***		-0.42***	
Option A (cross)	-1.35***	14.9	-8.06***	19.0
lanes=as now	-0.60***	6.6	-2.35***	5.5
no reservation			-2.02***	4.8
density=medium				
density=high	-0.31*	3.4	-1.53**	3.6
speed=30				
lanes=as now * speed=30			-1.16**	2.7
density=medium* no reservation	-0.57***	6.3	-1.69***	4.0
density=high* no reservation	-0.61***	6.7	-1.99***	4.7
Option C (don't cross)	-2.60***	28.7	-11.33***	26.7
n	4500		4500	
groups	200		200	
no coefficients log-likelihood	-1648		-1648	
final log-likelihood	-1411		-700	
Pseudo R^2	0.14		0.58	

Notes: Significance levels: ***1%, **5%, *10%; wtw: willingness to walk

Although the signs of the model coefficients are consistent with previous expectations, the results are not entirely satisfactory because some of the estimated trade-off values are implausibly high. For example, the willingness to walk in order to be able to cross the road (the ratio of the "don't cross" and the time coefficients) is greater than the maximum walking time offered in Option B: 28.7 minutes in the conditional logit and 26.7 minutes in the mixed logit model. The willingness to walk to avoid crossing in a place without facilities is also high (14.9 and 19 minutes in the conditional and mixed logit models respectively.). If we add the values for the characteristics of the road, the willingness to walk becomes greater than the maximum walking time offered in Option B (which is 20 minutes). For example, the willingness to walk to avoid crossing a road without facilities and with the current number of lanes is 21.6 (14.9+6.7), using the conditional logit model and 24.5 (19+5.5), using the mixed logit model).

Further analysis (not shown in this paper) revealed that the willingness to walk to avoid crossing a road without facilities is lower than average for people who cross the road every day and higher for females. The willingness to cross a road with high traffic density is higher for people aged above 50 than for younger groups. Residence location is also significant, both in relation to the road and to pedestrian crossing facilities.

The trade-off values derived from the econometric models are smaller when these are estimated only for the subsets of "crossers" and "traders" (Table 4). For example, for the group of "crossers," the willingness to walk to avoid crossing a road with without facilities and with the current number of lanes is 12.9 (7.5+5.4) and 13.9 (7.9+6) using the conditional and mixed logit models respectively, comparing with 21.6 and 24.5 for the whole sample.

Table 4. Models explaining choices in the first stated preference exercise ("crossers" and "traders")

	CONDITIONAL LOGIT				MIXED LOGIT			
	"crossers"		"traders"		"crossers"		"traders"	
	coeff.	wtw	coeff.	wtw	coeff.	wtw	coeff.	wtw
time	-0.14***		-0.19***		-0.31***		-0.45***	
Option A (cross)	-1.02***	7.5	-2.54***	13.6	-2.45***	7.9	-6.18***	13.8
lanes=as now	-0.73***	5.4	-0.63***	3.4	-1.86***	6.0	-2.81***	6.2
no reservation	-1.03***	7.6	-0.94***	5.0	-2.67***	8.7	-2.30***	5.1
density=medium			-0.33*	1.8			-0.93**	2.1
density=high	-0.74***	5.5	-0.73***	3.9	-1.63***	5.3	-2.03***	4.5
speed=30								
Option C (don't cross)	-2.91***	21.5	-3.18***	17.0	-7.95***	25.8	-7.80***	17.4
n	2247		2211		2247		2211	
groups	101		99		101		99	
no coefficients log-likelihood	-823		-810		-823		-810	
final log-likelihood	-567		-694		-432		-501	
Pseudo R^2	0.31		0.14		0.74		0.38	

Notes: Significance levels: ***1%, **5%, *10%; wtw: willingness to walk

5. Willingness to accept a cost saving to avoid crossing the road

5.1. Design of the stated preference exercise

The objective of the second stated preference exercise was to derive the willingness to forego a cost saving in order to avoid crossing a road in a place without crossing facilities. The scenario involves the participant having the opportunity of paying a lower shopping bill or public transport fare by crossing the road. Participants who stated they crossed the road to access public transport less often than once every 2-3 months or who are aged 60 or older were shown the shopping bill alternative. The other participants were shown the public transport alternative. Two options were presented in each question:

- Option A: Cross the road in a place without crossing facilities and pay a cheaper public transport fare or shopping bill on the other side
- Option B: Avoid crossing

The exercise consisted of seven questions in the London survey and eight questions in the Southend survey. Table 5 shows the attributes and levels of the problem. The cost savings presented to participants in the shopping bill segment are double of those presented to participants in the public transport segment, as the former have to cross the road twice.

Figure 3 shows an example of one of the questions, where the road in Option A has two lanes, central reservation, low traffic density, and 20mph speed, and the participant can save 80p if he/she crosses the road to use a bus stop on the other side.

Table 5. Second stated preference exercise: attributes and levels

Attributes	Levels
Number of lanes in each direction	As in the first exercise
Central reservation	
Traffic	
Cost saving	Public transport segment: from 20p to £2 Shopping bill segment: from 40p to £4

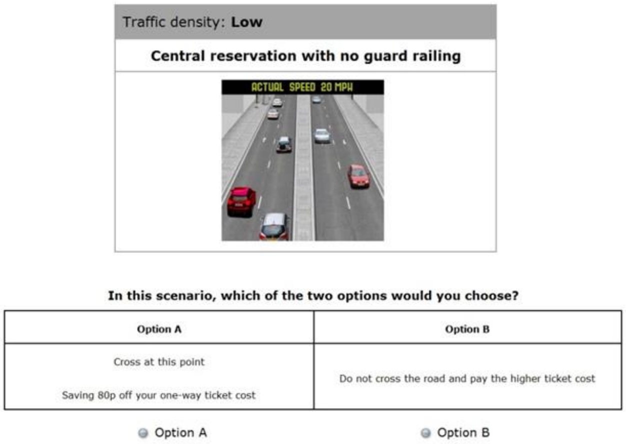

Fig.3. Example of question in the second stated preference exercise

5.2. Trading behaviour

The issues related to non-trading behaviour found in the first exercise are also found in the second exercise. Figure 4 shows that 76 (38%) of participants never chose Option A ("cross") and 35 (17%) chose that option in all questions. The number of "crossers" in the sample is therefore 124 (200-76) and the number of "traders" is 89 (200-76-35). Further analysis revealed that 65% of the participants who never chose to cross the road in the first exercise also never chose to cross in the second exercise and 87% of participants who never crossed in the second exercise also never crossed in the first exercise.

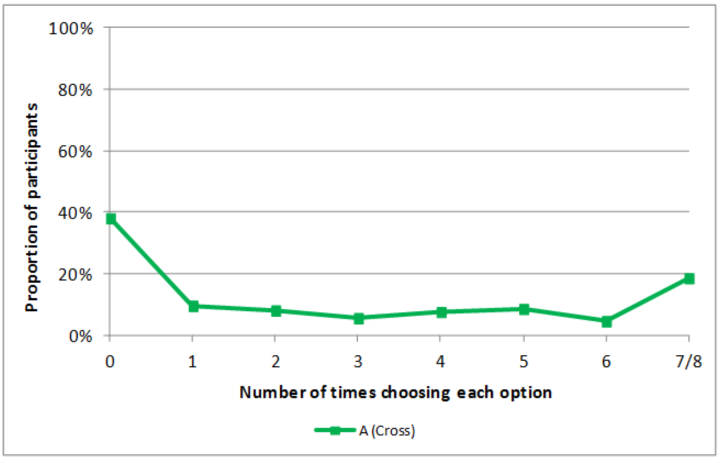

Fig.4. Proportion of all participants by the number of times they chose Option A ("cross")

The modelling of the probability of being a "non-crosser" (Table 6) reveals once more the role of residence location, as participants have a higher probability of never choosing to cross in the regions where there is a lower need to cross at all, or a lower need to cross away from pedestrian facilities. The propensity for being a non-crosser is also higher for females and people with restricted mobility, and lower for participants aged below 35.

Table 6. Model explaining the probability of being a "non-crosser" in the second stated preference exercise (logit)

	coeff.	p>|z|
constant	-2.72	<0.01***
age<35	-0.91	0.02**
restricted mobility	1.58	<0.01***
female	0.91	<0.01***
London: west of road	1.85	<0.01***
Southend: west of road	2.87	<0.01***
Southend: east of road	2.06	<0.01***
<400m from road and >200m from crossing	-0.64	0.10*
n	200	
no coefficients log-likelihood	-133	
log-likelihood	-110	
Pseudo R^2	0.18	

Notes: Significance levels: ***1%, **5%, *10%

5.3. Econometric models and trade-off values

The data was reshaped so that each record represents the participants' choice in each of the questions. A model was estimated where the dependent variable is a dummy variable for the case where the participant chose Option A ("cross and save"). The explanatory variables are cost saving and dummy variables for certain attribute values. The base scenario is assumed to be a road with one less lane than in the present, central reservation, low traffic density, and speed lower than 30mph.

The estimation used a random-effects logit model, as the conditional logit and mixed logit specifications require at least three options. The random-effects logit model includes a constant term, which is random. The coefficients of the variables are fixed across participants. This specification assumes that the utility of an option depends on the attribute levels ($x_{i,j}$) and on unobserved individual effects (α_i).

$$U_{i,j} = \alpha_i + \beta_j x_{i,j} + \varepsilon_{i,j} \tag{4}$$

Table 7 shows the estimated coefficients and the values of the willingness to forego a cost the road and traffic conditions are significant and have the expected sign, and the "high density" coefficient is more negative than the "medium density" one. The magnitude of the values is plausible but the value of the high density coefficient (£2.5) is above the maximum value offered, which is £2.

Table 7. Model explaining choices in the second stated preference exercise (random-effects logit)

	coeff.	wta
constant	-1.78***	
saving	0.86***	
lanes=as now	-1.40***	1.6
no reservation	-1.26***	1.7
density=medium	-0.95***	1.1
density=high	-2.11***	2.5
speed>=30	-0.43***	0.6
n	1500	
groups	200	
no coefficients log-likelihood	-647	
log-likelihood	-561	
Pseudo R2	0.13	

Notes: Significance levels: ***1%, **5%, *10%; wta: willingness to accept

Further analysis (not shown in this paper) revealed that participants living in the west side of the road in Southend and those living far from the road or near a crossing facility require a higher cost saving in order to cross the road in a place without facilities. Older participants require higher savings to cross a road with high traffic density and those with mobility restrictions require higher savings to cross a road with 30mph speed.

Unlike the case of the first exercise, the estimation of the model of the choices in the second exercise for participants who chose to cross in at least one question ("crossers") and who did not choose the same option (A or B) in all questions ("traders") yields trade-off values between cost saving and road attributes that are broadly similar to the ones found in the model using the whole sample (Table 8).

Table 8. Model explaining choices in the second stated preference exercise ("crossers" and "traders") (random-effects logit)

	"crossers"		"traders"	
	coeff.	wta	coeff.	wta
constant	1.24***		-0.73***	
saving	0.92		0.73***	
lanes=as now	-1.40***	1.5	-1.37***	1.9
no reservation	-1.24***	1.4	-1.34***	1.8
density=medium	-1.15***	1.3	-1.02***	1.4
density=high	-2.56***	2.8	-2.15***	2.9
speed>=30	-0.72***	0.8	-0.56**	0.8
n	920		658	
groups	124		89	
no coefficients log-likelihood	-529		-445	
log-likelihood	-440		-359	
Pseudo R^2	0.17		0.19	

Notes: Significance levels: ***1%, **5%, *10%; wta: willingness to accept

6. Discussion and conclusions

This paper presented the results of a stated preference survey to assess the value of reductions in community severance caused by major transport infrastructure. The design of the survey was informed by a preliminary stage consisting of focus groups and in-depth interviews. The main stage survey included two choice exercises, one where participants chose between crossing a road informally or walking to a safe crossing point, and another where participants chose between crossing the road informally and pay a lower shopping bill or public transport fare, or avoid crossing, and pay the current shopping bill or public transport fare.

The use of a stated preference survey for assessing the value of community severance revealed that on average participants are willing to walk or to forego a cost saving in order to avoid crossing a road in a place without crossing facilities. However, a large proportion of participants never chose options involving crossing the road. In the first exercise, this resulted in inflated trade-off values between the possibility of avoiding crossing the road in a place without facilities and the walking time to go to a place where the road is covered over.

The trade-off values are considerably lower when the models exclude the group of participants who never chose the option for crossing the road. However, this solution excludes a large proportion of the sample from the analysis. It is also not clear what value should be assigned to this group if the results of this study are applied in transport appraisal.

In a few cases, the estimated trade-off values are above the maximum value offered in the exercise because the econometric models extrapolate the observed relationships between choices and walking times. This is especially the case of the "don't cross" alternative in the SP1 exercise. Further analysis revealed that the issue also appears when using alternative model specifications, such as models estimated in willingness-to-pay (Train and Weeks 2005) and mixed logit models including correlation between coefficients. However, the value does not seem to be influenced by the number of "non-traders" and so it may express the real preferences of the participants in the survey.

A possible solution to the problems created by the presence of non-trading behaviour is to add a contingent valuation question to the survey, asking what is the maximum walking times people are prepared to walk to avoid crossing the road in a place without facilities. These times can be compared with the ones obtained in the stated preference exercises in order to assess whether the high trade-off values obtained in these exercises are valid. In alternative, the times stated by participants can be used to scale the values obtained in the stated preference exercises. The average times of the "non-crossers" can also be an indicator of their willingness to walk or accept a cost saving, replacing the inflated values obtained in the stated preference exercises.

The values obtained for the willingness to walk can also be interpreted in terms of the perceived disutility of the time spent crossing the road. Individuals may understand the walking times presented in the survey as delays and not as normal walking time, which may influence their choices, as the duration of delays tends to be overestimated. A method to test the hypothesis in the present survey would be to add a question asking how long people walk to go to a few main pedestrian destinations. The comparison of the stated values and the values estimated from network models (incorporating detours and waiting at signalised crossings) may uncover a systematic overestimation of delays to cross the road. A conversion factor can then be applied to convert the perceived time for crossing the road into real time. As an analogy, the UK Department for Transport recommends that the non-work values of walking time as a means of interchange between modes of transport should be double of those of other non-work values of walking time, as interchange time is perceived differently from "normal" walking time.

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