



Puffin Pedestrian Crossings in London: Collisions, Road User Behaviour, and Pedestrian Perceptions

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Overview

Puffin (**P**edestrian **U**ser-Friendly **I**ntelligent) crossings were designed to reduce delays to vehicles and improve pedestrians' feelings of safety while crossing the road.

The potential road safety benefits of Puffin crossings (compared with Pelican crossings), according to the DETR Traffic Advisory Leaflet 1/01(1) are:

1. Reduced harassment experienced by pedestrians as a result of the withdrawal of the flashing pedestrian phase.
2. Reduced frequency of shunt collisions as unnecessary signal changes are avoided.
3. Reduced confusion for pedestrians as the blackout and flashing pedestrian signals are not used.
4. Increased convenience and reduced confusion associated with the wider use of pedestrian stages at signalised junctions.

Collision analysis over all site groups revealed non-significant reductions of 15% in total collisions and 26% in pedestrian collisions.

Pedestrian behaviour observations indicated that the level and nature of road user conflict was similar at both Puffin and Pelican crossings. However, at Pelican crossings pedestrians are more likely to start crossing the road during the flashing green man period than during the all red period at Puffin crossings. The expected reduction in delay to vehicles seems to be unfounded as mean delays to the first vehicle in the queue were higher at Puffin (12.6 seconds) than at Pelican crossings (8.8 seconds).

Pedestrian perceptions of Puffin crossings indicate that the majority perceive Puffin crossings as safer than the facility they replaced. However, over a quarter of pedestrians at Puffin crossings report that their view of the pedestrian signal is sometimes obstructed by other pedestrians.

The use of pedestrian crossing detectors has resulted in pedestrians perceiving that they have more time to cross at Puffin than at Pelican crossings.



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Objectives

The overall aim of these studies was to assess all aspects of safety at stand-alone Puffin crossings (as opposed to at junctions).

Collisions

- To compare total collisions and pedestrian collisions before and after installation of Puffin crossings.
- To determine whether the effect varies with the previous crossing facility.

Road User Behaviour

- To compare pedestrian and driver behaviour at Pelican and Puffin crossings and identify any unsafe behaviour associated with Puffin crossings.
- To compare the levels and nature of pedestrian conflict with other traffic at Puffin and Pelican crossings.

Pedestrian Perceptions

- To determine the level of pedestrian user understanding of Puffin and Pelican crossings and any difficulties they report in using them.
- To determine pedestrian perceptions of safety at Puffin and Pelican crossings and levels of preference for each crossing type.
- To identify any differences in pedestrian perceptions between more or less experienced users of Puffin crossings and those of different age-groups.

A full report for each study is available.

Background

There are currently 111 stand alone Puffin crossings in service in Greater London. The DfT intention is to gradually replace Pelicans with Puffins. However, there is still some uncertainty about the road safety implications of Puffins in comparison with other

pedestrian crossing facilities such as Zebra and Pelican crossings.

Until now, only limited evaluation of Puffin crossings has been undertaken. One early study of sites in London found little difference in collision rates at Pelican and Puffin crossings (2). However, this study examined only five sites and found that some collision types declined while others increased. Another study of two pilot Puffin sites incorporated both behavioural and attitudinal measures but did not assess the collision data (3). There was evidently a need for further evaluation of the safety record of Puffin crossings.

The studies for TfL summarised here focus on Puffin crossings as they are functioning in London.

Method

Three complementary methods were employed:

1. A before and after collision analysis at a selection of 23 sites where Puffin crossings have been installed.
2. Video observation of road user behaviour and road user conflicts at a selection of 5 Puffin and 5 Pelican sites.
3. On-street pedestrian interviews at 14 Puffin and 10 Pelican crossings.

Results

1. Collision Analysis

Total and Pedestrian collision rates fall relative to controls when Puffin crossings replace other crossings but not significantly.

Table 1 gives the percentage change in collisions for each site type relative to borough control data. Over all the sites, following the introduction of a Puffin crossing there were reductions of 15% in total collisions and 26% in pedestrian collisions.

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Table 1: Percentage Change in Total and Pedestrian Collisions for each Site Type

Site Type	N ^o	All Collisions		Pedestrian collisions	
		Change in collisions ^{**}	Probability [*]	Change in collisions ^{**}	Probability [*]
All site groups	16	-15%	30%	-26%	22%
Previously no formal crossing	6	8%	82%	-35%	48%
Previously Zebra Crossing	6	-14%	62%	-8%	80%
Previously Pelican Crossing	6	-39%	7%	-30%	48%

N^o Number of site groups, ^{**} Change in collisions at Puffin crossings compared to control sites,

^{*} Probability that result is due to chance

However, the absolute number of collisions was relatively small and these reductions were not statistically significant at the 5% level. Where there had previously been no formal crossing, total collisions rose slightly (although this result was not statistically significant).

Shunt collisions have been predicted to decrease where Puffin crossings are installed because of the expected cancellation of unnecessary pedestrian demands. However, only a small reduction in the average monthly rate per site of shunt collisions from 0.007 in the before period to 0.006 in the after period was found (which equated to an actual reduction from 6 to 5 collisions overall) this difference was not statistically significant. Over all borough site groups, the monthly total collision rate fell between the before and after periods from 0.205 to 0.149. However, the rate rose at five of the 23 sites, two of which had previously had no formal crossing facility, two of which had been Zebra crossings and one had been converted from a Pelican crossing.

Over all sites, the monthly average pedestrian collision rate per site fell from 0.071 to 0.043. The monthly rate rose at seven out of 23 sites, four previously had no formal crossing. Two had been a Zebra crossing and one had previously been a Pelican crossing.

2. Road User Behaviour and Puffin Crossing Operation

Collision analysis was supplemented with information about road user behaviour and conflicts collected at five Puffin and five Pelican crossing sites in London. There were differences in pedestrian flows between the Puffin and Pelican sites at two of the site pairs which affected interpretation of the findings.

Pedestrian Behaviour

The proportion of pedestrians who use the pedestrian demand button varies widely between sites.

Over all the sites 20% of users of Pelican and 28% of users of Puffin crossings did not use the pedestrian demand button. However, this proportion varied from 2% to 49% between sites.

Pedestrians are more likely to start crossing during the Pelican flashing green man period than in the Puffin all red phase period.

While 0.1% of pedestrians started crossing in the all-red period at Puffin crossings, this figure was 1% at Pelican crossings. This difference is statistically significant at the 1% level. This suggests that pedestrians may be more cautious when faced with the red man

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Table 2: Vehicle and pedestrian conflicts at 5 Pelican and 5 Puffin crossings (0700-1900)

	Violations	Encounters	Conflicts	Collisions
Puffin crossings	15	22	1	0
Pelican crossings	3	18	1	1

than a flashing green man. Pedestrians were also more likely to cross the road outside the pedestrian green phase at sites operating under Urban Traffic Control (UTC) than sites on local control for both types of crossings.

Pedestrian vehicle conflicts

Frequency and types of conflict are similar at Puffin and Pelican crossings.

Conflicts between pedestrian and vehicles were observed on video (0700-1900) and categorised in order of descending severity:

1. Collisions
2. Conflicts (where two road users were on such a course that one of the two had to take sudden aversive action to avoid a collision)
3. Encounters (less serious interactions than conflicts)
4. Violations (of the Highway Code)

Table 2 shows the frequency of each of these at Puffin and Pelican crossings. The frequency and types of conflicts were similar at Puffin and Pelican crossings. Most occurred when pedestrians crossed against the lights or in platoons or when vehicles violated the red light. There were too few conflicts to determine any significant differences in frequency between Puffin and Pelican crossings.

Puffin Signal Operation

Delay to the first vehicle in the queue is longer at Puffin crossings.

The mean delay to the first vehicle in the queue was 12.6 seconds at Puffin crossings and 8.8 seconds at pelican crossings. Reasons for this may be:

- The all-red extension periods were frequently activated at Puffin crossings. The proportion of pedestrian phases using the extensions ranged from 20% to 91% at different Puffin sites.
- The call cancel facility (where pedestrian demands are cancelled at Puffin crossings if no longer required because a pedestrian crosses before the pedestrian phase) was used only once out of 500 crossing events and there were only 8 instances observed when a call should have been cancelled but was not.
- Checks of the crossing equipment revealed that 4 out of 5 Puffin crossings had faults with detectors which affected operation of the crossing. The videos also suggested that pedestrian on-crossing detectors failed for 1-3% of crossing events.
- Finally, Puffin timings may have been set conservatively in relation to the most recent guidance which has been published since the data were collected.

To test the relative contribution of these two last factors in increased vehicle delay, further data were collected at the Puffin site which had the longest mean vehicle red time (21.1 seconds). By making adjustments to detector alignment and signal timings (to conform to recent guidance), the subsequent effect on vehicle delay was calculated. There were significant reductions to the mean delay of the first vehicle in the queue when detectors were adjusted (to 12.8 seconds Standard Deviation=5.8) and timings altered (to 10.29 seconds, SD= 4.45).

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3. Pedestrian Interviews

On-street interviews were completed with 232 pedestrians using 10 Pelican crossings and 309 pedestrians using 14 Puffin crossings. To enable investigation of possible changes in perceptions over time, six 'new' Puffin crossings (implemented within one year of the study) and eight 'old' Puffin crossings (implemented for more than a year) were studied.

The sites were selected to have comparable vehicle flows, road widths, land use and crossing control and spread over inner and outer London. A short observation period at each site suggested that sites were well matched in terms of pedestrian flows while hourly vehicle flows were slightly higher at Pelican crossings (547 compared to 500 vehicles). The observations also showed that 80% of pedestrians crossed on the green man at all crossing sites.

Interviews were conducted over four hours including one peak period at each site during July and August 2005. Pedestrians were approached after they had crossed the road and the interviews included a mixture of open and closed questions which aimed to determine pedestrians' levels of understanding of Pelican and Puffin crossings, their perceptions of safety and their attitudes towards Puffin crossings.

Understanding

Over one quarter of pedestrians show little awareness of crossing design.

Nearly a quarter of respondents (27% at Pelicans and 22% at Puffins) could not correctly recall which side of the road the green pedestrian signal had been on the pedestrian crossing they had just used. A higher proportion of users of older Puffin crossings recalled this.

About 20% of all respondents reported that, according to the Highway Code, the flashing green man at a Pelican crossing meant "it's ok to start crossing the road – but slower walkers might prefer to wait until the next green man" whereas the Highway code advises that "When the green figure begins to flash you should not start to cross".

12% of Pelican users and 17% of Puffin users agreed that they are sometimes confused about when to start crossing

Only 9% of Puffin crossing users recalled ever having seen a leaflet or other publicity about Puffin crossings.

Respondents were asked to rate the crossing they had used for ease of use. The majority of users report that both types of crossing were "very" or "fairly" easy to use as shown in **Table 3**.

Table 3: Respondents ratings of ease of using Puffin and Pelican crossings

	Pelicans	Puffins
Very easy	92 %	84 %
Fairly easy	4 %	10 %
Neither easy nor difficult	3 %	2 %
Fairly difficult	1 %	4 %
Very difficult	0 %	*
Total easy	96 %	94 %
Total difficult	1 %	4 %

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Problems experienced

At both crossing types, the main problems for pedestrians are perceived as cars not stopping.

The 5% of respondents who had reported any difficulties were asked about the nature of these. Waiting too long for the pedestrian phase and the shortness of the pedestrian phase was mentioned for both Pelican and Puffin crossings.

A few pedestrians reported insufficient time to cross at Pelicans and confusion at Puffin crossings.

In addition, 13% of pedestrians at both Pelican and Puffin crossings reported having had problems using the crossing at some time in the past. Pedestrians who used the crossing more frequently (3 or more days per week) were most likely to report having experienced problems in the past than infrequent users (15% compared to 8%). Cars not stopping at the red light was a problem mentioned at both types of crossing. Some Pelican crossing users also mentioned not having enough time to cross before traffic moved off while a few Puffin crossing users mentioned equipment faults.

Over a quarter of Puffin users reported that their view of the pedestrian signal was sometimes obscured.

Respondents were asked to rate their agreement with a number of statements about the crossing they had used (shown in **Table 5**). At Pelican crossings users were more likely to agree that cars did not give them enough time to cross the road. More Puffin users (29%) agreed that their view of the pedestrian signal was sometimes obstructed by other people (compared to 8% at Pelican crossings).

Perceptions of Safety now and before

Pedestrians generally perceive Puffin crossings as safer than other types of crossings.

At Pelican crossings 81% of pedestrians reported feeling safe compared with 91% at Puffin crossings. This proportion is similar for both old and new Puffin crossings. However, some differences in responses may result from the local characteristics of each crossing such as speeding drivers or topography. This difference in perceived safety is wider for older pedestrians as shown in **Table 4**.

Table 4: Overall Feelings of Safety, by age

"I feel safe using this crossing to get across the road"	Age Group			
	14-40 years	41-60 years	61+years	All ages
Pedestrians at Pelicans agree	84 %	79 %	75 %	81 %
Pedestrians at Pelicans disagree	10 %	13 %	10 %	11 %
Pedestrians at Puffins agree	91 %	86 %	98 %	91 %
Pedestrians at Puffins disagree	4 %	4 %	0 %	3 %
Number of Pedestrians at Pelicans	136	56	40	232
Number of Pedestrians at Puffins	173	85	51	309

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143 of the 309 (46%) respondents at Puffin crossings said they remembered the previous crossing facility. Of these, 29% felt that there was no difference in safety before and after implementation of the Puffin crossing, 59% felt the Puffin crossing was safer and 20% had felt safer on the previous crossing.

Feelings of safety had increased most at Puffin sites which had replaced a Zebra or no formal crossing facility. Even at Puffin crossings that had replaced Pelican crossings, 48% of the 88 respondents thought the Puffin crossing was safer while 30% saw no difference.

The reasons given for preferring the previous crossing included difficulties in understanding the Puffin crossing and in seeing the green man. Reasons for preferring the Puffin crossing included introduction of signals and having more time to cross. Some respondents mentioned the audible signals suggesting that, in the absence of a farside pedestrian signal, some pedestrians may rely more heavily on these.

Pedestrians at each type of crossing were asked how often they crossed at that crossing against the green man. Levels of self-reported non-compliance with the crossing were similar at both Pelican (39%) and Puffin crossings (41%).

Discussion

These three studies provide a detailed snapshot of puffin crossings as they are being used and operated across London today. They offer reassurance on some of safety issues which have concerned practitioners, while highlighting other potential areas of concern.

The available data on collisions and conflicts suggest there is no significant difference in safety between Puffin and Pelican crossings and that installation of

Puffin crossings is usually associated with reductions in collision rates relative to controls and to other formal crossing types. However, these findings are based on only 23 Puffin crossings and, since the start of the collision analysis many more Puffin crossings have been implemented. Extending the collision analysis to more sites would test the robustness of this finding.

The expected reduction in shunt type collisions at Puffin crossings was not found, perhaps because there was not enough collision data but perhaps also because the call cancel facility was found to be rarely used.

The observational and pedestrian interviews suggest that crossing non-compliance is no higher at Puffin crossings than at Pelican crossings. In fact, the proportion of pedestrians who start crossing during the all red period at Puffins is lower than the proportion who start crossing during the flashing green man phase at Pelican sites. However, this effect may diminish as public understanding of Puffin crossings and extension periods increases as pedestrians may become less cautious during the all red phase. At present only a minority of pedestrians have read information about puffin crossings.

The intended goal of reducing pedestrian harassment by vehicle drivers seems to have been achieved with the introduction of Puffin crossings. Pedestrians, especially older pedestrians, report having more time to cross the road before the traffic starts. This benefit for pedestrians comes at a cost to vehicle drivers as the first vehicle in the queue is delayed longer at Puffin than Pelican crossings. However, these increased delays may be partly a result of misaligned detectors and conservative signal timings.

The subsequent data collection showed that, with fine tuning, these delays can

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be reduced. The call cancel facility was originally intended to offset the increased delay to the first vehicles by reducing the delay to vehicles overall. However, observations showed that this was rarely used.

A small minority of pedestrians did mention problems with confusion because of the nearside pedestrian signal and signal failure, the latter of which was borne out in the observational study. The few pedestrians who find the nearside signals confusing may rely more heavily on the audible signal.

It is interesting to note that pedestrian perceptions of safety don't always match reality. One of the situations where pedestrians perceived the greatest increases in safety (i.e. where a Puffin crossing had replaced a Zebra crossing) actually shows the smallest reduction in pedestrian collision rates.

It may be surprising that pedestrians feel safer at Puffin crossings than at other types of crossings given anecdotal evidence to the contrary. This finding may be a result of the study design which made it difficult to ask pedestrians for explicit comparisons between Puffin and Pelican crossings. A pedestrian survey comparing perceptions of safety before and after conversion of a Pelican to a Puffin crossing which confirmed these findings would provide added reassurance that this is a robust result.

Conclusions

Given the evidence available from Puffin sites in London, there seems no safety argument against the installation of Puffin crossings where appropriate. However, the following recommendations should be considered:

- Only to install the call cancel facility if the crossing is not running pre-timed maximum and pedestrian flows on the footway are low.
- Consider reviewing on-crossing detector positioning to establish pedestrians on the crossing.
- If installed, ensure kerbside detectors function properly and allow cancellation of pedestrian demand.
- Distribute information and publicity on using Puffin crossing more widely to pedestrians, especially at new sites.
- Ensure audible signals are functioning correctly as pedestrians may rely on these more at Puffin crossings.

Next steps

The studies summarised here uncovered a number of issues which could be investigated further:

- The collision analysis provides only preliminary results and further analysis should include more sites and perhaps should focus on selection of relevant collisions.
- Conduct interviews with non-users of Puffin crossings (i.e. those who choose to cross the road away from the crossing because they find it too confusing).
- Conduct before and after pedestrian interviews at Pelican to Puffin conversion sites.
- Studies of atypical Puffin crossing sites could be carried out. For example puffin crossings with central island (4).
- The research presented here did not assess changes in network capacity. Future work could investigate whether the provision of Puffin crossings has any impact on network capacity.

Also, a DfT study currently underway on Puffin crossings will give information on Puffin technology when it works perfectly and the subsequent potential benefits to road users.

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Table 5: Levels of agreement with statements about crossing used by pedestrians

Statement	Rating	Pelican Users	Puffin Users
“It is very easy to see the green and red men at this crossing”	Strongly agree	68 %	46 %
	Tend to agree	20 %	36 %
	Neither agree/disagree	5 %	2 %
	Tend to disagree	4 %	7 %
	Strongly disagree	3 %	8 %
“Sometimes I can’t see the red and green men because there are people in the way”	Strongly agree	1 %	8 %
	Tend to agree	6 %	22 %
	Neither agree/disagree	3 %	7 %
	Tend to disagree	23 %	24 %
	Strongly disagree	66 %	38 %
“You have to wait too long for the green man to appear”	Strongly agree	12 %	10 %
	Tend to agree	19 %	21 %
	Neither agree/disagree	7 %	8 %
	Tend to disagree	21 %	25 %
	Strongly disagree	40 %	34 %
“If I start crossing when the green man is showing, I have enough time to get across the road before the traffic starts”	Strongly agree	34 %	41 %
	Tend to agree	34 %	47 %
	Neither agree/disagree	12 %	2 %
	Tend to disagree	9 %	4 %
	Strongly disagree	9 %	5 %
“Sometimes the cars start moving off here before everybody has got across the road”	Strongly agree	28 %	18 %
	Tend to agree	34 %	35 %
	Neither agree/disagree	9 %	7 %
	Tend to disagree	15 %	23 %
	Strongly disagree	11 %	13 %
“I feel safe using this crossing to get across the road”	Strongly agree	36 %	40 %
	Tend to agree	45 %	50 %
	Neither agree/disagree	8 %	5 %
	Tend to disagree	6 %	2 %
	Strongly disagree	5 %	1 %
Number of Pedestrians interviewed		(232)	(309)

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Studies summarised

Outlook research (2005): Puffin and Pelican crossings. Views of pedestrian users. Research report prepared for the London Road Safety Unit.

Walker, R., Winnett, M., Martin, A., Kennedy, J. (2005): Puffin crossing operation and behaviour study. Unpublished TRL report for the London Road Safety Unit.

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