IMPROVEMENT OF PEDESTRIAN SAFETY AND COMFORT AT TRAFFIC LIGHTS. RESULTS FROM FRENCH, BRITISH AND DUTCH FIELD TESTS

DRIVE-PROJECT V1061: PUSSYCATS

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SUMMARY

This report is the summary of an international (French-British-Dutch) evaluation study of new pedestrian crossing facilities, entitled PUSSY-CATS.

Pedestrian signals consist of a red light (standing man) above a green light (walking man), positioned across the street. Before the green light changes to red, it flashes for a short period. Pedestrians are still permitted to cross while it does so. Red signifies either 'move to the kerb as quickly as possible' if the pedestrian is on the crossing, or otherwise 'do not cross'. In the UK, it is not forbidden to cross on red.

Some signals change automatically, while at others, the green light can be called up using a push button control. In this case, the delay may or may not be regulated by the presence of traffic at the crossing. Some crossings at junctions are 'conflict free', while at other crossings, vehicles may still turn off while the pedestrian light is green, but must give way to pedestrians on the crossing. In the UK, the pedestrian green light is always conflict free.

PUSSYCATS is a new system, characterized by technical improvements which are better adapted to the behaviour and needs of pedestrians, in particular the needs of vulnerable road users. The pedestrian display has been moved to the near side of the crossing (the Maastricht position), facing the oncoming traffic. A mat detector replaces the push button, with infra-red sensors detecting the presence of pedestrians on the crossing.

These technical improvements make it possible to show the pedestrian green light for short periods, to cancel unused calls and to adjust the clearance time for slow pedestrians and large groups. The new position of the display could encourage people to look out for traffic, and means that people are less concerned about lights turning red when they are halfway across.
The green light can be on for short periods, because it is a start signal only. Calls are cancelled one second after pedestrians have left the mat.
The implementation of PUSSYCATS differs from country to country. These differences, and the research questions and design are reported in.

Observations and questionnaire surveys took place at four sites, two in the UK, and one each in France and the Netherlands. The British and French observation surveys were 'before-after' surveys. The Dutch survey was an 'after' survey only.
Users of the crossing were interviewed, to obtain more information on their understanding of PUSSYCATS. They were asked to compare the old crosssing with the new one, in terms of safety and convenience.
Pedestrians were observed. Their crossing and watching behaviour was noted in relation to the different phases, traffic flows and the presence of other pedestrians. Conclusions were drawn about their understanding of PUSSYCATS.

Crossing on a red light, head movements, crossing between lines, conflicts and accepted gaps were observed as indicators of dangerous behaviour. Many factors, some clearly related to PUSSYCATS, were found to influence behaviour, either positively or negatively. Waiting times and crossing speeds were noted as indicators of the convenience of the system.

An estimate was made of the gain in time, as a measure of the system's efficiency. Vulnerable road users received special attention. The effect of the presence of other people was also determined.

Finally, conclusions are drawn about the efficiency, safety and convenience of PUSSYCATS.

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PREFACE

This report summarizes and combines the results of field studies done in France, the United Kingdom and the Netherlands on the safety and comfort of the PUSSYCATS system, a new system for pedestrian crossings. The system is primarily characterized by detectors for waiting and crossing pedestrians, to improve the safety and comfort of vulnerable road users.
The field studies consist of questionnaire surveys and observations of the behaviour of pedestrians on these kind of crossings, sometimes comparing their behaviour with the old situation.
Indications are sought for improvements in safety and comfort.

1. INTRODUCTION

The PUSSYCATS system, a new system of pedestrian crossings controlled by traffic lights, is characterized by technical elements, by messages to pedestrians, and by control strategies. These characteristics are described elsewhere. In this report, they are only referred to when a better understanding of the research questions and results is required.

The essential characteristics are a detector for waiting pedestrians, a detector for crossing pedestrians to give slow pedestrians and groups more time to cross, and a new position for the light head, on the near side of the crossing.
These technical improvements enable a new form of control. The following aspects can be distinguished:
- The detector for waiting pedestrians, in fact a mat with sensors, can replace the push button and allows the call to be cancelled when a pedestrian leaves the kerb. A wait lamp indicates whether somebody, on either side of the crossing, is standing on the mat.
- The detector for crossing pedestrians, in fact a passive infrared detector which detects moving 'warm' objects, allows a variable clearance time, depending on the presence of pedestrians on the crossing.
- The position of the light head on the near side of the crossing, the so-called 'Maastricht' solution, combined with an audible warning, allows a very short green phase, which only functions as a start signal. A second advantage is that crossing pedestrians are not confronted with a red signal while crossing. The light head can be placed such that waiting pedestrians look into the direction of oncoming traffic.

The realization of PUSSYCATS can vary from site to site and from country to country, depending on the local traffic situation and traffic regulations.
In France, the PUSSYCATS system does not include a wait lamp and is combined with a flashing yellow phase for pedestrians, meaning: "You may cross, but proceed with caution". In the United Kingdom, the system is combined with a push button, to confirm the call.

The expectation is that the more flexible system offers advantages to pedestrians in the form of increased safety and comfort, and to other road

users because it is less time consuming and less irritating (a cancelled call avoids waiting at an empty crossing).

The goal of the field studies in three countries is to gather comparable data on the safety and comfort offered by PUSSYCATS.

Comparability has two aspects: Comparability of implemented systems and sites, and comparability of measurements. The first aspect is outside the control of the researchers, but it has consequences for the interpretation of the results. Details of the systems and sites are presented in the reports from the three countries.
The second aspect has guided the development of research questions, measuring instruments, questionnaire and observation methods and methods of analysis.

The original research plan anticipated a comparison of the old situation with PUSSYCATS. DRIVE did not give its approval for this plan in 1989, for financial reasons. Only an 'after' study was allowed. TRL financed a 'before' study from other funds. DRIVE changed its decision in 1991; a 'before' study was required, therefore ZELT changed its design. The SWOV only executed an 'after' study, but has some comparison figures from other studies.

The resultant reports from the three institutes: ZELT (France), TRL (UK) and SWOV (Netherlands) form the basis for this combined and summarizing research report.

2. RESEARCH QUESTIONS AND DESIGN

2.1. Research questions

Three broad categories of research questions can be distinguished.
- The first question concerns the safety of PUSSYCATS. Indicators are sought for objective safety. Behavioural indications concern aspects such as red/green crossing, watching behaviour, crossing between the lines, comprehension of the functioning of the system, gap acceptance, conflicts, crossing in groups, imitation of (un)safe behaviour. System indicators relate to sufficient crossing time, correct detection of waiting and crossing pedestrians. Indicators of subjective safety are obtained from the opinions and feelings of pedestrians.
- The second question concerns the comfort of the system. Indicators of objective comfort are sought in waiting times, time allowed for crossing, clarity of the system, correct use of the system, a period for conflict free crossing. Indicators of subjective comfort are found in answers to questions on feelings and opinions about the new system and its various elements.
- The third question concerns the efficiency of the system. Indicators are found in waiting times, in duration of different stages and phases, in the variability of these periods, in the effect of cancelled calls, and in the use of the mat and the green pedestrian phase.

2.2. Research in the three countries

Relevant research reports are:

United Kingdom
- Report of Rustington Pedestrian Facilities Questionnaire Survey. Project Note No. 5. Questionnaire, conducted one week after commencement of the new system. Questionnaire and breakdown of responses: see Appendix 1.
- Report of Second Rustington Pedestrian Facilities Questionnaire Survey. Project Note No. 7. Questionnaire, conducted six and a half months after commencement of the new system. Comparison with first questionnaire. Questionnaire and breakdown of responses: see Appendix 2.
- Report of Rustington Before and First After Video Surveys. Project Note No. 6. The 'before' study was conducted two months before installation, the 'after' study one week after installation of the new system.

- Report of Rustington Second After Video Survey. Project Note no. 8. This study was carried out more than six months after installation. The report compares the new results with the 'before' and first 'after' study.
- Report of Woolwich Video Surveys and Questionnaire Surveys. Project Note No. 9. The report considers three video surveys: one 'before' study, four and a half months before installation, and two 'after' studies: one month and a little more than two months after installation. Two questionnaire surveys were conducted at the times of the two 'after' studies. See Appendix 3 and 4.

France

- ZELT Experimentation. Comparison of the situation before and after installation of PUSSYCATS. One month before installation and one month after installation: automatic assessment of traffic parameters, pedestrian observations by observers and video observations.
- Questionnaire survey, conducted one month after installation. Questionnaire and breakdown of responses: see Appendix 5.

Netherlands

- New pedestrian facilities: Technique, observations and opinions. The Dutch experiment (SWOV, 1992). The report considers the installation of PUSSYCATS at two junctions, and a video and questionnaire survey (Appendix 6) at one site. The video observations were carried out a little more than two months after installation, the questionnaire survey three and a half months after installation.

2.3. Research design: Questionnaire survey

At Rustington, two questionnaire surveys were held, one week and six and a half months after installation. 172 and 189 interviews were carried out respectively.
At Woolwich, two questionnaire surveys were held, with 188 and 186 interviews, one month and a little more than two months after installation, respectively.
At Toulouse, 238 interviews were carried out, one month after installation.
At Heemstede, the questionnaire survey was held 14 weeks after installation. 201 interviews were carried out.

The questionnaire consists of a little more than 20 questions and room for characteristics of the interviewed individuals.
The main topics are understanding of the system, opinions about the elements of the system and preferences in comparison with the old system. Questionnaires from the different countries and breakdown of responses can be found in the Appendix 1-6.

2.4. Research design: The sites and video recordings

The survey included four different sites: two in the UK (Rustington and Woolwich), one in France (Toulouse), and one in the Netherlands (Heemstede).

- The Rustington site is a T-junction, with two pedestrian crossings (see Appendix 7). Video recordings were made at both crossings: before, after and again half a year later, for four one-hour periods each time. The number of observed pedestrians in the three studies are: 605, 937 and 887 respectively.
- The intersection at Woolwich is a normal crossing with four pedestrian crossings (see Appendix 8), of which three were observed. Each pedestrian crossing was observed for three hours, 'before', first 'after' and second 'after'. The number of observed pedestrians in the three studies were: 939, 850 and 903 respectively.
- The site in Toulouse is a normal crossing with only two pedestrian crossings over the main road (see Appendix 9). The minor road is a one-way street. 48 hours were recorded, for both 'before' and 'after'. The observations were made at one crossing. Data were gathered for 1409 and 1542 pedestrians respectively. During these periods, 2 surveyors, using microcomputers, continuously recorded a number of parameters, for each pedestrian and each of the 2 crossing directions. Data were gathered for 1943 and 1779 pedestrians respectively.
- The pedestrian crossing at Heemstede crosses one arm of a complicated four-way intersection (see Appendix 10). Video recordings were made over 32 hours, of which 14 hours were analyzed to obtain data on 1000 pedestrians.

Information forms to be collected from the video recordings were set up, in an iterative process. The UK forms and the accompanying coding instructions are given in Appendix 11. The Dutch and French forms differ only in minor respects from the UK ones.

The main topics included characteristics and behaviour of pedestrians, traffic signal information and traffic flow information, in such a way that the three kinds of data can be related to each other.

2.5. Differences between countries and sites

For a better understanding of the results, it is necessary to understand some differences between the locations, types of installation and strategies employed.

2.5.1. Design of PUSSYCATS

The general design comprises a mat, which registers a call when a pedestrian stands on it, the pedestrian light head on the near side of the crossing and infrared detectors, which register the presence of pedestrians on the crossing and can influence the clearance time, depending on the programme of the controller. The stage when pedestrians can cross is 'conflict free'.
The light head is placed in the direction of oncoming traffic.
If one of the (5 to 6) sensors in the pressure mat is pressed for more than a preset adjustable delay (maximum delay: 130 seconds), the sensor stops functioning.

A push button is added in the UK. The pedestrian is required to stand on the mat and press the button, asking for a signal to cross. If the pedestrian subsequently walks off the mat, the call is cancelled. When a signal is received at a push button, this signal is 'remembered' by the controller for a preset period. When a signal is received from the mat during this period, a request to cross is entered.

In France, a flashing yellow signal is added to the pedestrian light head. The system functions as follows:
- When the traffic lights on the main road are green, PUSSYCATS displays a red pictogram, meaning: "don't cross".
- When the lights on the main road are red, and green on the secondary road, PUSSYCATS displays a flashing yellow light, which means: "you may cross, but proceed with caution". In this situation, the pedestrian has priority, but conflicts can arise with vehicles turning off from the secondary road.

- During the previous phase, if a pedestrian is waiting on the mat, his presence is detected by the system. After a certain time, if the pedestrian has not left the mat, the traffic lights at the secondary road also turn red (now all the traffic lights at the junction are red), and PUSSYCATS displays a green pictogram meaning: "it is now absolutely safe to cross".
Compared to the previous situation, the flashing yellow stage has thus replaced the pedestrian green light, as a new conflict free stage has been introduced (new green pedestrian light). This modification of stages explains why some of the results are different from those obtained in other countries (waiting time, use of pedestrian green, etc.)
The position of the light head, in the direction of oncoming traffic, could only be realised at one side in the Netherlands. The crossing has a refuge in the centre.

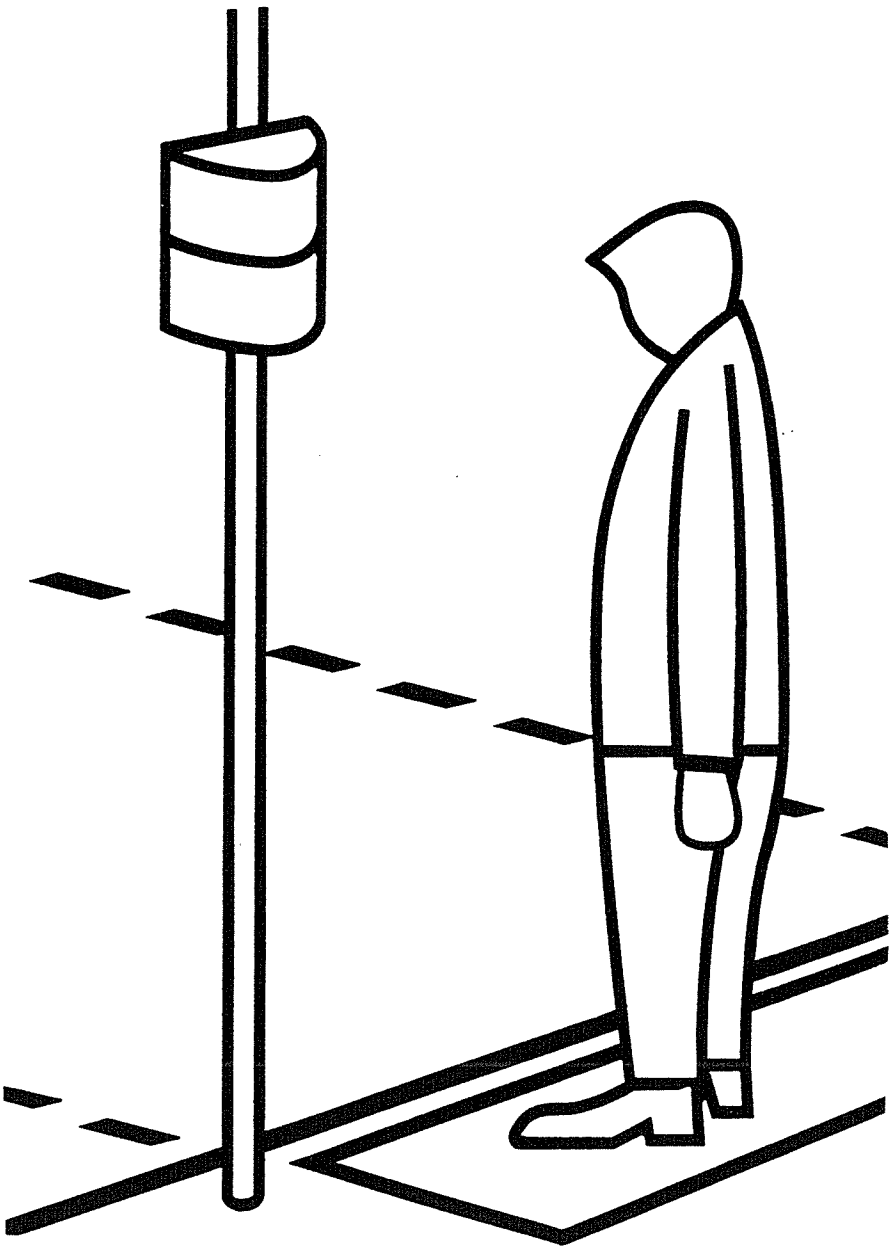
2.5.2. Other differences

Another difference is found in the information given on the pole.
Toulouse does not offer wait lamp information, contrary to the UK and the Netherlands.
In the UK, the press button unit provides the sentence: 'To cross. Stand on mat, push button and wait for signal'. The letters "WAIT" are used for a wait signal, after which two texts appear in turn: 'wait' or 'cross with care'.
Another text panel shows a walking man with 'To cross, stand on mat and push button'.

In France, the information consists of pictograms with texts on a panel.
The three stages of the pedestrian lights were illustrated and titled:
* Yellow: 'TRAVERSEZ AVEC PRECAUTION' (cross carefully)
* Red: 'ATTENDEZ' (wait)
* Green: 'TRAVERSEE PROTEGEE' (safe to cross)

Another text indicated that the crossing represented an experimental system: 'ZELT - EXPERIMENTATION TEMPORAIRE' (ZELT - Temporary experiment)
Below, a little pictogram and text said that people had to stand on the mat.

The Dutch information consists of a text and a pictogram. The text sign instructs people to stand on the mat and stay there until green appears on their side, to cross within the lines and to remain attentive.
The pictogram shows a man standing on the mat, in front of the crossing, and the light head on the near-side pole.



3. RESULTS OF QUESTIONNAIRES

The questionnaire gives information on the safety and comfort of the new system, compared with the old system. One aspect is the understanding of the elements of the system. The accent is placed on subjective safety and feelings of comfort, however. Comprehension can increase with experience and with publicity. Questions are asked about these aspects.

As previously discussed, six questionnaires were held:
#1. Rustington, one week after installation.
#2. Rustington, six and a half months after installation.
#3. Woolwich, one month after installation.
#4. Woolwich, two months after installation.
#5. Toulouse, one month after installation.
#6. Heemstede, three and a half months after installation.

3.1. Composition of samples

Table 1 presents the composition of the six samples, broken down by age, sex, composition of group, and special circumstances. The age distribution differs from crossing to crossing, the Dutch sample representing the average. Rustington has a predominantly 'old' population, Toulouse a predominantly 'young' one.
More women were interviewed. Rustington has the largest proportion of women. Most individuals are adults walking alone, or small groups of adults or adults with children. Only 5% have physical disabilities, in particular walking difficulties. Some are partially sighted. Other inhibiting factors are found in 13% of all cases. The main factors are walking with very young children and prams/pushchairs. The samples are not representative of all pedestrians crossing at the sites. Some effort has been made to reach special groups. Care was taken to interview individuals with factors inhibiting ease of crossing, or with physical disabilities (study #1, #2, #3 and #4) or young people (study #6). People going to the train were under-represented (#6), because they tended to be in a hurry. 26% of those interviewed were pedestrians crossing on red, 54% were pedestrians crossing on green. 11% don't know or are unsure. If the question was asked in the Netherlands and people did not know, the answer supplied by observation. It is remarkable that the decision to cross is so automa-

PUSSYCATS-study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		256		201		1192	
Age														
10-20	6	4	5	3	42	22	43	23	78	33	31	15	205	18
21-40	44	26	49	25	85	45	78	42	106	45	68	34	430	37
41-59	42	24	57	30	35	19	36	19	20	9	53	26	243	21
60+	80	47	78	41	26	14	29	16	30	13	49	24	292	25
Sex														
male	63	37	63	33	85	45	76	41	110	46	94	47	491	42
female	109	63	126	67	103	55	110	59	128	54	107	53	683	58
Group														
alone	131	76	150	79	140	75	139	75	173	73	167	83	900	77
child with adult	0	0	1	0	1	1	0	0	0	0	7	3	9	1
adult with child	11	6	14	7	12	6	14	8	31	13	14	7	96	8
adult only group	27	16	22	12	35	19	32	17	32	13	9	4	157	13
with disabled	2	1	1	1	*	*	*	*	1	0	0	0	4	0
children group	1	1	1	1	*	*	1	1	0	0	7	3	10	1
Physical disabilities														
none	163	95	177	94	174	93	172	93	230	100	191	95	1107	95
blind	0	0	0	0	1	1	0	0	0	0	0	0	1	0
partially sighted	4	2	0	0	2	1	5	3	0	0	3	1	14	1
deaf/hard of hearing	0	0	4	2	0	0	2	1	0	0	0	0	6	1
wheelchair user	2	1	1	1	0	0	0	0	0	0	0	0	3	0
walking difficulties	2	1	7	4	5	6	6	3	1	0	5	2	26	2
mental disability	1	1	*	*	*	*	1	1	*	*	1	0	3	0
Other inhibiting factors														
none	156	91	161	85	169	90	104	88	224	95	163	81	977	87
young children (walking)	3	2	5	3	4	2	7	4	7	3	5	2	31	3
pram/pushchair	6	4	8	4	9	5	7	4	4	2	14	7	48	4
heavy load	0	0	4	2	2	1	4	2	0	0	4	2	14	1
dog	0	0	1	1	1	1	0	0	2	1	5	2	9	1
pushing bike	1	1	6	3	*	*	1	1	0	0	9	4	17	2
shopping trolley	6	4	4	2	2	1	3	2	1	0	4	2	20	2
headphones	*	*	*	*	1	1	*	*	*	*	*	*	1	0
Signal on crossing														
green	124	72	128	68	113	60	97	52	54	21	123	61	639	54
red	48	28	53	28	56	30	62	33	14	6	69	34	302	26
flashing yellow									109	43			109	9
not sure	*	*	8	4	19	10	27	15	79	31	*	*	133	11

* no information gathered

Table 1. Composition of samples.

tic that people sometimes don't even know whether they crossed deliberately or not. The number of people crossing on red is small. This could be due to the selection of interviewed pedestrians, or due to the fact that people are less likely to cross on red when observedIn France, a large number of pedestrians (43%) are using the flashing yellow signal to cross.

3.2. Information about the system

3.2.1. Two sources of information are available: own experience and publicity.

The old system was never used by 14%, and neither was the new system (See Table 2). These people cannot compare the 'before' and 'after' situation.

PUSSYCATS-study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201		1191	
Use old system														
Once a day or more	70	41	87	46	78	41	77	41	114	45	120	60	546	46
Once a week or more	84	49	71	38	55	29	59	32	49	19	31	15	349	29
Once a month or more	8	4	9	5	10	5	14	8	18	7	20	10	79	7
Less frequently	3	2	0	0	10	5	4	2	27	11	2	1	46	4
Never	7	4	22	12	35	19	32	17	47	18	28	14	171	14
Months after installation	0.25		6.5		1		2		1		3.5			
Use pussycats														
Once a day or more	70	41	90	48	80	43	92	50	121	47	121	60	574	48
Once a week or more	60	35	79	42	64	34	63	34	48	19	37	18	351	29
Once a month or more	2	1	8	4	11	6	11	6	45	18	22	11	99	8
First time today	40	23	12	6	33	18	20	11	42	16	21	10	168	14
Publicity														
Seen something	139	81	120	64	15	8	14	8	*	*	42	21	330	35
Nothing	33	19	69	37	173	92	172	93	*	*	159	79	606	65
don't know	1	1	1	1	1	7	0	0	*	*	0	0	3	1
local paper	78	56	86	72	12	80	11	79	*	*	17	40	204	62
regional paper	*	*	*	*	*	*	*	*	*	*	6	14	6	2
national paper	14	10	9	8	*	*	1	7	*	*	*	*	24	7
paper	*	*	*	*	*	*	*	*	*	*	13	31	13	4
radio	4	3	1	1	*	*	*	*	*	*	*	*	5	2
tv	42	30	23	19	*	*	1	7	*	*	*	*	66	20
other	*	*	*	*	2	13	1	7	*	*	6	14	9	3

Table 2. Experience and publicity.

The frequency of use was just the same in the 'before' and the 'after' situation. Nearly half the pedestrians use the crossing at least every day. Nearly three quarters of the people use the crossing once a week or more.
A relationship is found between period of installation and experience ('first time today'). It is important to know that a situation is never reached where all pedestrians are experienced users. Good information on an instruction board remains necessary.
Study #1, #3 and #4 show that no relationship exists between frequency of use and answers to other questions. Study #2, #5 and #6 have not analyzed possible relationships.

3.2.2. No French data are available on experience with publicity, because no publicity campaign was held. The most varied publicity campaign was held at Rustington: papers, radio and tv. Even the BBC World Service devoted attention to PUSSYCATS. 81% of the interviewed pedestrians had seen or heard something. The most important source of information is the local papers. TV is second and national papers are third. After half a year, less people (64%) recalled that they had received information. The number of individuals mentioning 'local papers' did not decrease.
Pedestrians at Woolwich received much less information (8% after 1 month and after 2 months). Only local papers were mentioned, the same figures after one and two months (80-79%).
Heemstede has three local papers and one regional paper. All have devoted attention to PUSSYCATS. 21% of the people received information. Of these, 40% mention a local paper, 14% the regional paper, and 31% do not specify the paper.
One could conclude that local papers are probably the best source of information. The difference in information received between Rustington and Heemstede could perhaps be explained by the difference in pedestrians aged 60 and over. It could be that older people are better readers of local papers. However, such a difference could not be found between the age groups 41-59 and 60+ in the Heemstede survey.

3.2.3. The UK survey (Study #1) provided some information on the relationship between seeing publicity and knowledge and opinion. Study #1 shows that those who have seen some form of publicity seem to understand the purpose of the mat better. 55% of those who had seen no publicity did not

understand what the mat was for, compared with only 37% of those who had seen some publicity. Only 6% of those who had seen no publicity understood that they must stand on the mat and press the button, compared with 19% of those who had seen some publicity.
A relationship exists with the judgement of the waiting time. Informed people find the waiting times longer than uninformed people.
The opinion about the safety of PUSSYCATS is better when one has seen some publicity.
Study #2 does not find any further relationship. Studies #3 and #4 have shown that only 8% had seen any publicity. Those people were about twice as likely to understand the purpose of the mat and more than twice as likely to know how to request the pedestrian signal.
Analysis of the Dutch data (Study #6) produced the following results.
Better informed people were significantly more frequent users of the crossing. They also chose answer 1 (You have to stand on it) less frequently in response to question 5 (What do you think the mat does?): 2% against 14% of the uninformed people. The more frequently selected answer 2 (Senses pedestrians waiting to cross): 88% against 55% of the uninformed. Clearly, answer 2 is preferable to answer 1.
No differences are found in understanding how to elicit green.
Well informed people have a slight preference for the new system (Question 7A, B and C), compared to uninformed people, but the differences are not significant.
The detection answer on Question 22 about the function of the 'box' (infrared detector) is given by 29% of the well informed and by 20% of the uninformed people, but the difference is not significant.
No significant differences are found in other respects between well informed and uninformed people.
We could conclude from this that the information from publicity probably contributes to knowledge and to improved opinion, but that the differences are small.
The relationship between use of the crossing and the publicity seen complicates possible conclusions, in particular because the direction of the relationship can move from "use of the crossing" to "attention of publicity". It could also be that neighbours, who probably are more frequent users, have had a better opportunity to come into contact with local publicity.

3.3. Observation and understanding of the new system

3.3.1. After several months, a level was reached where 7 to 8 percent of the pedestrians did not notice the mat, comparable with the number of people who used the crossing 'first time today' (See Table 3).
The number in Study #3 is very large (43% after one month), and does not correspond with the answer 'first time today': 18%. No explanation can be given.

3.3.2. People in the UK show a poor understanding of the function of the mat. This is somewhat better in France and the Netherlands, but still inadequate.
Likewise, understanding of the system, as indicated in answers to the question on 'how to request green' is poor, particularly in the UK. In France and in the Netherlands, 71% mention the mat as being necessary, in the Netherlands often combined with 'pushing the button'. These people can at least elicit a green phase.
In France, the push button has been removed. In the Netherlands, the push button is still there, but it no longer functions. This is confusing.

PUSSYCATS-study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201		1191	
Did you notice the mat by the kerb?														
yes	149	87	176	93	108	51	135	73	189	74	184	92	941	80
no	23	13	13	7	80	43	51	27	67	23	17	8	251	21
What do you think it does?														
No idea/wrong	70	41	122	65	133	71	110	59	51	20	28	14	514	43
Senses pedestrians	75	44	65	34	49	26	70	38	171	67	124	62	554	47
Other	3	2	2	1	6	3	6	3	34	13	32	16	83	7
Have to stand on it	29	17	*	*	*	*	*	*	*	*	23	11	52	4
What do you need to do to get green? (Pour pouvoir traverser)														
No idea	*	*	7	4	15	8	4	2	34	13	10	5		
Stand and press	*	*	71	38	32	17	40	22	*	*	58	29		
Stand on mat only	*	*	9	5	6	3	3	2	181	71	85	42		
Press button only	*	*	97	51	132	70	139	75	*	*	47	23		
Wait for sequence	*	*	5	3	1	1	*	*	*	*	*	*		
Mat or button	*	*	*	*	2	1	*	*	*	*	*	*		
Other	*	*	*	*	*	*	*	*	41	16	7	3		

* Not coded or asked

Table 3. Experience and publicity.

No relationship is found in Study #6 between sex and age and the understanding of the system. Only the 60+ age group will have slightly greater difficulty in getting green.
In Study #1, the 60+ age group had a better understanding, but six months later, in Study #2, their understanding was worse, although not significantly. In Studies #3 and #4, the 60+ age group again showed less understanding.

3.3.3. Taking the results over all, we can conclude that the 60+ age group has greater problems in grasping the concept than the other age groups. A second conclusion is that the understanding in general is poor and should be improved.

3.3.4. In Toulouse, questions were asked about the meaning of red, green and flashing yellow. The understanding of the flashing yellow was not perfect (See Table 4). 60% Could explain the purpose of this light.

Meaning	Flashing triangle		Green		Red	
	count	%	count	%	count	%
No opinion	49	19	9	4	10	4
You can cross	11	4	237	93	2	1
You can cross with care	154	60	4	2	1	0
Do not cross	11	4	1	0	243	95
Other	31	12	5	2	0	0

Table 4. The understanding of the French display.

3.4. The place of the light head, the form of the display and the instruction sign

3.4.1. The position of the light head demonstrates two variations from the old one: (1) the light head is on the near side of the crossing, (2) it is at eye level on the pole. One general question is asked about the display: "Have you any comments on the new display of the green and red man?" (In Study #1 and #5: '..on the position of the display?') In Heemstede, an additional question is asked in order to get information about the position on the near side of the crossing: 'The display is now on this side. What is your opinion about that? And why?'. The answers to this question can be found in Table 5, under Study #6-2.

PUSSYCATS-study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		#6-2	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201		201	
No opinion	33	19	62	33	52	28	53	27	81	32	18	9	9	4
Makes no difference	*	*	*	*	*	*	*	*	*	*	*	*	22	11
Prefer new system	27	16	29	15	68	36	56	29	48	19	*	*	*	*
Prefer old system	*	*	*	*	*	*	6	3	*	*	44	22	*	*
Prefer old system other side	80	47	80	42	48	26	59	30	100	39	39	19	87	43
Other pedestrians obscured view	26	15	25	13	7	4	3	2	*	*	2	1	*	*
Not bright enough	3	2	2	1	0	0	*	*	*	*	5	2	*	*
Needs getting used to	12	7	3	2	2	1	3	2	*	*	*	*	18	9
Did not notice it/ looked in wrong place	7	4	7	4	15	8	11	6	*	*	*	*	*	*
Should be angled towards pavement more	3	2	0	0	*	*	*	*	*	*	*	*	*	*
Should be higher/ lower	3	2	1	1	1	1	*	*	6	2	*	*	*	*
Too small	1	1	2	1	1	1	2	1	7	3	*	*	*	*
Should be in both positions	*	*	*	*	*	*	6	3	*	*	*	*	*	*
Would like to see it while crossing	*	*	*	*	*	*	*	*	27	11	*	*	39	18
Prefer position to the right	*	*	*	*	*	*	*	*	4	2	*	*	*	*
Positive	*	*	*	*	*	*	*	*	*	*	33	16	38	19
Negative	*	*	*	*	*	*	*	*	*	*	9	4	52	25
Audible signal good	*	*	*	*	*	*	*	*	*	*	7	3	*	*
Other	*	*	*	*	*	*	*	*	46	18	*	*	*	*

* Not coded or asked.

Table 5. Opinion about the new display.

A second aspect is the different form of the displays. The general question also gives information about this aspect, but in Heemstede a question is added to the form: 'The display is different. What is your opinion about that? And why?'

3.4.2. In general, a clear preference for the old system is expressed. It should also be noted that many people have no opinion whatsever, or are indifferent. The most important aspect is that they prefer the position on the other side, since they want to see the light while crossing, and want to see it turn red. This preference is clear in Rustington, Toulouse and

Heemstede. Woolwich is an exception: there, the opinions are equally divided. No explanation can be given. No relationship is found with age or sex, in Study #1, #2 and #6.
The position on the pole is sometimes negatively evaluated, because other people obscure the view. This could be attributable to the pedestrian flow, since more waiting pedestrians result in more problems with the visibility of the display. Heemstede only has small groups of pedestrians. Rustington and Woolwich have larger ones. But only Rustington expressed a considerable amount of complaints.
The answers given in Heemstede in response to questions on the new half round display are positive. 30% prefer the new display, 12% the old one. 12% is indifferent and 7% has no opinion. The 20 to 60 year age group have a greater preference for the new display (34% versus 24%), and also for the old display (16% versus 4%). Women have a stronger preference for the new display (35% versus 25%).
In the UK and in the Netherlands, people often expressed strong opinions about the position on the near side. However, it must be noted that people are not aware of the fact that the clearance time adapts itself to their pace. Good explanation could resolve the strong resistance.

3.4.3. There were not many complaints about the instruction signs (See Table 6). The differences in 'no opinion' are remarkable, so is the number of people who chose 'not noticed' in the UK, even with the second questionnaire. The Dutch sign consists of a text and a pictogram. Questions were asked about both signs. The results concerning the pictogram can be found under Study #6-2. The reception of the pictogram was also positive.

PUSSYCATS-study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		#6-2	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201		201	
No opinion	45	26	44	23	32	17	24	13	39	31	9	4	12	6
Difficult to see/ read	6	4	5	3	5	3	5	3	*	*	12	6	11	5
Did not notice it	41	24	76	40	99	53	97	52	*	*	27	13	31	15
Seemed clear	74	43	65	34	55	29	52	28	69	55	110	55	110	55
Didn't like position	7	4	3	2	2	1	6	3	*	*	24	12	9	4
Not clear	5	3	0	0	2	1	3	2	7	6	*	*	*	*
Other *	*	*	*	*	*	*	*	*	11	9	*	*	*	*
Positive	*	*	*	*	*	*	*	*	*	*	23	11	17	8
Negative	*	*	*	*	*	*	*	*	*	*	16	8	16	8

* Not coded or asked

Table 6. Opinion about the instruction board.

3.5. Waiting time perception

From the responses to the question on waiting time "How does the waiting time now compare with before?", there appears to be a higher percentage of people who perceive the waiting time to be shorter compared with those who perceive it to be longer, in all studies except in study #2 (See Table 7). Most people had no opinion, or else thought there was no difference. The UK observation studies have found a small decrease in waiting time.

PUSSYCATS-study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)	
	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201	
No opinion	16	9	14	7	32	17	29	16	87	34	26	13
Shorter now	62	36	29	15	38	20	45	24	65	25	25	12
Longer now	16	9	33	18	15	8	31	17	26	10	19	9
About the same	73	42	91	48	68	36	49	26	75	29	73	36
Didn't use old crossing	2	1	22	12	35	19	32	17	3	1	11	5

* Not coded or asked.

Table 7. Comparisons of the waiting time 'before' and 'after'.

It can be seen that the perception of the waiting time is quite different from the actual difference 'before-after'. Observations at Toulouse have shown an increase of 37.5% at Toulouse, corresponding to an increase of about 4 seconds. This is not reflected in the opinions measured.

3.6. Safety

Questions were asked on (un)safe feelings while crossing, and on the new system.

3.6.1. People were asked whether they felt safe as they were crossing the road (See Table 8).
70% to 87% felt safe while crossing (74% on average). However, only a small percentage of this group responded to the question for reasons of safety, implying that they felt safe because of the new system. The infra-red detectors were mentioned by 13, 6, 0, 0, 5 and 7 pedestrians in the six studies. The 'new system' was mentioned by 14 individuals in total.

PUSSYCATS study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201		1191	
Safe while crossing														
Yes	150	87	165	87	144	77	130	70	124	48	174	87	887	74
No	14	8	20	11	39	21	50	27	7	3	25	12	155	13
Not sure	8	5	4	2	5	3	6	3	8	3	2	1	33	3
Quite safe	*	*	*	*	*	*	*	*	77	30	*	*	77	6
Quite unsafe	*	*	*	*	*	*	*	*	40	16	*	*	40	3
New compared toe old														
No opinion	7	4	18	42	22	12	15	8	49	19	28	14	139	12
New safer	77	45	66	35	86	46	79	43	122	48	40	20	470	40
Old safer	15	9	16	9	13	7	23	12	12	5	29	14	108	9
About the same	70	41	82	43	32	17	37	20	67	26	74	37	362	31
Can't remember	1	1	7	4	*	*	*	*	6	2	4	2	18	2
Never used old	1	1	*	*	35	19	32	17	6	2	7	3	81	7

* Not coded or asked.

Table 8. Feeling safe while crossing and comparison of new situation with old situation.

Most answers concerned crossings in general: 'pedestrian signals on green/-no traffic' (43, 93, 65, 61, 110, and 63), and 'looked and made sure it was safe' (8, 15, 6, 11, *, and 25).
In the UK and Dutch studies, no relationships were found with age and sex, and with whether they had seen publicity. Only study #1 found a small relationship between safety and publicity seen.
32 (16%) of the individuals who felt unsafe while crossing mentioned 'could not see green man' as a reason for feeling unsafe. Other reasons were: "never feel safe"', "busy junction", "cars jumping lights", "pedestrian signals on red" and 'moving traffic' (French study).

3.6.2. The new system is regarded as safer by 20 to 48 percent (40% on average), less safe by 5 to 14 percent (9% on average), and about the same by 17 to 43 percent(31% on average). The differences are large, and favour the new system (See Table 8). Only the Dutch study shows a smaller difference, which cannot be explained. No relationships were found with characteristics of the pedestrians.
Many pedestrians cannot give reasons for their opinion that the new system is safer (22 to 56%, average 42%. No French data available), or that the old system is safer (7 to 31 %, average 25%).

Reasons for safety mentioned often imply characteristics of PUSSYCATS. 20% mention the increased crossing time, sometimes referring to the infrared detector. 17% refer to the new system and system efficiency.
The audible noise is mentioned by 4%. The position of the pedestrian light by 3%.
Reasons for feeling unsafe are "position of old display better" (46%), and "old system better, more efficient, clearer" (28%).

3.6.3. 48 individuals (4%) confirmed the question: "Did you have any difficulty crossing the road". Of those that did, some had problems using the new system, some expressed their problem as being due to a disability they had. Other complaints were: "shoe stuck on mat", "should be opposite side sign", "violated red", and "car violated red".

3.7. Purpose of journey and group behaviour

3.7.1. Half the pedestrians said they were shopping (See Table 9). 'Work' (17%) and 'Other business' (16%) are the other main categories. Only at Woolwich, a group stated they were going to or from college or school, and at Toulouse 11% stated they were going to or from leisure activities.
The general opinion of the interviewers is that 'work' and 'station' are under-represented, because people were in a hurry. The consequence could be that answers on some questions are biased, e.g. less red light violation etcetera.

PUSSYCATS study	#1(UK)		#2(UK)		#3(UK)		#4(UK)		#5(FR)		#6(NL)		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	172		189		188		186		255		201		1191	
Shopping	149	87	160	85	78	42	73	39	71	28	79	39	610	51
To/from work	6	3	15	8	54	29	32	17	69	27	24	12	200	17
To/from other Business	17	10	8	4	20	11	35	19	64	25	43	21	187	16
To/from station	*	*	*	*	*	*	*	*	*	*	50	25	50	4
School/college/other	0	0	*	*	36	19	46	25	*	*	6	3	88	7
Other	*	*	6	3	*	*	*	*	24	9	*	*	30	3
Leisure activities	*	*	*	*	*	*	*	*	28	11	*	*	28	2

* Not coded or asked

Table 9. Purpose of journey.

3.7.2. In Study #1 and #6, the question is asked: "If in a group, did the behaviour of people you were walking with influence the way you crossed?" In Study #1 11 (29%), in Study #6 7 (7%) confirmed this question. The general opinion was that they felt safer when crossing in a group.

3.8. Crossing behaviour

3.8.1. In the UK studies, 40 to 50% said they always press the button (See Table 10). In Heemstede, only 34% gave this answer. Here, more people said that they only pressed if no one else has done so first. The total number using the push button is equal.
The UK study concludes that the positive answers differ from the reality observed on the video surveys, which show fewer people press the button.

PUSSYCATS study	#1(UK) N	%	#2(UK) N	%	#3(UK) N	%	#4(UK) N	%	#5(FR) N	%	#6(NL) N	%	Total N
All	172		189		188		186		255		201		1191
Press button normally													
Yes	86	50	86	46	92	42	91	49	*	*	68	34	
Yes, if no one else has done so first	42	24	44	23	29	15	35	19	*	*	83	41	
Yes, unless safe to cross without doing so	20	12	18	10	42	22	39	21	*	*	19	9	
No	23	13	41	22	25	13	21	11	*	*	25	12	
Don't know	1	1	*	*	*	*	*	*	*	*	6	3	
Crossing behaviour in general													
Cross before green man appears	15	9	13	7	6	3	10	5	*	*	19	9	
Cross before, but only if safe	90	52	88	47	108	57	110	59	*	*	109	54	
Wait for green	67	39	88	47	19	10	66	36	*	*	71	35	
Don't know	0	0	*	*	*	*	*	*	*	*	*	*	
Crossing behaviour just now													
Crossed on red	48	28	53	28	56	30	62	33	14	6	69	34	
Crossed on green	123	72	128	68	113	60	97	52	54	21	123	61	
Crossed on yellow	*	*	*	*	*	*	*	*	109	43	*	*	
Press button	*	*	*	*	*	*	*	*	*	*	68	34	
Stand on mat	*	*	*	*	*	*	*	*	*	*	116	58	

* Not coded or asked

Table 10. Use of the push button and crossing behaviour.

In Heemstede, 43 individuals were asked whether they pressed the button when they crossed on red. 53% confirmed this. This illustrates the function of the mat. The demand called up by the button remains after crossing on red, the demand called up by the mat is cancelled.

3.8.2. Table 9 shows that 3 to 9% usually cross before the green man, and 10 to 47% wait for the green man to appear. The others (47-59%) cross on red, only if it is safe to do so. These figures agree with the data from the video surveys.
These answers contrast with the measured crossing behaviour. Many people waited for the green man to appear. The conclusion can be that the presence of interviewers stopped people crossing on red.
In France, a large number (43%) of pedestrians cross on flashing yellow, which is in fact similar to the 'old' green they were familiar with.

3.9. Conclusions

1. The samples interviewed differ in certain respects from expectations. More women than men were interviewed and hurrying people were not selected. Hurrying often means going to work. A large proportion of the interviewed people are shopping.
The larger number of green crossers than expected can be attributed to the same factors, or to the fact that people feel observed and so behave more obediently. The observed behaviour of interviewees is less in accordance with what could be expected on the basis of the video surveys, than what they claim they do.

2. The fact that a small group of 'first users' will always remain necessitates good information near the crossing. Only the large scale installation of PUSSYCATS will make the system widely known.

3. Seeing publicity, particularly in local papers, relates to a better understanding and, probably, to a greater approval. However, the explanation that more concerned people see more publicity, cannot be excluded.

4. The understanding of the operation of the mat is inadequate in all countries. So is the understanding of how to get green, and the understanding of the flashing yellow in France. The understanding of the 60+ age group is even worse.

5. A high percentage of people prefer the old location for the display, where it is visible while they cross. If more of them understood that the infrared-detectors give them more time to cross, they might not have such strong feelings about the location.

6. The instruction signs seem to meet approval. There were not many complaints.

7. Most people did not experience a change in waiting time. Those who did, tended to experience shorter waiting times.

8. Most people felt safe while crossing. They did not mention reasons of safety related to PUSSYCATS. A small number of unsafe feelings were related to PUSSYCATS, particularly to the fact they did not see the display while crossing.

10. The new system is considered to be safer, or the same, by most people. The reasons for safety mentioned often imply characteristics of PUSSYCATS. The most important reason given for a decrease in safety is again the position of the display on the near side.

4. RESULTS OF OBSERVATIONS

Video observations were made in Rustington, Woolwich, Heemstede and Toulouse. The resulting reports used for this summary are:

- Report of Rustington video surveys: 'before' and first 'after'. Project Note No. 6 (Studies #1 and #2).
- Report of Rustington video survey: second 'after' (#3). Project Note No. 8 (Study #3).
- Report of Woolwich video surveys and questionnaire surveys. Project Note No. 9 (Studies #4, #5, and #6).
- New pedestrian facilities: Technique, observations and opinions. The Dutch experiment (SWOV, 1992) (Study #7).
- PUSSYCATS. Zelt Experimentation. Toulouse. September 1991.

The first three reports relate to 'before-after' studies, 'After' consisting of two studies. The fourth report is only an 'after' study. The fifth study is a 'before-after' study.
Table 11 presents the surveys and the reference codes used in this chapter.

Observation sites	Relation to installation		
	Before	After 1	After 2
Rustington	(#1) five weeks	(#2) one week	(#3) six months
Woolwich	(#4) six months	(#5) one month	(#6) two months
Heemstede	-	(#7) two months	-
Toulouse	(#8) one month	(#9) one month	-

Table 11. The video surveys.

4.1. Phase distribution

Details of phase distributions at the different sites can be found in the original reports. Some aspects are mentioned here, insofar as they are needed to understand the observation data.

4.1.1. The most important difference with the old system is the variable pedestrian clearance period (IR clear), influenced by detection of pedestrians on the crossing by the Infrared detector. This variable period has a minimum and maximum time. In Study #2, #3, #5, #6 and #9, these times are fixed. In Study #7, the maximum time depends on the following phase (See Table 12). The figures of this table relate to observation periods.

Sites	Study	Green	Infrared clearance Minimum	Maximum	Average time ped. phase	Average number per hour
Rustington	#2, #3	6	3	15	15.9, 16.6	42, 35
Woolwich	#5, #6	6	3	15	18.3, 20.8	41, 38
Heemstede	#7	7	0	7-11	15.8	17
Toulouse	#9	6	1	8	*	3.5

* Considered to be irrelevant because the pedestrian phase consists of different combinations of Yellow, Green, Red and IR clearance.

Table 12. Pedestrian phases in 'after'-studies. Duration in seconds and numbers per hour.

4.1.2. The pedestrian phase consists of a green period and two clearance periods. In Rustington and Woolwich, the IR clearance period is followed by a 3 and 4 second inter-green period respectively, provided the maximum IR clearance time has been reached. This phase was called in 3 out of 168 and 9 out of 183 pedestrian phases, in Study #2 and #3 respectively, and in about 50% of the pedestrian phases in Study #5 and #6. This time is included in the 'Average time pedestrian phase'.

In Toulouse, pedestrians may cross the main street during the stage when traffic lights are green for the secondary street. This corresponds to a flashing yellow pedestrian signal. The conflict free pedestrian green phase occurs after this stage, if pedestrians are still waiting on the mat. This explains the low rate of occurrence of this pedestrian green phase.

In Heemstede, a clearance period of 1 to 4 seconds, depending on the following stage, is inserted between the green phase and the IR clearance period. In Table 12, an average of 3 seconds is added to the 'Average time pedestrian phase' as an estimate of this variable period, to make data comparable to the UK data. In Rustington, Woolwich and Heemstede, an inter-green period (IG Ped) precedes the pedestrian green. This period was included in the total vehicle time. In Rustington, this period lasts 6 seconds, in Woolwich 7 seconds. In Heemstede, it again is defined as 3 seconds.

In Toulouse, the pedestrian green, when it occurs, is preceded by a 5 second inter-green phase (3 second yellow traffic lights on secondary street and 2 seconds red traffic clearance), followed by a fixed clearance time of 1 second, possibly followed by an IR extension. When the pedestrian green does not occur, the pedestrian flashing yellow (which is associated

with the vehicle green on the secondary street and continues during the yellow traffic and red clearance phase) is followed by the same 1 second fixed clearance time and the same possible extension.

4.1.3. The number of pedestrian phases per hour varies markedly. In Rustington, the maximum is 49, the minimum is 23. In Woolwich, the equivalent figures are 52 and 25, and in Heemstede, 26 and 11. In Toulouse, no hourly data were gathered.

4.1.4. The pedestrian time as a percentage of total time per hour varies at Rustington from 9 to 24%, at Woolwich from 12 to 30% and at Heemstede from 5 to 11%.

4.2. Vehicle and pedestrian flows

Table 13 presents some data on pedestrian and traffic flow. At Rustington, two crossings were observed (A and B), at Woolwich three (A, B, and C) and at Heemstede and Toulouse, one.

Sites	Before study		After study 1		After study 2	
	Vehicles	Pedestrians	Vehicles	Pedestrians	Vehicles	Pedestrians
Rustington A	1375	196	941	128	1028	176
Rustington B	547	406	474	298	512	515
Woolwich A	404	338	412	573	379	596
Woolwich B	390	297	373	534	361	485
Woolwich C	555	311	551	337	527	338
Heemstede	-	-	533	72	-	-
Toulouse	800	70	761	55	-	-

Table 13. Average two way pedestrian and traffic flow at observed sites per hour.

4.2.1. The sites are hardly comparable for pedestrian and traffic flow, and hours per day differ greatly.
Some examples to illustrate the high variability:
- The traffic flow per hour at Rustington A, 'before', is 1375, at Woolwich B, 'after-2', 361.
- The pedestrian flow at Woolwich A, 'after 2', is 596, at Heemstede 72.
- The pedestrian flow at Rustington A, 'before', per hour varies from 100 to 314 per hour.

- The vehicle flow at Woolwich A, 'after 1', varies from 299 to 486 per hour.
- No relationship seems to exist between average pedestrian and traffic flow per crossing.

4.2.2. Table 13 also illustrates that the vehicle flows in both 'after' surveys at Woolwich were generally lower than in the 'before' survey, particularly at site A, and most pronounced in survey 'after 1'.
The higher traffic flow in the 'before' study was due in part to the road-work taking place on the main road around Rustington, causing traffic to be diverted through the town.

4.2.3. A relationship is found between vehicle and pedestrian flow per hour in Study #7. The correlation is .74. The same relationship is found for cycles (n=244): r=.60. The explanation for this can be sought in the fact that, when the length of the cycle increases because more vehicles are detected, more pedestrians will arrive during this cycle, the average number of pedestrians per unit of time being equal. To assess this hypothesis, the correlation between the number of pedestrians and the number of vehicles is controlled based on the length of the cycle. The result is a partial correlation of .21. This relationship must be due to the fact that at times, the pedestrian flow and the vehicle flow are higher than at other times, resulting in the correlation between vehicles and pedestrians per hour.

4.3. Sample composition

4.3.1. In Heemstede and Toulouse, hours were sampled, but the data for all pedestrians were gathered. In Rustington and Woolwich, sampling was carried out by taking every nth complete cycle and sampling every pedestrian within that cycle, in order to have approximately 100 pedestrians sampled per crossing within each hour.
The samples of the studies differ in composition (Table 14).
Differences per site ('before'-'after') are smaller. Important differences between sites are:
- Rustington Studies #1-3: women far outnumbered men; a large proportion was aged 60+.
- Rustington Studies #1-3 and Heemstede study #7: less children in the age group of 11-20 than elsewhere.

Study	Sex	Age 0-10 count	%	11-20 count	%	21-60 count	%	60+ count	%	Total count	%
#1	Male	4	1	27	5	93	15	78	13	202	33
	Female	10	2	47	8	216	36	130	22	403	67
	Total	14	2	74	12	309	51	208	34	605	100
#2	Male	11	1	9	1	170	18	125	13	315	34
	Female	10	1	11	1	376	40	225	24	622	66
	Total	21	2	20	2	546	58	350	37	937	100
#3	Male	18	2	6	1	181	20	109	12	314	35
	Female	19	2	19	2	363	41	172	19	573	65
	Total	37	4	25	3	544	61	281	32	887	100
#4	Male	26	3	42	5	328	35	31	3	427	46
	Female	19	2	51	5	384	41	58	6	512	55
	Total	45	5	93	10	712	76	89	10	939	100
#5	Male	10	1	154	18	246	29	24	3	434	51
	Female	12	1	126	15	239	28	39	5	416	49
	Total	22	3	280	33	485	57	63	7	850	100
#6	Male	15	2	152	17	281	31	27	3	475	53
	Female	12	1	114	13	268	30	34	4	428	47
	Total	27	3	266	30	549	61	61	7	903	100
#7	Male	15	2	76	7	383	37	65	6	539	53
	Female	10	1	81	7	302	29	94	9	487	48
	Total	25	3	157	15	685	67	159	16	1026	100
#8	Male	20	1	285	20	293	21	31	2	631	45
	Female	17	1	418	30	304	22	38	3	778	55
	Total	37	3	703	50	597	42	69	5	1409	100
#9	Male	32	2	158	10	515	33	45	3	750	49
	Female	32	2	189	12	519	34	51	3	792	51
	Total	64	4	347	23	1034	67	96	6	1542	100

Table 14. Composition of samples of different studies, broken down according to age and sex.

Remarkable differences between 'before-after' studies:

- Rustington Study #1 versus Studies #2-3: a decrease in the 11-20 age group.
- Woolwich Study #1 versus Studies #2-3: an increase in the age group 11-20, and a decrease in the 21-60 age group.
- Toulouse Study #8 versus Study #9: an increase in the 11-20 age group and a decrease in the 21-60 age group.

4.3.2. Pedestrians are categorized according to whether they were subject to special circumstances, as was shown in Table 1. Characteristic figures for the different studies are as follows:

Studies #1-3. The proportion of those subject to special circumstances is 17, 15 and 21% respectively. The most important special circumstances are:

- walking difficulties: 1, 2, and 2%
- young children walking: 2, 2, and 3%
- pram/pushchair: 2, 3, and 2%
- bicycle: 6, 2, and 2%

Studies #4-6. The proportions are 10, 9 and 8% respectively. The most important are:

- walking difficulties: 1, 2, and 2%
- young children walking: 4, 2, and 2%
- pram/pushchair: 1, 2, and 2%
- heavy load: 3, 2, and 1%

Study #7. The proportion is 16%. The most important are:

- pram, pushchair: 2%
- heavy load: 1%
- dog: 2%
- bicycle: 9%

Studies #8-9. The proportions are 4 and 7%, respectively. The most important are:

- walking difficulties: 1 and 1%
- young children walking: 1 and 1%
- pram/pushchair: 1 and 1%
- heavy load: 1 and 3%
- dog: 1 and 1%

There are hardly any cases in the samples of blind and partially sighted people (7 in total) or wheelchair users (17 in total), probably the two most important special circumstances groups as far as different crossing behaviour is concerned.

The relatively large number of 'bicycles' in the Heemstede survey can be explained by the group of bicyclists going to the station. They can avoid crossing the main road twice, by walking 50 meters.

4.4. Behaviour and understanding

4.4.1. In Study #2, #3, #5 and #6, the addition of the mat complicates the procedure needed for the pedestrian to activate the system. He must press the button and stand on the mat. In Study #7 and #9, the mat replaces the push button.

'Before' studies	Count	%
Study #1		
Did not press button	130	65%
Pressed button	69	35%
Total	199	100%
Study #4		
Did not press button	439	86%
Pressed button	69	14%
Total	508	100%
Study #8		
Did not press button	674	82%
Pressed button	144	18%
Total	818	100%

'After' studies	Not on mat		On mat		Total	
	Count	%	Count	%	Count	%
Study #2						
Did not press button	67	32%	62	30%	129	62%
Pressed button	2	1%	78	37%	80	38%
Total	69	33%	140	67%	209	100%
Study #3						
Did not press button	159	48%	85	26%	244	74%
Pressed button	13	4%	72	22%	85	26%
Total	172	52%	157	48%	329	100%
Study #5						
Did not press button	254	72%	30	8%	284	80%
Pressed button	36	10%	34	10%	70	20%
Total	290	82%	64	18%	354	100%
Study #6						
Did not press button	387	80%	34	7%	421	87%
Pressed button	14	3%	48	10%	62	13%
Total	401	83%	82	17%	483	100%
Study #7						
Total	378	51%	364	49%	742	100%
Study #9						
Total	551	58%	403	42%	954	100%

Table 15. Button and mat behaviour for those who arrive with wait lamp off and pedestrian signal on red.

To assess the pedestrian's understanding of the system, only those who are expected to activate the system should be considered. These are pedestrians who arrive at the crossing while the wait lamp is off and the pedestrian signal is on red. Comparisons can be made 'before' and 'after' the installation of the new system, to assess whether knowledge about how to activate the system has deteriorated. Table 15 presents the results.

As can been seen from the Table, few people correctly activated the system, 'before' (Study #1: 35%, Study #4: 14%, and Study #8: 18%) and 'after' (Study #2, and #3: 37% and 22%, Study #5, and #6: 10%, Study #7: 49%, and Study #9: 42%). In the British case, a deterioration could be expected, because people have to do two things. However, the differences are small.
It should be noted that the Dutch and French data (Study #7 and #9) are very similar, and that the number of persons who correctly operate the system in France has considerably increased, from 18% pressing the push button to 42% using the mat.

4.4.2. 'Incorrect use' is a mixture of not understanding the method of operation and refusal to use the system. A better representation of understanding is to exclude those who cross within three seconds, since they probably have no intention of correctly using the crossing. These results are shown in Table 16.

As can be seen from the Table, too few people correctly activated the system, 'before' (Study #1: 49%, Study #4: 27%) and 'after' (Study #2, and #3: 52% and 33%, Study #5, and #6: 28% and 30%, Study #7: 88%). In the British case, the expected deterioration did not occur again.

From comparison of the two Tables, we can see that people who arrive with the wait lamp off and intend to wait, use the push button more often than all the pedestrians combined (Study #1: 49% versus 35%, and Study #4: 27% versus 14%) in the 'before' studies. The same is true for the 'after' studies (Study #2: 53% versus 38%, Study #3: 37% versus 26%, Study #5: 41% versus 20%, and Study #6: 33% versus 13%). The same can be said for use of the mat in the 'after' studies (Study #2: 91% versus 67%, Study #3: 70 versus 48%, Study #5: 51% versus 18%, Study #6: 53% versus 17%, Study #7: 88% versus 49%).

'Before' studies	Count	%
Study #1		
Did not press button	71	51%
Pressed button	68	49%
Total	139	100%
Study #4		
Did not press button	166	73%
Pressed button	60	27%
Total	226	100%

'After' studies	Not on mat		On mat		Total	
	Count	%	Count	%	]Count	%
Study #2						
Did not press button	12	8%	58	39%	70	47%
Pressed button	2	1%	76	52%	78	53%
Total	14	9%	134	91%	209	100%
Study #3						
Did not press button	56	25%	84	38%	140	63%
Pressed button	9	4%	72	33%	81	37%
Total	65	30%	156	70%	221	100%
Study #5						
Did not press button	35	36%	22	23%	57	59%
Pressed button	13	13%	27	28%	40	41%
Total	55	49%	62	51%	97	100%
Study #6						
Did not press button	51	44%	27	23%	78	67%
Pressed button	4	3%	35	30%	39	33%
Total	55	47%	62	53%	117	100%
Study #7						
Green crossers	28	12%	208	88%	236	100%
Red crossers	350	69%	156	31%	506	100%

Table 16. Button and mat behaviour for those who arrive while wait lamp is off and pedestrian signal is on red, and do not cross immediately (or cross on green: Study #7).

The French situation is a special case, due to the specific staging. Only 2% use the green light after installation of PUSSYCATS with the flashing yellow. One can ask whether a mat has any sense, if nobody wait for green.

4.4.3. We can compare the use of the push button and the use of the mat in two different ways.

- From the French studies, we can see that the use of the push button ('before': Study #8: 18%) is much less than the use of the mat ('after': Study #9: 42%).
- From the British studies, we can see that, in a situation where people have to use both, they use the mat more often than the push button (Study #2: 67% versus 38%, Study #3: 48% versus 26%, Study #6: 17% versus 13%). Study #5 is an exception: 18% versus 20%. The effect is much larger for people who arrive with the wait lamp off and wait at least some time (Study #2: 91% versus 53%, Study #3: 70% versus 37%, Study #5: 51% versus 41%, and Study #6: 53% versus 33%).

4.4.4. In general, the correct use of the push button and mat by people who arrive while the wait lamp is off is generally low, but better for people who intend to wait some time, or intend to wait for green. Indications are found that installation of PUSSYCATS does not deteriorate the situation when the pedestrians' tasks are made more complex (mat & push button), and improves the situation where the task changes from push button to mat. The mat is used more effectively, both when pedestrians have to use a combination of mat and push button, and in situations where the push button is replaced by a mat.

4.5. Pedestrian use of crossing and risk taking

4.5.1. Red and green crossing

1. Table 17 shows the signals which the pedestrian intending to cross may encounter. The table offers three possibilities: the pedestrian is confronted by a red, green (flashing green included) or flashing yellow signal. Red means: 'do not cross' and green and flashing yellow means: "you may cross".

In the second part, more distinctions were made, because each sub-category can be linked to expectations about the behaviour of pedestrians. The experimental sites and the 'before' and 'after' situations differ in the number of possible distinctions, and in the length of the phases. Moreover, not all nine studies provide all possible data. The table has made the data as comparable as possible.

Pedestrian signal	#1	#2	#3	#4	#5	#6	#7	#8	#9
All pedestrians									
Red	356	451	438	710	707	737	626	572	574
	59%	48%	49%	76%	83%	82%	61%	41%	38%
Green plus	249	486	449	229	143	166	396	808	36
Flashing Green	41%	52%	51%	24%	17%	18%	39%	59%	2%
Flashing Yellow									906
									60%
Total	605	937	887	939	850	903	1022	1380	1516
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Arrivers on red									
Red							617		
				86%	90%	89%	64%		
Green plus							343		
Flashing Green				14%	10%	11%	36%		
Flashing Yellow									
Total							960		
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Subdivisions									
Clearance, Red 1, 2							600		
							59%		
Clearance							9		
							1%		
Clearance, Red 1	298	338	339	591	560	583	591		
	49%	36%	38%	63%	66%	65%	58%		
Red 2	29	71	54	98	77	49	24		
	5%	8%	6%	10%	9%	5%	2%		
Green without flashing green								570	
								41%	
Flashing Green								238	
								17%	
Clearance Red	29	42	45	21	70	105	26		
	5%	5%	4%	2%	8%	12%	3%		

Clearance Red:	Clearance red or extended red pedestrian signal ('after') or blackout ('before')
Clearance:	Pedestrian additional inter-green period
Red 1:	Red phase between Clearance and Red 2
Red 2:	A pre-'pedestrian green' phase (where all pedestrians and vehicle signals were red)
Red:	Clearance red plus clearance, Red 1, Red 2.

Table 17. Pedestrian signal at start of crossing.

3. The Dutch study has calculated pedestrian counts for the phase of arrival, broken down according to starting phase and finishing phase.
The important flows are:
1. Arriving on Red 1 plus Red 2, starting on it and finishing on it (51.7%).
2. Arriving on Red 1 plus Red 2, starting on pedestrian green and then finishing on Clearance Red or Clearance (30.6%). Clearance, in this case, was three seconds between Clearance Red and Red 1.

4. It could be expected that pedestrians anticipate the green phase by starting during pre-pedestrian green (red 2). This should happen less in the 'after'-situation, due to the uncertainty arising from the new system and the phasing.
In 'before'-study #1, the percentage of crossers during this phase is 5%, the percentage of total time being 6%. In 'before'-study #4, the percentage of crossers is 10%, of time: 8%. This is no clear indication of anticipation in the 'before'-studies.
In 'after'-study #2, the percentages are respectively 8% and 7%. In Study #3: 6% and 6%. In Study #5: 9% and 8%. In Study #6: 5% and 7%. In Study #7: 2% and 1.5%.
One can conclude that no anticipation on pedestrian green occurs, neither in the 'before', nor in the 'after' studies.

Anticipation on green can also lead to more arrivals on green than expected from the duration of green. Data are available from Study #7. The percentage of people arriving when the pedestrian signal was green was 8.3%. Green time covers only 3.5% of total time. Some people clearly anticipate the green phase. The same difference is found in another Dutch study. There green time covered 27% of the total time. 45% of the pedestrians arrived on green (SWOV-report R-91-82; Levelt, 1991).

4.5.2. Head movements

1. A comparison of head movements both before and during crossing is important, as in the new system, the red and green man display is on the near side, rather than the far side as it was in the 'before'-surveys (#1, #4, and #8). This is likely to affect head movements. The table shows head movements before crossing for different pedestrian signals, broken down by

direction of view (away from and towards oncoming traffic. In Toulouse: away from and towards intersection). Study #1 and #4 distinguish Red, Green, the pre-pedestrian inter-green, and a blackout period, the clearance period after green. This last period was replaced by the extended red, triggered by the infrared detectors, in 'after'-studies #2, #3, #5, and #6. The Dutch study distinguished Green and Red only, because of the very small numbers in the other phases. The French study distinguished Green, Flashing Green, Red in the 'before'-study #8, and Green, Flashing Yellow and Red in the 'after'-study #9.

Study/ Phase	Head movements None count	%	Away from count	%	Towards count	%	Both count	%	All count	%
#1										
Red	35	12	28	9	38	13	197	66	298	100
Pre-ped Gr	3	10	1	3	2	7	23	79	29	100
Green	62	25	8	3	30	12	149	60	249	100
Blackout	14	48	3	10	4	14	8	28	29	100
All	114	19	40	7	74	12	377	62	605	100
#2										
Red	20	6	18	5	24	7	276	82	338	100
Pre-ped Gr	19	27	1	1	3	4	48	68	71	100
Green	291	60	8	2	63	13	124	26	486	100
Clear-Red	20	48	8	19	4	10	10	24	42	100
All	350	37	35	4	94	10	458	49	937	100
#3										
Red	12	4	12	4	11	3	304	90	339	100
Pre-ped Gr	5	9	2	4	1	2	46	85	54	100
Green	208	46	8	2	32	7	201	45	449	100
Clear-Red	33	73	0	0	1	2	11	24	45	100
All	258	29	22	2	45	5	562	63	887	100
#4										
Red	63	11	13	2	42	7	473	80	591	100
Pre-ped Gr	10	10	2	2	2	2	84	86	98	100
Green	106	46	3	1	15	7	105	46	229	100
Blackout	10	48	0	0	1	5	10	48	21	100
All	189	20	18	2	60	6	672	72	939	100
#5										
Red	115	21	39	7	128	23	278	50	560	100
Pre-ped Gr	7	9	12	16	15	19	43	56	77	100
Green	46	32	16	11	30	21	51	36	143	100
Clear-Red	28	40	13	19	19	27	10	14	70	100
All	196	23	80	9	192	23	382	45	850	100
#6										
Red	100	17	60	10	140	24	283	49	583	100
Pre-ped Gr	3	6	2	4	5	10	39	80	49	100
Green	39	23	22	13	30	18	75	45	166	100
Clear-Red	38	36	13	12	25	24	29	28	105	100
All	180	20	97	11	200	22	426	47	903	100
#7										
Red	108	17	60	10	247	40	211	34	626	100
Green	96	24	29	7	87	22	188	47	400	100
All	204	20	89	9	334	33	399	39	1026	100
#8										
Red	138	23	33	6	70	12	359	60	600	100
Green	179	31	16	3	70	12	306	54	571	100
Flashing G	124	52	9	4	51	21	54	23	238	100
All	441	31	58	4	191	14	719	51	1409	100
#9										
Red	172	30	27	5	75	13	298	52	572	100
Green	12	33	0	0	1	3	22	61	36	100
Flash-Amb	279	31	14	2	96	11	515	57	906	100
All	463	31	41	3	172	11	835	55	1514	100

Table 18. Head movements before crossing, analyzed for different phases.

2. Table 18 shows that those crossing on red, a high percentage looked both ways or at least towards the oncoming traffic (65 to 93%). The figures only show an improvement in the 'after'-studies #2 and #3. The other 'after'-studies (#4, and 5) show a decrease. 'Not-looking' shows the same pattern. An increase in not-looking is also observed in #9. Head movements during the pre-pedestrian green period do not differ much from those observed during red. People who start during the blackout period or extended red look less than people who start on red or green. They probably follow green crossers as fast as possible, only paying attention to the crossers in front of them. There appears to be no systematic change in head movements for these crossers.
Crossers on Flashing Yellow (Study #9) show the same pattern of head movements as red crossers.

3. Green crossers are less likely to make head movements than red crossers, in all surveys. The differences vary widely, but no systematic differences are shown between 'before' and 'after' studies. The large increase in the number of green crossers who do not look at all from Study #1 to Study #2 and Study #3 could be the result of the introduction of an audible signal. People do not need to look at the pedestrian signal.
All crossers combined in the British studies show a decrease in head movements from the 'before' to the 'after' situation when looking towards the oncoming traffic and to both sides taking together: Study #1: 74%, versus Study #2: 59% and Study #3: 68%. Study #4: 78%, versus Study #5: 68% and Study #6: 69%. The French study shows no difference.

4. The data so far do not prove that the improved position of the light head is advantageous. The light head should be positioned so that pedestrians watching the light are looking towards the oncoming traffic. In Heemstede (Study #7), this position could only be realized at the side of the station. Indeed, it was found that starters travelling towards the station looked left less (26%) than starters travelling from the station (41%). The PUSSYCATS position of the display seems to increase looking in the direction of oncoming traffic.

5. Table 19 below is similar to Table 18, but relates to head movements made while crossing the road. Only the interpretation is different. Head movements before crossing are useful, if one looks towards the oncoming

Study/ Phase	Head movements None count	%	Away from count	%	Towards count	%	Both count	%	All count	%
#1										
Red	204	69	25	8	16	5	53	18	298	100
Pre-ped Gr	25	86	2	7	2	7	0	0	29	100
Green	217	87	12	5	13	5	7	3	249	100
Blackout	21	72	3	10	2	7	3	10	29	100
All	467	77	42	7	33	5	63	10	605	100
#2										
Red	273	81	25	7	14	4	26	8	338	100
Pre-ped Gr	66	93	4	6	1	1	0	0	71	100
Green	474	98	4	1	5	1	3	1	486	100
Clear-Red	37	88	2	5	1	2	2	5	42	100
All	850	91	35	4	21	2	31	3	937	100
#3										
Red	176	52	92	27	26	8	45	13	339	100
Pre-ped Gr	40	74	4	7	3	6	7	13	54	100
Green	377	84	28	6	24	5	20	5	449	100
Clear-Red	38	84	2	4	2	4	3	7	45	100
All	631	71	126	14	55	6	75	8	887	100
#4										
Red	289	49	120	20	36	6	146	25	591	100
Pre-ped Gr	71	72	17	17	4	4	6	6	98	100
Green	172	75	24	10	12	5	21	9	229	100
Blackout	19	90	1	5	1	5	0	0	21	100
All	551	59	162	17	53	6	173	18	939	100
#5										
Red	265	47	117	21	74	13	104	19	560	100
Pre-ped Gr	34	44	24	31	7	9	12	16	77	100
Green	80	56	25	17	20	14	18	13	143	100
Clear-Red	35	50	15	21	10	14	10	14	70	100
All	414	49	181	21	111	13	144	17	850	100
#6										
Red	240	41	139	24	79	14	125	21	583	100
Pre-ped Gr	29	59	11	22	3	6	6	12	49	100
Green	85	51	44	27	16	10	21	13	166	100
Clear-Red	40	38	20	19	15	14	30	29	105	100
All	394	44	214	24	113	13	182	20	903	100
#7										
Red	125	20	196	31	46	7	259	41	626	100
Green	152	38	91	23	33	8	124	31	400	100
All	277	27	287	28	79	8	383	37	1026	100
#8										
Red	272	45	75	13	118	20	135	23	600	100
Green	393	69	39	7	70	12	69	12	571	100
Flashing G	157	66	16	7	26	11	39	16	238	100
All	822	58	130	9	214	15	243	17	1409	100
#9										
Red	340	59	54	9	100	17	78	14	572	100
Green	31	86	0	0	4	11	1	3	36	100
Flash-Yel	625	69	58	6	143	16	78	9	904	100
All	996	66	112	7	247	16	157	10	1512	100

Table 19. Head movements while crossing, analyzed for different phases.

traffic, or to both sides. Head movements towards oncoming traffic while crossing are useful if one has not yet looked in that direction. The other head movements are useful in any case. For the sake of convenience, all head movements were classed as potentially 'useful'.

6. The percentage of pedestrians making useful head movements while crossing is small in the 'before' and in the 'after' surveys. The Dutch survey is an exception, probably because the crossing consists of two sections, with a traffic island in the middle. 73% make useful head movements.
In all studies, red crossers made more head movements than green crossers. Differences are found from 9 to 32%.
No systematic differences were found comparing the 'before' and 'after' studies. The expectation that people in general are less likely to look straight ahead, due to the relocation of the display from the far side to the near side of the crossing has not eventuated. For red crossers in the British studies, there appears to be less of a tendency to make 'no head movement' in the second 'after' studies in comparison with the 'before' studies. The French data show the opposite tendency.

4.5.3. Crossing between lines

1. It is necessary to start crossing between the lines to trigger the infrared detector. Finishing is required to extend the clearance red by keeping the detector functioning. In Heemstede (Study #7), the crossing consists of two sections with a traffic island in the middle. Table 20 shows the number of pedestrians crossing between the lines, analyzed according to the percentage of crossings made between the lines, and for Study #7, analyzed for first and second section of the crossing, and for green and red crossers separately.

2. Differences between the locations are small, except for Heemstede. Heemstede does not use pedestrian railings to guide the pedestrians, and the layout of the crossing is illogical. The section furthest from the station does not meet the street corner. The distance to the corner is 7 meters. When crossing from the station, people cross more between the lines of the first section (67%) than when crossing to the station (55%). Differences between the old and the new system are found in the UK studies, probably because of the introduction of pedestrian railings.

Study	Percentage of crossings made between lines													
	> 95%		50-95%		5-49%		< 5%		> 50%		< 50%		All	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
#1	509	84	47	8	44	7	5	1	556	92	49	8	605	100
#2	867	93	23	3	28	3	19	2	890	95	47	5	937	100
#3	820	92	23	3	24	3	20	2	853	95	44	5	887	100
#4	761	81	45	5	39	4	94	10	806	86	133	14	939	100
#5	667	78	68	8	68	8	47	6	735	86	115	14	850	100
#6	749	83	76	8	37	4	41	5	825	91	78	9	903	100
#7 first section														
green									313	78	90	22	403	100
red									310	50	313	50	623	100
all									623	61	403	39	1026	100
#7 second section														
green									290	73	113	27	403	100
red									338	54	285	46	623	100
all									628	61	398	39	1026	100
#8	896	65	284	21	47	3	152	11	1180	86	199	14	1379	100
#9	1024	68	295	20	73	5	122	8	1319	87	195	13	1514	100

Table 20. Percentage of crossings between the pedestrian lines.

The differences, however, are small. Barriers prove to be effective, but a logical layout is more important.

3. Green crossers cross between the lines more often (Study #7). We have already seen that red crossers make more head movements. Table 21 presents the relationships between looking before crossing and crossing between the lines of the first section for the two groups.

	Between lines		Outside lines		Total	
	count	%	count	%	count	%
Green crossers						
watches before	243	61%	61	15%	304	76%
do not watch	70	18%	26	7%	96	24%
Total	313	78%	87	22%	400	100%
Red crossers						
watches before	278	44%	240	38%	518	83%
do not watch	32	5%	76	12%	108	17%
Total	310	50%	316	51%	626	100%

Table 21. Looking before crossing and crossing between the lines on the first section (Heemstede: Study #7).

Green crossers are more likely to look and cross between the lines than red crossers. Green crossers also cross between the lines more often, but red crossers more often look before crossing. Looking is more important for red crossers, because of potential conflicts. Crossing between the lines is more important for green crossers, because of the infrared detectors. We can conclude that a relationship exists between the logic of PUSSYCATS and the behaviour of green and red crossers.
Also in relation to PUSSYCATS, the same study found that standing on the mat almost automatically led to crossing between the lines (90% versus 36% of the people who not stand on the mat), which is necessary to trigger the infrared detector, and that green crossers very often continue crossing between the lines (90% versus 60% of red crossers), which is necessary to keep the infrared detector functioning.

4.5.4. Potential conflict between pedestrians and vehicles

Comments were made on potential conflicts. Different classifications were used:
- hurrying (Study #1-6);
- hesitation or potential conflict (Study #1-6);
- potential conflict, in terms of an encounter where at least one party must change direction or speed to avoid a collision (Study #7).

1. Hurrying. The only comment made reasonably frequently was that of pedestrians hurrying. In the 'before'-survey #1, this amounted to 72 people or 12% of the sample; in the 'after'-studies #2 and #3, 46 or just under 5% and 47 or just over 5%, respectively. The majority of these people were red crossers and were aged between 21 and 60.
Approximately 30-40 pedestrians, or 4%, in Survey #4-6, were noted as being in a hurry when crossing the road.

2. Hesitating or potentially having a conflict. In Survey #1-3, only two or three people were noted as hesitating during crossing or as potentially having a conflict with a vehicle.
In each survey 4-6, approximately 10-20, or 2% were noted as hesitating during crossing, and a similar number were noted as having a potential conflict with a vehicle, usually when a vehicle was too slow to allow a pedestrian to cross. There were one or two cases where this was very

serious and an accident nearly occurred. For all these cases, however, the pedestrian crossed on pedestrian red.

3. Avoiding collisions (Study #7). In 34 cases, pedestrians and vehicles were observed in conflict (3.3% of all pedestrians, during 14 hours of observation). A distinction can be made between situations where pedestrians have to rush forward to avoid a vehicle (27: 75%) and where they have to stop to avoid a passing vehicle (9: 25%). A conflict is defined as an encounter where at least one party has to change direction or speed to avoid a collision. In all conflicts, the pedestrians, at least, had to change pace. The danger of the conflicts could not be assessed, due to lack of time.
All but four cases involved pedestrians who violated the red light. 4.8% of all red crossers came into conflict, compared with 1% of green crossers who conflicted with cyclists violating red. We can conclude that crossing on green has a lower risk potential than violating red.
Most conflicts occur on the second part of the crossing, particularly on the section nearest the station. This section is clearly the most dangerous. Pedestrians face traffic from three directions, with different starting moments. 76% of conflicts occurred on this section.
People crossing in groups were less likely to become involved in conflicts. 1.1% of group members come into conflict, compared with 4.1% of pedestrians walking alone. The same is true when other people start crossing from the same side at the same time (1.1% versus 4.0%).
Most conflicts involve encounters with motor vehicles, but encounters with cyclists lead to conflicts relatively more often. No indication of more careless behaviour was found in terms of head movements and crossing within the lines.
In general, neither the number nor the quality of hesitating, hurrying and potential conflict incidents can be linked to characteristics of PUSSYCATS. If PUSSYCATS had decreased the number of red crossers or increased the number of people crossing together, this might have changed the situation.

4.5.5. Acceptance of gaps

1. Four studies provide detailed data on short accepted gaps. The accepted gap is defined as the difference in time between the crossing pedestrian

to the next vehicle passing through the crossing. The pedestrian time is calculated by subtracting half of the crossing time from the finishing time, assuming a constant crossing speed. This may overestimate the degree of risk. Table 22 presents the results.
It is worth noting that the number of short gaps is small. The second 'after'-study (#3) contains more very short gaps than the 'before'-study (#1). The British and Dutch figures are similar.

Study	Accepted gaps								All pedestrians	
	< 1 sec		1-2 sec		2-3 sec		Total			
	Count	%	Count	%	Count	%	Count	%	Count	%
#1	4	0.66	8	1.32	18	2.98	30	4.96	605	100
#2	6	0.64	12	1.28	15	1.60	33	3.52	937	100
#3	17	1.92	18	1.92	25	2.67	60	6.76	887	100
#7 sect 1	7	0.68	11	1.07	15	1.17	33	3.22	1026	100
#7 sect 2	7	0.68	22	2.14	20	1.95	49	4.78	1026	100

Table 22. Frequency distribution of short accepted gaps.

2. The Dutch study searched for relationships between gaps with conflicts, section of crossing, starting and finishing phase and personal characteristics. Accepted gaps were measured as being the time between the pedestrian completing a crossing of the first or second section and the first vehicle arriving at that part of the crossing. Sometimes, the vehicle passed before the pedestrian reached the island or kerb (a negative time), sometimes shortly after the pedestrian reached the kerb. Both situations are unsafe. Gaps of more than 10 seconds were not counted.

On the whole, all conflicts in which pedestrians have to hurry to avoid a car are reflected in negative or short positive accepted gaps, and half of the negative gaps are in fact conflicts. The large number of gaps and the short ones fall in the category 'red start - red finish'.
Again, it is shown that the IR clearance time is too short. Quite a number of short gaps on the second section of the crossing were seen for pedestrians who crossed on green and finished on red. This is corroborated by the fact that slower crossers and people with a slower response to the green signal show shorter gaps on this section of the crossing, that longer lengths of IR clearance make gaps longer, and that finishing on red makes gaps shorter. This aspect of PUSSYCATS is easily corrected.

It is worth noting that people with special circumstances have longer gaps.
Members of groups look less closely before crossing. They have shorter gaps on the first section of the crossing as well. People who start together with others, but not as members of groups, have longer gaps on this section of the crossing.

3. At Toulouse, other definitions of gaps were used. A gap is the time between two vehicles passing through the crossing. The aim was to study how the pedestrians use the gaps between vehicles to cross. It is clear that this study is pointless during the periods when the pedestrian has priority (because in that case, the vehicles have to adapt their behaviour to the pedestrians and one cannot say that a pedestrian accepts a gap or not). Consequently, the study deals with the "green vehicle periods" on the main street, or with "red pedestrian periods".
- A gap can be "refused" when pedestrians are waiting and have not started to cross.
- An "accepted gap" corresponds to a gap between two vehicles with a pedestrian crossing (start and end) during the gap.
- Many gaps are "unmeasurable". A pedestrian starts to cross when a vehicle is still on the crossing. Or the occupancy period of the vehicles is more than two seconds (congestion), and the pedestrian can cross between two stationary vehicles. Or the occupance rate of the vehicle is less than two seconds, and we can expect that the gap is a very short one, with a duration shorter than the measurable minimum time interval (three seconds).
- A gap can be "uncompleted". The vehicle arrives before the crossing is completed. Here again, we can expect a gap shorter than the precision of measurement (three seconds).
Table 23 presents the results.

Most of the gaps used by red crossers are very short ones: only a few (45 'before', 7 'after') could actually be measured, the others corresponding to crossing with vehicle present at the same time. This can mean that vehicles are stopped because of congestion (about 40% of total gaps), or that pedestrians make use of very short gaps between vehicles moving in both directions (crossing one half of the street as a vehicle comes from the other direction), which can be qualified as a 'hazardous' crossing (another 40% of total gaps). The 'uncompleted' gaps correspond to similar situations (vehicles passing before the pedestrian has finished crossing).

	'Before' Number	%*	Sec	'After' Number	%	Sec
Number of pedestrians	1943			1599		
Crossing in gaps = used gaps (= red crossers)	587	30		322	20	
Measurable used gaps	45	7.7	5.5	7	2.2	3.9
Unmeasurable gaps (fluid traffic)	234	40		132	41	
Unmeas. gaps (congestion)	239	41		131	41	
Uncompleted gaps	69	12		52	16	
Refused gaps	1978		1.7	2036		1.6

* All percentages are expressed as a % of used gaps. Only the percentage of "Crossing in gaps" is a % of "Number of pedestrians".

Table 23. Comparison between gaps, at Toulouse. Number, percentage and duration in seconds.

This way of using gaps is very similar for the 'before' and 'after' surveys: the proportion of the various types of gaps are quite similar. The mean duration of measurable gaps is different, but the number of measured gaps is too low to be of any significance.

4. One can conclude that a closer analysis of gap acceptance is very informative, not so much to gain an impression of the concrete dangers as to understand the functioning of PUSSYCATS, as is shown in the Dutch example. A major shortcoming of the Dutch implementation was revealed: the maximum Infrared Extended Red period was too short. The increase in the second 'after' study at Rustington is not alarming, but a closer analysis could have revealed responsible PUSSYCATS characteristics.

4.5.6. Behaviour of extended red/blackout arrivals

1. A particular question of interest was the behaviour of individuals who arrive at the crossing during the blackout period ('before' surveys UK: Study #1 and #4) or the clearance/extended red period in the 'after' surveys (UK: Study #2, #3, and #5, #6 and The Netherlands: Study #7. No

French data are available). One might on the one hand anticipate that a greater proportion of pedestrians in the 'after' survey would realise that the vehicle red signal could be held by the infra-red detector and therefore cross immediately. They also see other people crossing when they arrive at the crossing. On the other hand, in the British 'after' surveys, the pedestrian signal would be red rather than blacked out, which might discourage crossers.
Table 24 shows the proportions of clearance/extended red or blackout crosers who cross within three seconds of arrival, in the seven surveys.

Study	#1		#2		#3		#4		#5		#6		#7.1		#7.2	
	Cnt	%	Cnt	%	Cnt	%	Cnt	%	Cnt	%	Cnt	%	Cnt	%	Cnt	%
Do not cross immediately	29	76	18	34	19	32	1	5	12	14	8	7	7	24	203	34
Cross within three seconds	9	24	35	66	41	68	21	95	75	86	104	93	22	76	397	64
All	38	100	53	100	60	100	22	100	87	100	112	100	29	100	600	100

Table 24. Crossing behaviour of individuals arriving in Blackout (#1,4) or Clearance/Extended Red periods (#2,3,5,6,7.1) or Red (#7.2) by survey.

2. The small cell numbers of Table 24 preclude much detailed analysis. The first three studies show an increase in immediate crossing for PUSSYCATS. The second three do not. Survey-study #7 compared the IR Clearance Red arrivers (Study #7.1) with other red arrivers (Study #7.2). The other red arrivers do not cross within three seconds as frequently.
On the whole, there is some evidence that IR Clearance arrivers cross more often within 3 seconds, but the reason could be their understanding of the possible extension of red, or their imitation of other people on the crossing on arrival.

4.6. Pedestrian comfort and convenience

4.6.1. Waiting times

1. At the Rustington site (Study #1-3), the new system has sought to retain the overall cycle time features of the old, in order to facilitate comparison. As signal timings and length of cycle were different to the

other 'before-after' surveys and for each hour of observation, a change in waiting times must be analyzed carefully.
Waiting times will obviously be influenced by the pedestrian signal shown at start of crossing, and Table 25 shows the mean and standard deviations of waiting times for each pedestrian signal, wherever possible.

	Red			Pre-ped Gr			Green			Clear Red			All		
	Mn	sd	cnt	Mn	sd	cnt	Mn	sd	cnt	Mn	sd	cnt	Mn	sd	cnt
#1	17	17	298	33	29	29	30	25	249	2.4	6.8	29	22		605
#2	12	14	338	21	18	71	26	23	486	1.5	6.2	42	20		937
#3	14	15	339	26	19	54	27	25	449	1.8	8.2	45	21		887
#4	5.5	8.3	591	13	13	98	9.9	16	229	.67	.97	21	7.3		939
#5	4.3	7.4	560	9.0	13	77	11	17	143	.29	.62	68	5.6		850
#6	3.9	7.2	583	12	11	49	12	18	166	.42	1.4	105	5.5		903
#7	7.2	13	559	19	23	24	28	25	391	1.5	2.5	26	15	22	1001
#8													9.7	13	1409
#9													13	18	1541

Table 25. Mean (Mn), standard deviations (sd) and number (cnt) of waiting times (in seconds), according to pedestrian signal at start of crossing for each survey.

2. For red crossers, mean waiting times in the four 'after'-studies (#2-3 and #5-6) were lower than in the 'before'-studies. Other differences were not statistically significant. The decrease in waiting times at Rustington can probably be explained by the fact that in both 'after' surveys, the vehicle flows were lower than in the 'before' survey. Individuals waiting to cross on red would have shorter waiting times when the vehicle flow was lower, as was seen to be the case. The flows in the '2nd after' survey were slightly higher than in the '1st after', reflected by the slight increase in mean waiting times for red crossers. The mean waiting times between the two 'after'-surveys #4 and #5 have decreased, because the percentage waiting for less than five seconds has increased.
The Rustington report suggest that the decrease of waiting times for all groups of crossers may indicate a difference in behaviour since the installation of the new system. These differences are not reflected in the overall results, because of the shift between groups (41% green crossers in the 'before' study, versus 52% and 51% in the 'after' studies).
In Toulouse, the mean waiting times for all crossers together has increased to 3.6 seconds (37.5%). The explanation can be found in the over

all modifications of the intersection timings, due to the implementation of PUSSYCATS: the cycle time has increased overall, and the proportion of green allocated to traffic on the main street has also increased. The probability that a pedestrian does not have to wait at all has therefore decreased: 27.9% of pedestrians arrive while the signal is flashing yellow or green in the 'after' situation, while this applies to 33.9% in the 'before' situation. As the duration of the red pedestrian signal has increased, the distribution of waiting times is shifted towards high values.

3. The differences between red and green crossers are large in all surveys. The green waiting times are related to the cycle lengths. Rustington: about 74 seconds, Woolwich 67 seconds and Heemstede 202 seconds. Red crossers at Rustington are prepared to wait longer than in Woolwich and Heemstede. This view may be supported by the finding that at Rustington, red crossers wait about half as long as green crossers, while at Woolwich, this value is about two thirds and at Heemstede, three quarters. This can be explained by the characteristics of the population. In Rustington, the number of women and people aged over 60 is much larger than at the other two sites.
The Dutch study showed that those aged 60+ had longer waiting times. Women also had longer waiting times, but these differences could be explained by the higher proportion of women who crossed on green.
At Heemstede, it was found that most red crossers (72%) cross as soon as possible, while others wait first (they stand on the mat and press the button), but then decide to cross on red. The waiting time of green crossers depends on the arrival phase, but the other important factors were the waiting time required, and whether other people were already waiting and had made a call by standing on the mat.

Overall, no clear effects of PUSSYCATS were shown by the waiting times. A possible effect could have been that green crossers have to wait longer because calls are often cancelled, after which the necessary waiting time has to start again. The phase of arrival is another determining factor. The short green of the implemented PUSSYCATS systems could also increase the waiting times, because green arrivers have extremely short waiting times.

4.6.2. Crossing times

1. It is of interest to examine whether the crossing times varied between the 'before' and 'after' surveys. It is possible, for example, that the introduction of the new pedestrian facility might have had the effect of either increasing or decreasing green crossing times. The knowledge that their progress was being monitored by the infra-red detectors may have reassured pedestrians and resulted in their walking more slowly. On the other hand, the absence of the far-side pedestrian signal head may have resulted in their hurrying and in a decrease in pedestrian crossing time. It is apparent that crossing time will vary, depending on the pedestrian signal on arrival at the crossing. Red crossers are often in a hurry, and pedestrians with special circumstances are more inclined to cross on green. Table 26 shows the mean values and standard deviations of crossing times, based on the starting phase.

study	Red			Pre-ped Gr			Green			Clear			Red All		
	Mn	sd	cnt	Mn	sd	cnt	Mn	sd	cnt	Mn	sd	cnt	Mn	sd	cnt
#1	5.5	1.3	298	5.9	1.5	29	6.8	2.1	249	5.5	1.3	29	6.0		605
#2	5.4	1.4	338	6.5	1.6	71	7.3	1.7	486	5.8	1.7	42	6.5		937
#3	5.6	1.6	339	6.2	1.4	54	7.3	1.7	449	6.2	2.0	45	6.5		887
#4a	6.7	2.0	396	7.1	1.4	87	7.5	1.6	145	7.1	1.5	18	7.0		646
#4b	7.8	2.2	195	7.2	1.2	11	7.9	1.4	84	7.3	1.5	3	7.8		293
#5a	6.1	1.4	416	6.6	1.2	67	6.6	1.4	103	5.7	1.9	51	6.2		637
#5b	7.6	2.0	144	7.6	1.3	10	8.5	1.5	40	7.4	1.8	19	7.8		213
#6a	6.1	1.7	382	6.6	1.1	42	6.4	1.3	117	6.0	1.2	68	6.2		609
#6b	7.5	1.8	201	7.9	1.1	7	7.2	1.1	49	7.2	1.8	37	7.4		294
#7	9.4	2.1	576	10	7.3	24	9.8	2.0	396	9.4	2.0	26	9.6	2.3	1026
#8													6.0	2.6	
#9													6.3	1.9	

Table 26. Mean (Mn), standard deviations (sd) and number (cnt) of crossing times (in seconds), based on the pedestrian signal at start of crossing for each survey.

5. In the Rustington survey, green crossers indeed crossed more slowly in the 'after' study. Red crossers showed no change. At Woolwich, two crossings of different width were observed (a and b). Both showed a decrease in crossing times of green crossers and of red crossers. Thus, no general PUSSYCATS effect can be shown for green crossing time.
In general, green crossers crossed more slowly than red crossers, includ-

ing crossers in the Infrared Clearance period. Pre-pedestrian Green crossers sometimes crossed more slowly than green crossers. They actually have more time, if others cross on green.

6. Multilinear regression analyses were run on the data of Rustington, Woolwich and Heemstede. In all studies, a number of population variables were the most important predictors of crossing time.
Those aged over 60, women, pedestrians with special circumstances and group members crossed more slowly. These effects can probably explain why the starting phase has disappeared as a contributing factor.

7. Crossing time is important in order to establish the correct settings for pedestrian signals. When these operate on fixed times, an allowance must be made for slower than average walkers, but any increase in time will lead to increased delay to traffic. PUSSYCATS relieves this problem by automatically adjusting the pedestrian phase to the walking speeds, to a certain minimum speed, depending on the pedestrians characteristic for a crossing.
For example, at Rustington, the pedestrians cross at an average speed of 1.4 meters per second in the 'before' survey, and at 1.3 meters per second in the 2 'after' studies. At Heemstede, the mean speed is also 1.3 meters per second.
Green crossers are of special importance. The mean speed at Rustington in the 'before' survey is 1.3 meters per second, in the 'after' study 1.2 meters per second. At Heemstede, 1.3 meters per second.
PUSSYCATS, developed for vulnerable road users, ought to cater in particular to very slow crossers. At Rustington, about 2.4% of green crossers crossed more slowly than .8 meters per second, while at Heemstede, this figure was 1%, reflecting the difference in the proportion of people aged over 60.
As we have seen, the PUSSYCAT system at Heemstede is not well adjusted to slow crossers. 17% of the green crossers finish in the Clearance period of 3 seconds after IR clearance, 4.8% even after the clearance period. Perhaps some start crossing at the end of the green phase, after which they only have the IR clearance period (7 to 11 seconds, dependent on the next stage), plus some clearance time for crossing. Lengthening the maximum IR Clearance time does not result in much delay for traffic. Only about 10% of the IR clearance periods are fully used. The situation at Rustington and Woolwich is better adjusted to slow crossers, as we will see.

In general, large differences in walking speed were found between crossers. PUSSYCATS, therefore, is particularly suitable for guaranteeing safe crossing, while not significantly increasing traffic waiting times. The expectation that PUSSYCATS could lead to longer crossing times has on the whole not eventuated. One site, Heemstede, has proved to be poorly suited to slow walkers.

4.7. System safety and efficiency

4.7.1. System safety

1. The British PUSSYCATS system at Rustington can be said to be safer, if only on the basis that in the 'after' surveys, the percentage of green crossers increased quite considerably. At Woolwich, the percentage of green crossers decreased. In Toulouse, green crossers became exceptional in the 'after' study. It is only this last finding which can be attributed to the specific implementation of PUSSYCATS. On the other hand, the Toulouse implementation introduced a conflict free pedestrian green, which did not form part of the previous system and which provides safer crossing conditions for people waiting for this phase.

2. Another method of looking at the safety of the system is to compare the pedestrian signal on completing the crossing, relative to the pedestrian signal on commencing the crossing for each survey. Only those who start to cross on green or Infrared extended red/blackout are of interest. This is shown in Table 27 No French data were available.

3. Looking at those who cross on green, it can be seen that in the British 'before' surveys, many finished crossing on green (Study #1: 45%, Study #4: 38%). In all 'after' surveys, the proportion finishing on green dropped dramatically (to 5%, 7%, 7%, and 3% in Study #2, #3, #5 and #6, respectively). In the Dutch Study (#7), only 2% of green crossers arrived on green. The decrease in the number of green finishers is because of the reduction in green time from 7 (Study #1), 10 (Study #4) 12 (Study #7) to 6, 6 and 12 seconds respectively, and probably also due to introduction of the audible signal. Conversely, many more finish in the IR Extended Red period than 'before' in the blackout period. 'Before': 53 and 35%, 'after': 94, 93, 92; 89% in the British surveys, and 76% in the Dutch survey.

Signal at start	Pedestrian signal at finish: Green Count	%	Ext.Red* Count	%	Clear** Count	%	Red Count	%	Total Count	%
#1										
Green	112	45	132	53			5	2	249	100
Blackout	0	0	6	21			23	79	29	100
#2										
Green	26	5	454	94			6	1	486	100
Ext.Red	0	0	32	76			10	24	42	100
#3										
Green	30	7	410	93			0	0	449	100
Ext.Red	0	0	42	93			3	7	45	100
#4										
Green	86	38	80	35			63	28	229	100
Blackout	0	0	0	0			21	100	21	100
#5										
Green	10	7	131	92			2	1	143	100
Ext.Red	0	0	26	37			44	63	70	100
#6										
Green	5	3	147	89			14	8	166	100
Ext.Red	0	0	55	52			50	48	105	100
#7										
Green	6	2	301	76	67	17	22	6	396	100
Ext.Red	0	0	6	23	5	22	15	65	26	100

* Survey #1 and 4: blackout period
** Survey #7: first 3 seconds after IR Clearance

Table 27. Pedestrian signal at finish, relative to pedestrian signal at start of crossing.

The most significant thing to note for those who start on green is the reduction in the British 'after' surveys, in particular in the Woolwich survey, relative to the 'before' surveys with respect to the percentage of pedestrians who finish on a pedestrian red signal. In the 'before' surveys, this was 2 and 28%, compared with 1/0% and 1/8% in the 'after' surveys. The results of the Dutch study are slightly worse: 17% finished on Clearance (the first 3 seconds after IR Extended Red) and another 5.6% on Red. And as we have seen, the Clearance period is not completely safe. For the 8% of the second Woolwich 'after' survey, the extended red period did not reach its maximum, implying that it did not detect these 14 people. This happened because the angle of the infrared detector was not well adjusted.

4. In the Dutch survey, a multilinear regression analysis was run to detect factors related to the finishing of red crossers on Clearance or

Vehicle red. Slower pedestrians, in terms of reaction to the green signal and to crossing speed, are more likely to finish on red. The same is true for crossing outside the lines of the second section of the crossing. Pedestrians with special circumstances are less likely to finish on red, to an almost significant degree. They use the possibility of crossing safely. Absence of the IR clearance period also makes finishing on red more probable.
One can conclude that maximum IR clearance at Heemstede needs to be extended, so that all pedestrians starting on green finish in the safe period. But more instruction is needed too. Pedestrians must be convinced that they must cross between the lines, to ensure maximum effectiveness of the IR detector.

5. Table 28 shows the numbers who finish crossing on a traffic red/yellow or green light for each survey, except for the Dutch study, for those who

Signal at start	Vehicle signal at finish: Red Count	%	Green Count	%	Yellow Count	%	Total Count	%
#1								
Green			3	1			249	100
Blackout			15	52			29	100
#2								
Green			0	0			486	100
Ext.Red			7	17			42	100
#3								
Green			0	0			449	100
Ext.Red			3	7			45	100
#4								
Green			26	11			229	100
Blackout			19	90			21	100
#5								
Green			0	0			143	100
Ext.Red			32	46			70	100
#6								
Green			1	1			166	100
Ext.Red			29	28			105	100
#8								
Red	146	26	388	68	38	7	572	100
Green	561	98	9	2	0	0	570	100
Flash.Gr	164	69	74	31	0	0	238	100
#9								
Red	235	41	313	55	26	5	574	100
Green	36	100	0	0	0	0	36	100
Flash.Amb	900	99	6	1	0	0	906	100

Table 28. Vehicle signal at finish, relative to pedestrian signal at start of crossing.

start to cross on a pedestrian green or an extended red/blackout period (British surveys), on a pedestrian (flashing) green, red or flashing yellow period (French surveys). This gives a more direct idea of the numbers at risk when finishing crossing.

6. This table shows more clearly the decrease in cases of potential conflict in the five 'after' surveys. For pedestrian green and flashing green crossers, there was only one such case, a very slow crosser, against 69 in the three 'before' studies. Further, six flashing yellow crossers finished on vehicle green, in 'after'-study #9.
There are much smaller percentages in the British 'after' surveys who finished crossing on traffic green after starting to cross in the IR Extended Red period, compared with those who crossed in the blackout period in the 'before' study.
Therefore, the results from Table 23 quite clearly show an improvement in safety, by reducing those potentially at risk under PUSSYCATS.

7. On the whole, one can conclude that PUSSYCATS has the potential to offer a safer crossing to green crossers, especially to slower crossers. If the Infrared Clearance Period has a sufficiently long maximum time, which was not the case at Heemstede, only few people finish crossing in dangerous periods. Another necessary condition is that the layout of the crossing, or barriers, or good publicity, 'force' people to cross between the lines, the detection field of the infrared detectors.

4.7.2. System efficiency

1. The cost efficiency of the new system is the time saving for vehicles, due to two factors: the cancellation of calls when pedestrians leave the mat before the green signal is given (or if nobody stands on the mat after a call by pressing the push button, in Studie #2-3 and #5-6), if no other pedestrians remain on the mat and there are no calls at other points in the system where other road users receive green at the same time as pedestrians; and possibly, the shorter duration of the pedestrian phase.

2. As shown in Table 29, the rate of not used calls is similar for British 'before' and 'after' surveys. The saving in time is considerable. In these British surveys, a pedestrian phase is only regarded as cancelled

if the pedestrian green phase is not called again within that cycle. The advantage in time by postponing the next pedestrian green is not calculated.

Study	Number of cycles in which call is not used		Total cycles	
	Count	%	Count	%
#1	8	6.5	123	100
#2	14	6.8	201	100
#3	12	6.6	183	100
#4	22	14.7	150	100
#5	21	13.8	152	100
#6	29	17.0	171	100

Table 29. Not used calls.

3. At Heemstede, 156 pedestrians (15%) arriving while the signal was on red and the wait lamp was off used the mat, but left before the signal turned green. It is not certain whether other people remained on the mat at that time. Savings due to cancelled calls can only be realized if no traffic from any other direction receives a green signal simultaneously with the pedestrians. At this site, there is a green phase for a bicycle lane at the same time. This phase is only realized when bicycles use a push button. It is not known what proportion of the traffic light cycles do not have a bicycle phase concurrent with the pedestrian phase. Estimated savings should be multiplied by this proportion.
In the absence of empirical data, we can only make estimates for a situation in which pedestrians represent the only flow during their phase, as if this were a midblocks crossing.
An estimate of time savings is found in the time between the first call and the last, i.e. effective, call of a cycle. A cycle is defined as the period between two pedestrian greens. If there is only one call, no savings are made. If there are two, then the first must have been cancelled, because a call is only counted when the wait lamp switches on. The expected time saving is the time between the first and second call, if this time does not exceed the mean time of the pedestrian phase (IG ped + Green + IR clear + Clearance): about 20 seconds. In this case, the time saving is 20 seconds. Sometimes, more than one call is cancelled. Table 30 shows the frequency distribution of calls.

Number of calls per cycle	Frequency	Percentage	Number cancelled
1	140	61	-
2	57	25	57
3	21	9	42
4	8	3	24
5	4	2	12
Total	230	100	135

Table 30. Frequencies of calls and cancelled calls.

Calls were cancelled in 90 cycles, one call in 57 cycles and more than one call in 33. Only the time between the first and last call of a cycle is known. A measure of time-saving is the sum of the times between first and last calls, unless this difference is longer than 20 seconds, in which case the saving is 20 seconds. The result is 1,764 seconds. This represents 3.6% of the total time for all cycles (48,382 seconds) and 40% of the total time for pedestrians (4366 seconds). These percentages are a conservative estimate, because only the first and last calls are considered. Cycles sometimes have more than one cancelled call. In these cases, the maximum time saving with two cancelled calls could be 40 seconds, and with four, as much as 80 seconds.

4. The second possible factor producing a time saving is the duration and the number of the pedestrian phases.
The Rustington site (Table 31) shows that an average of 16.6% of the total cycle time was given to the pedestrian phase (including inter-green and

Study	% of cycles containing a ped. phase	Average duration of ped. phase	% of cycle time given to ped. phase
#1	92	15	16.7
#2			
#3	70	17.4	16.6
#4	85	17	28
#5	81	18.3	29
#6	67	21.4	29
#7	100*	15.8	7.8

* Cycle defined from pedestrian green to pedestrian green

Table 31. Cycle time given to pedestrian phase, including inter-green.

the blackout/extended red period) in the '2nd after' survey, compared with 16.7% in the 'before' study. The same figures are not given for the first 'after' survey as time periods were not strictly comparable.
In the Woolwich 'before' survey, an average of 28% of the total cycle time was given to the pedestrian phase and in both 'after' surveys, this figure was 29%, showing the similarity.
The results show no obvious change in the percentage of time given to the pedestrian phase, with the fewer number of phases called in the 'after' surveys counterbalancing the increase in average pedestrian phase time.

5. The times for the 'old' Dutch conflict free system have been calculated using a method proposed by Jansen (P.B. Jansen, Lichtzeichenregelung in den Niederlanden. In: Sicherheit für Fussgänger an lichtzeichengeregelten Verkehrsknoten. Aachen, 1989)
- IG ped: 3 seconds
- green: minimal 6 seconds green
- green + flashing green: 0.5 * (length of crossing / speed of slowest pedestrian)
- flashing green + clearance time: length of crossing / speed of slowest pedestrian
- clearance time: length of crossing / speed of fastest pedestrian

The length of the crossing is 13.5 meters. The speed of the fastest pedestrian is 1.8 m/s, and of the slowest 1 m/s.

Summary:	Jansen	PUSSYCATS
- IG ped	3	3
- Green	6	4
- Flashing green	6	3
- Clearance time/IR Clearance	7.5	5.9
- Clearance	-	3
Total	22.5	18.9

The observed mean duration of the pedestrian cycle is 18.9 seconds. The time-saving is at least 3.6 seconds per cycle, or 835 seconds in total: 1.7% of total cycle time. The saving represents 19% of the pedestrian time.

The advantage is provided by the short green + flashing green, due to the position of the light, and by the variable IR clearance time, due to the IR detector. The advantage of the short green is particularly due to the length of the crossing. Shorter crossings would have led to relatively less advantage.
One can conclude that, if the Heemstede crossing were a midblocks crossing, the mean length of the pedestrian phase would have fallen by 19% and the number of realized phases by 40%. The total savings would have been 50% of the pedestrian time.

6. On the whole, one can conclude that the British crossings use the 10% time advantage (of the pedestrian time, approx.) gained by cancelled calls to allow more crossing time for pedestrians, and so offer a safer crossing. The effect of a short green, made possible by the new position of the light head, only becomes interesting with longer crossings than these British ones.
The situation at Heemstede was too complicated to make a real estimation of times saved, because the pedestrian phase can overlap other phases. However, an estimation, based on an ideal situation, calculated that the mean length of the pedestrian phase would have fallen by 19% and the number of realized phases by 40%. The total savings would have been 50% of the pedestrian time. This can only happen at a long crossing with few pedestrians per cycle, where a large advantage can be gained by the short green period, and a cancelled call is made possible because no other pedestrians remain waiting.

4.8. Special groups and group behaviour

4.8.1. Special groups

1. 4 to 20% of the samples in the different surveys were noted as being subject to special circumstances, and only a small number fall into each category of special circumstances, as we have seen in par. 4.3.2, making analysis difficult.
As might be expected, the proportion of green crossers is higher amongst those subject to special circumstances, than among the other crossers. The difference is about 20% for four surveys (#1-3, and #7). At Woolwich, there was not a vast difference. No French data are available.

As a result, the pedestrians with special circumstances at Heemstede registered higher waiting times (22 versus 14 seconds).
Crossing times were also higher. At Heemstede, 0.5 and 1.1 seconds were recorded for pedestrians with bicycles and dogs, and for those with other special circumstances, respectively. At Rustington, from -.6 to 2.7 seconds, depending on the category of special circumstances. With dog or bicycle: faster, with walking difficulties: slower. At Woolwich, the same pattern is seen. The fast pace of pedestrians with dogs and bicycles at Rustington is probably related to the younger age.

2. At Heemstede, some aspects of crossing behaviour were analyzed. People with special circumstances used the push button more frequently and stood on the mat immediately. No relation was found with careful behaviour, such as watching and crossing between the lines.

3. On the whole, one can conclude that pedestrians with special circumstances are more inclined to use PUSSYCATS properly (Green crossing and use of mat) and that PUSSYCATS can be of greater value to them, because they have longer crossing times.

4.8.2. Group behaviour

1. One could expect differences in crossing behaviour between pedestrians walking alone and pedestrians forming part of a group. Pedestrians walking with young children might show more careful behaviour, and pedestrians with adults are probably less careful, because they divide their attention between the traffic situation and other group members.
Table 32 shows the proportion of pedestrians belonging to groups or walking alone. The proportions walking with young children are very small (3 to 4%).

Survey	#1	#2	#3	#4	#5	#6	#7	#8	#9
All pedestrians	605	937	887	939	850	903	1026	1409	1541
Walking alone	374	729	564	633	536	611	761	907	989
Percentage alone	62	78	64	67	63	68	74	64	64

Table 32. Percentage of people walking alone.

2. Data on behaviour of group members are sparse. However, the first 7 surveys show that groups cross more slowly than pedestrians walking alone. The Dutch survey, moreover, showed that group members are less likely to cross on red (53% versus 68%), have shorter accepted gaps on the first section of the crossing, look less frequently before crossing (67% versus 85%) and cross more frequently between the lines of the second section (68% versus 59%). Group members crossing on green had longer reaction times than other green crossers (1.9 versus 1.3 seconds).

4.8.3. Social behaviour

1. Other people may be waiting, or crossing on the same side or other side of the crossing when a pedestrian arrives. Table 33 presents the number of people confronted with other people waiting or crossing at the time of arrival. Data are restricted to the Dutch and French surveys.
If imitation of waiting or crossing behaviour is important, and some other studies have shown this to be the case, then an increase in confrontations with other people waiting, and a decrease in confrontations with crossers, after implementation of PUSSYCATS, could be advantageous to safety. However, the French data do not show a difference. The difference between the French and Dutch data can be explained by the difference in red crossers. There are more red crossers at Heemstede. The number of pedestrians per hour is about the same.

Survey	Waiting		Crossing		Total	
	count	%	count	%	count	%
#7	75	7	257	25	1026	100
#8	221	16	157	11	1409	100
#9	260	17	171	11	1541	100

Table 33. Number of pedestrians confronted with other people waiting and crossing at the time of arrival.

2. The Dutch survey analyzed whether the crossing behaviour of pedestrians differed in the presence of others. Pedestrians can find four possible combinations of people waiting and crossing on arrival. Table 34 presents these combinations with red crossing percentages. Red crossing is lowest when other people are waiting and no-one else is crossing. It is highest

when no-one else is waiting and other people are crossing. The two other combinations are in the middle.

Other people waiting	Other people crossing			
	Yes		No	
	Count	%	Count	%
Yes	29	71% (1)	95	49% (2)
No	93	82% (3)	400	65% (4)

Significant differences at the 5% level: 1-2, 2-3, 2-4 and 3-4.

Table 34. Number and percentage of people arriving on red who cross on red, for different combinations of other people waiting or crossing.

3. If a pedestrian arrives on red, someone else may or may not be standing on the mat already (wait lamp on or not). Is crossing on red related to the presence of another person on the mat? Table 35 presents the Dutch data. 'Wait lamp on' and 'At least one person waiting' are not identical, but the results are comparable. Red crossing is higher for arrivers if the wait lamp is off.

	Wait lamp on, on arrival			
	Yes		No	
	Count	%	Count	%
Crossing on red	111	51%	506	68%
Crossing on green	107	49%	236	32%

Table 35. Number and percentage of red crossers among pedestrians who arrive when the wait lamp is on.

4. It is difficult to distinguish imitation from making comparative decisions about the traffic situation. One could expect that people who make an independent decision are more careful than people who imitate the behaviour of others. One indication of increased carelessness was found. Arriving pedestrians who cross on red when others are already crossing, look less carefully, before (71% versus 86%) and during crossing (74% versus 82%).

On the whole, a strong relationship is found between crossing behaviour, particularly crossing on red or green and waiting times, and the presence, on arriving at the crossing, of other pedestrians who are crossing or

waiting. Pedestrians who 'follow' crossing on red look less carefully, before and during crossing. This increased carelessness corroborates the hypothesis of imitation.

4.9. Conclusions

This section summarizes the most important conclusions from the observation surveys regarding the operation and efficiency of PUSSYCATS and the safety and convenience of the new system.

4.9.1. Operation and efficiency

The observation surveys have not systematically tested the operation of the mats and infrared detectors. Only accidental information was gathered.

1. The infrared detectors have revealed two kind of problems. Firstly, at Toulouse, a large number of false alarms were given, probably due to traffic passing through the crossing. The conclusion could be that the use of the infrared detector after the flashing yellow phase for pedestrians is not adequate. Secondly, at Woolwich, a number of pedestrians were not detected, because of the incorrect angle of the infrared detector.

2. No operational problems with the mats were encountered.

3. The British and French PUSSYCATS made better use of the information given by the infrared detectors than the Dutch system.
At Heemstede, the fact that pedestrians finished the crossing on red after starting on green can be attributed to their slow response times to green, slow crossing, crossing outside the lines of the second section of the crossing, and the absence of the infrared clearance period. All aspects are related to PUSSYCATS.
If the infrared detectors do not detect a moving object for 1 second, the controller finishes the clearance time. Extending this period can prevent slow responses from obstructing the onset of the clearance time.
The maximum clearance time allowed by the infrared detectors proved to be too short for slow pedestrians. This can easily be adjusted.

4. Another aspect is that PUSSYCATS requires that people cross between

the lines. Barriers could be a solution. If this is not possible, instruction is necessary.

5. Many pedestrians arrived on red with the wait lamp off, used the mat, but then left it before the signal turned green. This proves the importance of one aspect of PUSSYCATS, the fact that leaving the mat cancels the call.

6. In the Heemstede survey, An estimate was made of the time gained through cancelled calls. A time gain of 3.6% of total time, and 40% of pedestrian time is achieved. A further 1.7% of total time and 19% of pedestrian time was achieved as a result of the shorter duration of the pedestrian stage, made possible by the variable clearance period and short green signal. One can conclude that, if the PUSSYCATS crossing were a midblocks crossing of comparable length, the average length of the pedestrian phase would be reduced by 50%.
In the British surveys, the time gained (10% of pedestrian time) by cancelled calls was used for more crossing time.

7. One can expect that the gain in time achieved by PUSSYCATS increases with the length of the crossing and decreases with the number of pedestrians. Longer crossings, in the old situation, need longer green periods. The PUSSYCATS green can always be short. With fewer people, leaving the mat is more likely to lead to cancellation of the call.

4.9.2. Safety

Aspects of objective safety are understanding and proper use of the system, crossing on green and arriving on the other side before other traffic starts moving, looking before and during crossing, safe gap acceptance and no conflicts.

1. The old push button was used less than the PUSSYCATS mat. And, where pedestrians have to use both, the mat is used more frequently.

2. The correct use of the push button (in the UK) and mat by people who arrive while nobody is standing on the mat is generally low, but better for people who intend to wait some time, or wait for green. PUSSYCATS encourages better use.

3. The number of red crossers is considerable, but no indications are found that PUSSYCATS changes the situation. The only negative point could be that people arriving on green cross on green, and that they more often arrive on green by chance, and that PUSSYCATS offers a relatively short green period, particularly at longer crossings.

4. In Heemstede, the fact that people may get to the other side on red while starting on green, is, as we have shown, largely avoidable through software modifications.

5. Looking out for traffic, as demonstrated by head movements, is insufficient. Red crossers are more careful. A special element of PUSSYCATS, the position of the display on the side of oncoming traffic, seems to work with respect to looking before crossing. This could not be assessed in 'before-after' surveys, but it could at Heemstede, where it was realized at only one side of the crossing.
The expectation that people in general are less likely to look straight ahead because of the relocation of the display from the far side to the near side of the crossing has not been demonstrated.

6. PUSSYCATS makes green crossing between the lines essential, because the infrared detector has to be triggered by a moving object and requires people to finish crossing between the lines, because this extends the clearance time. A large proportion at all sites, except Heemstede, crossed between the lines. At Heemstede, no barriers were used and the layout of the crossing did not encourage pedestrians to stay inside the lines.
At Heemstede, it was found that many more green crossers crossed between the lines than red crossers. Starting to cross between the lines was also found to be strongly related to standing on the mat.

7. We can conclude that there is a relationship between the logic of PUSSYCATS and the behaviour of green and red crossers. Green crossers cross between the lines more often, as they are attracted by the mat, while red crossers look more carefully.

8. The occurrence and quality of conflicts provides no information on PUSSYCATS. The important factor causing conflicts is crossing on red.

9. The number of accepted gaps of less than 4 seconds was strongly related to red crossing. The increase in short gaps at Rustington cannot be explained.
The French analysis of gaps, the time between two vehicles, has not revealled characteristics of PUSSYCATS either.
A special case at Heemstede involves the gaps for people who start on green but arrive on red. These gaps are very small, and provide more evidence of the fact that the clearance period extended by the infrared detectors is too short. As already stated, this aspect of PUSSYCATS can easily be improved.

10. The most important safety advantage for vulnerable road users is the adaptation to slow pedestrians. The British PUSSYCATS fulfilled this expectation. But, as we have seen, the software at Heemstede has to be changed to give slow starters and slow crossers more time.
The over 60 age group and pedestrians with special circumstances, other than walking with bicycles or dogs, cross more slowly and thereby draw particular benefit from the system.

4.9.3. Convenience

Aspects of objective convenience include correct use and understanding of the mats, an adequate green phase and clearance periods, short waiting times and no conflicting traffic while crossing on green.

1. The video surveys show that people know how to get a green signal, if they intend to cross on green.

2. There are no indications that the short green period bothers the pedestrians, if they start too late. This might be expected, as the audible signal provides an efficient warning.

3. The French pedestrian flashing amber is preferred by many pedestrians (60%). Virtually no green crossers remain. The question is whether a mat makes sense if people do not cross on green.

4. Possible negative effects of PUSSYCATS on waiting times could have been that green crossers had to wait longer because calls were often cancelled,

so that the necessary waiting time had to start again. The arrival phase is another determining factor. The short green of the implemented PUSSY-CATS systems could also increase the waiting times, because green arrivers have extremely short waiting times. No such effects have been shown.

5. Short accepted gaps, often also recognized as 'conflicts', have increased at Rustington. No explanation is found. At Heemstede, the short maximum Infrared Clearance period led to a number of short accepted gaps.

6. The old pedestrian display, situated at the opposite end of the crossing, is more visible from a distance. One could therefore expect anticipation of the green light to be hampered. But at Heemstede, the percentage of people arriving at the crossing while the pedestrian signal was on green is much larger than would be expected on basis of the length of the green period. The new position of the pedestrian display does not hamper such anticipation.

5. CONCLUSIONS AND DISCUSSION

Most conclusions are drawn at the end of Chapters 3 and 4. A summary follows here. Some elements, from outside the field study, will be mentioned. DRIVE has asked us to compare our results with the results of other surveys (Drive Projects V1031 and V1062). Drive Project V1062 has no elements for comparison with PUSSYCATS, but Drive Project V1031 does. A discussion will follow at the end of this chapter, based on the results mentioned in: "D.J. Sherborne; I.N.L.G. van Schagen and L. Ekman: Microwave detection of vulnerable road users. Three feasibility trials carried out at traffic signal locations. Deliverable No. 11. September 1991".

5.1. Operation

5.1.1. Installation of the mats on peaty soil is difficult, or even impossible. Cables under the pavement can impede the prescribed concrete foundation. Getting a flat mat surface and avoiding sharp edges is difficult when the pavement is not completely level. Dutch standard measurements for paving stones (30 * 30 centimeters) do not correspond to the measurements of the mats.
In the UK, there were early problems with the electronic cards.
Once the mats were installed and electronic cards were replaced, however, no important problems with the operation of the mats were encountered during the field study. The 'theoretical' problem, that the mats are not sensitive enough for lightweight pedestrians, has not arisen.
Development of mats with fewer limitations with respect to a flat surface is desirable.

5.1.2 The infrared detectors revealed two kinds of problems: false alarms and non-detection. The first problem probably has nothing to do with the operation of the detector. If the infrared detector is only used to detect pedestrians crossing after conflict free green, the chance that the pedestrian phase is extended by other traffic, violating red, is small.
The second problem has not been solved. It was caused by the incorrect adjustment of the angle of the infrared detector.
An important lesson is that infrared detectors can only be used in conflict free situations, to avoid time loss due to false alarms.
Another point is that crossings longer than 13 or 14 meters cannot be equipped with these detectors. However, other detectors are available.

No vandalism was reported during the period the experiments were running.

Mats and infrared detectors can be linked to different modern controllers. No programming problems were encountered.

5.2. Efficiency

Two aspects of efficiency can be distinguished:

5.2.1. Firstly, losses and gains in time for vehicles and pedestrians could result from:
- Cancellation of unused calls by pedestrians who leave the mat before receiving a green signal is an important advantage for traffic. This advantage will be seen particularly when the flow of pedestrians is such that no other people remain waiting on the mat when somebody leaves the mat. Even in rather crowded situations such as in the UK, however, a considerable number of cancelled calls was reported.
- Adapting the extension of the clearance period by infrared detectors can produce gains and losses for pedestrians and other traffic. In the UK situation, the gains for pedestrians prevailed. But one has to consider that the 'before' situation can be characterized as unsafe because the clearance time for pedestrians was too short. The extension can be caused by slow pedestrians, by large, i.e. slow-moving, groups and by late (red) starters.
- The short green phase, made possible by the 'Maastricht' position of the pedestrian display on the near side, is only advantageous for other vehicles when the crossing is long. This was the case in Heemstede, not at the other sites.

5.2.2. Secondly, PUSSYCATS can be regarded as 'efficient' when it adapts to the behaviour and understanding of pedestrians.
PUSSYCATS requires pedestrians to stand on the mat and remain there (UK: and press button) when they intend to cross on green, and to cross between the lines depicting the detection field of the infrared detectors.

Mat

The questionnaire made clear that the understanding of the operation of the mat, and of how to ask for green, was insufficient. Inhibiting factors

included the fact that in the UK, the mat was combined with the push button, while in the Netherlands, the superfluous push button equipment was not removed.
People aged over 60 encountered even greater problems.
The observation surveys showed that the correct use of the push button and mat by people who arrived while nobody was standing on the mat was generally low, but better for people who intended to wait for some time, or intended to wait for green.
Moreover, the use of the push button under the old system, and the use of the push button under PUSSYCATS (UK only) were poorer than the use of the mat. One can conclude that a clear situation of 'mat only' is relatively more efficient than a clear situation of 'push button only'.

Lines

Crossing inside the lines was good at the sites where barriers were installed to guide the pedestrians. At Heemstede, where this was not done, and where the layout of the crossing encouraged crossing outside the lines, the use of the detection field was not as good. However, green crossers crossed between the lines more often than red crossers. It is the green crossers in particular who should keep inside the lines, to trigger the infrared detectors and ensure they keep operating.
At the crossings, no information was given about the infrared detectors, and few people understood what was expected from them in this respect. In all probability, knowledge of the working of the detectors would increase the number of crossers between the lines.

PUSSYCATS gives pedestrians an adapted time to cross, by means of the infrared detectors. This has proved to work efficiently if the maximum extended clearance time is well adapted to the pace of those crossing. In the Netherlands, where this was not the case, many pedestrians could not cross within the green phase.
In the UK, the maximum was seldom reached at Rustington, though at Woolwich about 50% of pedestrian phases reached maximum. At both sites almost all pedestrians completed their crossing before vehicle green was called.

The conclusion is that PUSSYCATS operates well and is very efficient. However, the operation can be improved by technical changes to the mats, while the efficiency can be enhanced by clarifying the function of the mat and the infrared detector.

5.3. Safety

5.3.1. The PUSSYCATS mats encourage better use of registering a call than push buttons do, although this is not reflected in a general increase in green crossers. Mat users also cross more between the lines.

5.3.2 PUSSYCATS offered green crossers an increase in safety.
The extended red clearance time proved to be very safe when the maximum clearance time was correctly adjusted. Pedestrians who started on green all finished in time. This is particularly important for vulnerable road users: those aged over 60 and pedestrians with special circumstances.
The insufficient maximum clearance time in the Netherlands can be easily adapted.

5.3.3. The expectation that people will not tend to look straight ahead with PUSSYCATS, because of the relocation of the display from the far side to the near side of the crossing, has not eventuated. No gain in safety is reported in this respect.
Looking out for traffic, as demonstrated by head movements, is insufficient, although red crossers are more careful than green crossers. The conflict free green is probably responsible for this lack of caution.
A special element of PUSSYCATS, the position of the display on the side of the oncoming traffic, seems to work. At least at Heemstede, where this was realized at only one side of the crossing.
We can conclude that there is a relationship between the logic of PUSSYCATS and the behaviour of green and red crossers. Green crossers more often cross between the lines, as they are attracted by the mat, while red crossers watch the traffic more carefully.

5.3.4. Characteristics of PUSSYCATS are not reflected in a change in conflicts with vehicles, nor in short accepted gaps. The important factor is whether or not people crossed on red. The only exception is the phenomenon at Heemstede, where many short accepted gaps were found in situations where pedestrians crossed on green, but finish on red, demonstrating that the extended red period initiated by infrared detectors was too short.

5.3.5. Most interviewed people felt safe while crossing. They did not mention reasons for safety related to PUSSYCATS. A small number of unsafe

feelings were attributed to PUSSYCATS, particularly to the fact that people did not see the display while crossing.
The new system is felt to be safer or the same by most people. The safety reasons mentioned often imply characteristics of PUSSYCATS. The most important reason mentioned for a decrease in safety is again the position of the display on the near side. Better information concerning the infra-red detectors action should decrease this negative feeling.

5.4. Convenience

Aspects of objective convenience are correct use and understanding of the mats, a sufficiently long green phase and clearance periods, short waiting times and no conflicting traffic while crossing on green. Subjective convenience consisted of positive feelings about PUSSYCATS in general, and feelings about individual aspects such as the mat, the pedestrian display and its position, the information given, short subjective waiting time and enough time for crossing.

5.4.1. The theoretical understanding of the operation of the mat is insufficient in all countries. So is the understanding of how to request green, and the understanding of the flashing yellow in France. The understanding of the 60+ age group is even worse. However, the video surveys show that people know how to call up a green signal if they intend to cross on green. We have also suggested that removing non-functional push buttons and push button equipment could improve the clarity of the system.

5.4.2. There are no indications that the short green period bothers the pedestrians. The accompanying audible signal seems necessary.
Although the extended red initiated by infrared detectors was not long enough at one site, the other sites have shown that PUSSYCATS can be controlled in such a way that it gives all pedestrians enough time to cross, without too much time loss for traffic. If people had been aware of this fact, which they were not, PUSSYCATS is likely to have had more supporters.

5.4.3. Although the understanding of the meaning of the French flashing yellow was poor, it was very popular. It was preferred by many pedestrians. Almost no green crossers were left.

5.4.4. Contrary to expectations, waiting times have not generally increased. Most people have not experienced a change in waiting time or have experienced shorter waiting times. Where waiting times actually increased significantly (Toulouse), pedestrians even reported shorter subjective waiting times.

5.4.5. A high percentage of people prefer the old location of the display, where it is visible while they cross. The 'Maastricht' position was not popular. Because these negative feelings were linked with 'not seeing that the light turns red', or 'not knowing when the traffic starts', a better understanding of the working of the infrared detectors could have changed this. Another possibility is that people have to get used to the new display location.

5.4.6. There are no indications that the convenience of PUSSYCATS is hampered by incidents of conflicts between pedestrians and traffic. To the contrary, it is considered to be a safer system.

5.5. Publicity and information

5.5.1. Although knowledge about the system was insufficient, it was not demonstrated that pedestrians could not use the system in an adequate manner.
There was a lack of knowledge regarding the function of the mats, and about how to request green. An understanding of the function of the infrared detectors was completely absent.

5.5.2. The information given by the displays seemed to be satisfactory. There were few complaints. The information was directed at what to do, not at understanding the system. Therefore, no information was given on the infrared detectors.

5.5.3. Publicity campaigns were organized in the UK (local papers, TV and national papers, in order of importance) and in the Netherlands (local papers and regional papers, in order of importance), but not in France.
It was shown that better informed people understood the system better, and it was suggested that they also had a more positive opinion about the system.

It is expected that the opinion on the 'Maastricht' position of the display can be improved, by informing people that they will get enough time to cross because of the infrared detectors.

5.5.4. Since a small group of "first users" will always remain, good information near the crossing will be required. Only large scale installation of PUSSYCATS will make the system familiar to the general public.

5.6. Differences between sites

An important difference between the sites was the particular implementation of PUSSYCATS. We can distinguish the following elements:
- The French flashing yellow light during the 'main road red' and 'secondary road green' light had many consequences. Firstly, 60% of all pedestrians crossing used the flashing yellow period to cross. Secondly, the green period was seldom requested by pedestrians using the mat. Thirdly, the infrared detector very often functioned after flashing yellow, leading to many false alarms, probably caused by traffic turning off from the secondary road. One can conclude that this special way of implementing PUSSYCATS is not efficient.
- The UK have retained the push button to avoid false calls of the pedestrian phase by people activating the mat as they pass, or who stand on the mat but with no intention of waiting for a pedestrian phase. Understanding of the combined use of mat and button is low, though the 'before' survey suggested that the function of the push button on standard crossings is also poorly understood.
- The insufficient period of Infrared extended red in the Netherlands has to be changed for optimal efficiency and safety. The maintenance of the push button equipment, to keep the wait lamp, obscures the function of the mat, therefore the push button should be removed.

5.7. Comparison with DRIVE Project V1031

The microwave detection of vulnerable road users (DRIVE Project V1031) and the mat and infrared detectors (PUSSYCATS) both share a common feature: they are meant to give vulnerable road users more and safer opportunities in the use of the space shared with traffic, particularly the motorized kind. Modern ideas on the use of the shared space adhere to another

philosophy. When different categories of road users have to share the space, then the infrastructure should be such that speeds are very low. However, separation of different traffic categories is preferred. In both cases, traffic signals would not be needed.
Before this ideal situation is reached, temporary, but probably long lasting, measures are needed.
Both studies show that detectors can improve the crossing situation for vulnerable road users, by giving them better crossing facilities. The accent in study DRIVE Project V1031 lies on shortening the delay for pedestrians, to increase the attractiveness of a pelican crossing without causing major delays to motorized traffic. This is reached by detecting the movement (microwave detection) of pedestrians towards the crossing point. The same device is used to give pedestrians more crossing time at an intersection that is only controlled for vehicles, by lengthening the all red interval. One can ask whether such intersections are in fact desirable.
The accent of V1061 is on improving the efficiency, safety and comfort of a controlled crossing, by detecting the presence of crossers at, or on, the crossing.
The three detectors differ in the completeness of detection of pedestrians. The mat detects all pedestrians and the infrared detector, if correctly aligned, does it too, but the microwave detector misses nearly 20%. False alarms are reported by the infrared detector, as a result of crossing vehicles; false alarms by the microwave detector are due to one-way traffic where the street is rather narrow and by pedestrians who do not cross. No false alarms are reported by the mats.

No indications were found for shorter waiting times or an increased attractiveness of the pelican crossing. Neither did the PUSSYCATS waiting times give indications of improvement. However, the use of the mat, compared with the use of the push button, indicates a preference for the new system. The other advantages of PUSSYCATS have no counterpart in the new pelican crossing.

Increasing the extended all red period has not led to a significant decrease in conflicts. However, one can expect that giving pedestrians more time must lead to lower accident rates. The missed (microwave-) detections could be dangerous, because pedestrians probably develop expectations

about the length of the all red period. The mat could be a safer and more efficient, albeit more expensive, alternative, since reports indicate it did not fail to register pedestrians, nor did it emit false alarms.

APPENDICES 1 - 11

APPENDIX 1. Rustington: questionnaire, first 'after' survey

Rustington Pedestrian Facilities Questionnaire

Question		Code	Answer	Results	%
Q1	How often have you used this crossing in the past week?	1	More than once a day	19	11.0
		2	Every day	51	29.7
		3	Once or twice a week	60	34.9
		4	Once or twice in the last month	2	1.2
		5	Just today	40	23.3
Q2	Did you see this crossing before it was changed?	1	Yes	165	95.9
		2	No	7	4.1
Q3	How frequently did you use it?	1	Once a day or more	70	42.4
		2	Once a week or more	84	50.9
		3	Once a month or more	8	4.8
		4	Less frequently	3	1.8
Q4	Did you notice the mat by the kerb?	1	Yes	149	86.6
		2	No	23	13.4
Q5	What is the mat for? *	0	No idea/wrong answers	70	40.7
		1	Must stand on mat before/after pressing button	29	16.9
		2	Senses pedestrian waiting to cross	75	43.6
		3	Other	3	1.7
Q6	Have you any comments on location of green and red man display? *	0	No opinion	33	19.2
		1	Prefer new system	27	15.7
		2	Prefer old system with display other side	80	46.5
		3	Display not bright enough	3	1.7
		4	Other pedestrians obscured view	26	15.1
		5	Needs getting used to	12	7.0
		6	Could not see it at first	7	4.1
		7	Should be angled towards pavement more	3	1.7
		8	Should be higher/lower	3	1.7
		9	Too small	1	0.6
Q7	Have you any comments on the instruction board? *	0	No opinion	45	26.2
		1	Difficult to see/read	6	3.5
		2	Did not notice it	41	23.8
		3	Seemed clear	74	43.0
		4	Did not like its position	7	4.1
		5	Not clear	5	2.9

Question		Code	Answer	Results			
					%		
				New		Old	
Q13	Why is that? (safer or not safer)	0	Don't know	17	22.1	1	6.7
		1	Red/green man better	2	2.6	9	60.0
		2	Audible noise on green better	2	2.6	1	6.7
		3	IR detectors give extra time to cross	32	41.6	0	0.0
		4	System more efficient : more cross on green	11	14.3	1	6.7
		5	Because new system (ie. better or more confusing)	9	11.7	3	20.0
		6	Read or told was safer	3	3.9	0	0.0
		7	Clearer/easier to use	1	1.3	0	0.0
Q14	Did you have any difficulty crossing the road?	1	Yes		11		6.4
		2	No		161		93.6
Q15	Why was that?	0	No answer		5		45.5
		1	Problems with new system		3		27.3
		2	Shoe stuck on mat		2		18.2
		3	Wheelchair user		1		9.1
Q16	What is the purpose of your journey right now?	1	To/from shops		149		86.6
		2	To/from school		0		0.0
		3	To/from work		6		3.5
		4	To/from other business		17		9.9
Q17	If in group, did behaviour of people you're walking with influence way you crossed?	1	Yes		11		28.9
		2	No		27		71.1
		3	Don't know		0		0.0
Q18	Why was that?	0	Don't know		1		9.1
		1	Felt safer		3		27.3
		2	Crossed later/more carefully		5		45.5
		3	Do as others do		2		18.2
Q19	Have you seen any publicity about new crossing?	1	Yes/think so		139		80.8
		2	No		33		19.2
Q20	Where did you see it?	0	Not sure/don't know		1		0.7
		1	Local paper		78		56.1
		2	National paper		14		10.1
		3	Radio		4		2.9
		4	TV		42		30.2

Characteristic	Code	Type	Results	%
Age group	1	10 - 20	6	3.5
	2	21 - 40	44	25.6
	3	41 - 59	42	24.4
	4	60+	80	46.5
Sex	1	Male	63	36.6
	2	Female	109	63.4
Physical disability	0	None	163	94.8
	1	Blind	0	0.0
	2	Partially sighted	4	2.3
	3	Deaf	0	0.0
	4	Hard of hearing	0	0.0
	5	Wheelchair user	2	1.2
	6	Walking difficulties	2	1.2
	7	Mental disability	1	0.6
Other factors inhibiting ease of crossing	0	None	156	90.7
	1	Young children (walking)	3	1.7
	2	Pram/pushchair	6	3.5
	3	Heavy load	0	0.0
	4	Dog	0	0.0
	5	Pushing bike	1	0.6
	6	Shopping trolley	6	3.5
Individual interviewed	0	Alone	131	76.2
	1	Child accompanied by adult	0	0.0
	2	Adult accompanied by child(ren)	11	6.4
	3	Adult only group	27	15.7
	4	With disabled adults	2	1.2
	5	Children only group	1	0.6

* *Percentages add to more than 100% resulting from coding of more than one response for some pedestrians*

APPENDIX 2. Rustington: questionnaire, second 'after' survey

Question		Code	Answer	Results	%
Q1	How often have you used this crossing in the last month?	1	Once a day or more	90	47.6
		2	Once a week or more	79	41.8
		3	Once a month or more	8	4.2
		4	Just today	12	6.3
Q2	Did you use this crossing before it was changed?	1	Yes	167	88.4
		2	No	22	11.6
Q3	How frequently did you use it?	1	Once a day or more	87	52.1
		2	Once a week or more	71	42.5
		3	Once a month or more	9	5.4
		4	Less frequently	0	0.0
Q4	Did you notice the mat by the kerb?	1	Yes	176	93.1
		2	No	13	6.9
Q5	What do you think it does?	0	No idea/wrong answers	122	64.6
		1	Senses pedestrians waiting to cross	65	34.4
		2	Other	2	1.1
Q6	What do you need to do to get the pedestrian signal to come on?	0	No idea	7	3.7
		1	Stand on mat and press button	71	37.6
		2	Stand on mat only	9	4.8
		3	Press button only	97	51.3
		4	Wait for sequence	5	2.6
Q7	Have you any comments on the new green and red man display? *	0	No opinion	62	32.8
		1	Prefer new system	29	15.3
		2	Prefer old system with display other side	80	42.3
		3	Other pedestrians obscured view	25	13.2
		4	Display not bright enough	2	1.1
		5	Needs getting used to	3	1.6
		6	Did not notice it/look in wrong place	7	3.7
		7	Should be angled towards pavement more	0	0.0
		8	Should be higher/lower	1	0.5
		9	Too small	2	1.1
Q8	Have you any comments on the instruction board? *	0	No opinion	44	23.3
		1	Did not notice it	76	40.2
		2	Seemed clear	65	34.4
		3	Difficult to see/read	5	2.7
		4	Did not like its position	3	1.6
		5	Not clear	0	0.0

Question		Code	Answer	Results	
					%
Q9	How does the waiting time now compare with before?	0	No opinion	14	7.4
		1	Shorter now	29	15.3
		2	Longer now	33	17.5
		3	About the same	91	48.1
		4	Didn't use old crossing	22	11.6
Q10	Did you feel safe as you were crossing the road?	1	Yes	165	87.3
		2	No	20	10.6
		3	Not sure	4	2.1
Q11A	Were there any reasons why? *	0	No	44	26.8
		1	Ped signals on green/no traffic	93	56.7
		2	Noticed infra-red detectors	6	3.7
		3	Other people crossing	3	1.8
		4	Looked and made sure was safe	15	9.2
		5	New system for improved safety	0	0.0
		6	Know sequence of lights	6	3.7
Q11B	Why not? *	0	No reason	3	14.3
		1	Could not see green man	5	23.8
		2	Traffic was moving	3	14.3
		3	Ped signals were red	3	14.3
		4	New system, not understood, new timings	1	4.8
		5	Special circumstances (eg. bike, wheelchair) hindered	0	0.0
		6	Never feel safe as busy junction	5	23.8
		7	Did not look	1	4.8
		8	Audible noise stopped	1	4.8
Q12	Do you feel this new type of crossing is safer or less safe at this junction?	0	No opinion	18	9.5
		1	New crossing safer	66	34.9
		2	Old crossing safer	16	8.5
		3	About the same	82	43.4
		4	Can't remember	7	3.7
				New	% Old %
Q13	Why is that? (safer or not safer)	0	Don't know	18 42	2 20
		1	Red/green man better	0 0	3 30
		2	Audible noise on green better	4 9	0 0
		3	More time to cross	11 26	1 10
		4	System more efficient : more cross on green	1 2	1 10
		5	Because new system (ie. better or more confusing)	6 14	3 30
		6	Read or told was safer	0 0	0 0
		7	Clearer/easier to use/more signs	3 7	0 0

Question		Code	Answer	Results	%
Q14	Did you have any difficulty crossing the road?	1	Yes	6	3.2
		2	No	183	96.8
Q15	What was that?	0	No answer	1	17
		1	Problems with new system	0	0
		2	Shoe stuck on mat	1	17
		3	Wheelchair user	0	0
		4	Other	4	67
Q16	What is the purpose of your journey now?	1	Shopping	160	84.7
		2	To/from work	15	7.9
		3	To/from other business	8	4.2
		4	Other	6	3.2
Q17	Have you seen any publicity about this new type of crossing?	1	Yes/think so	120	63.5
		2	No	69	36.5
Q18	Where did you see it?	0	Not sure/don't know	1	0.8
		1	Local paper	86	71.7
		2	National paper	9	7.5
		3	Radio	1	0.8
		4	TV	23	19.2
Q19	Do you usually press the button before crossing the road?	1	Yes	86	45.5
		2	Yes, if no one else has done so first	44	23.3
		3	Yes, unless safe to cross without doing so	18	9.5
		4	No	41	21.7
Q20	When you cross the road do you usually .....?	1	Cross before green man appears	13	6.9
		2	Cross before green man, but only if safe	88	46.6
		3	Wait for green man to appear	88	46.6
Q21	What did you do just now?	1	Crossed on red	53	28.0
		2	Crossed on green	128	67.7
		3	Not sure/don't remember	8	4.2

Characteristic	Code	Type	Results	%
Age group	1	10 - 20	5	2.6
	2	21 - 40	49	25.4
	3	41 - 59	57	30.2
	4	60+	78	41.3
Sex	1	Male	63	33.3
	2	Female	126	66.7
Physical disability	0	None	177	93.7
	1	Blind	0	0.0
	2	Partially sighted	0	0.0
	3	Deaf/hard of hearing	4	2.1
	4	Wheelchair user	1	0.5
	5	Walking difficulties	7	3.7
Other factors inhibiting ease of crossing	0	None	161	85.2
	1	Young children (walking)	5	2.6
	2	Pram/pushchair	8	4.2
	3	Heavy load	4	2.1
	4	Shoppig trolley	4	2.1
	5	Dog	1	0.5
	6	Pushing bike	6	3.2
Individual interviewed	0	Alone	150	79.4
	1	Adult accompanied by child(ren)	14	7.4
	2	Adult only group	22	11.6
	3	Child accompanied by adult	1	0.5
	4	With disabled adults	1	0.5
	5	Children only group	1	0.5

** Percentages add to more than 100% resulting from coding of more than one response for some pedestrians*

APPENDIX 3. Woolwich: questionnaire, first 'after' survey

Question		Code	Answer	Results	%
Q1	How often have you used this crossing in the last month?	1	Once a day or more	80	42.6
		2	Once a week or more	64	34.0
		3	Once a month or more	11	5.9
		4	Just today	33	17.6
Q2	Did you use this crossing before it was changed?	1	Yes	153	81.4
		2	No	35	18.6
Q3	How frequently did you use it?	1	Once a day or more	78	51.0
		2	Once a week or more	55	35.9
		3	Once a month or more	10	6.5
		4	Less frequently	10	6.5
Q4	Did you notice the mat by the kerb?	1	Yes	108	51.4
		2	No	80	42.6
Q5	What do you think it does?	0	No idea/wrong answers	133	70.7
		1	Senses pedestrians waiting to cross	49	26.1
		2	Other	6	3.2
Q6	What do you need to do to get the pedestrian signal to come on?	0	No idea	15	8.0
		1	Stand on mat and press button	32	17.0
		2	Stand on mat only	6	3.2
		3	Press button only	132	70.2
		4	Wait for sequence	1	0.5
		5	Mat or button	2	1.1
Q7	Have you any comments on the new green and red man display? *	0	No opinion	52	27.7
		1	Prefer new system	68	36.2
		2	Prefer old system with display other side	48	25.5
		3	Other pedestrians obscured view	7	3.7
		4	Display not bright enough	0	0.0
		5	Needs getting used to	2	1.1
		6	Did not notice it/look in wrong place	15	8.0
		7	Too small	1	0.5
		8	Should be higher/lower	1	0.5
Q8	Have you any comments on the instruction board? *	0	No opinion	32	17.0
		1	Did not notice it	99	52.7
		2	Seemed clear	55	29.3
		3	Difficult to see/read	5	2.7
		4	Did not like its position	2	1.1
		5	Not clear	2	1.1

Question		Code	Answer	Results	%
Q9	How does the waiting time now compare with before?	0	No opinion	32.	17.0
		1	Shorter now	38	20.2
		2	Longer now	15	8.0
		3	About the same	68	36.2
		4	Didn't use old crossing	35	18.6
Q10	Did you feel safe as you were crossing the road?	1	Yes	144	76.6
		2	No	39	20.7
		3	Not sure	5	2.7
Q11A	Were there any reasons why? *	0	No	67	46.5
		1	Ped signals on green/no traffic	65	45.1
		2	Noticed infra-red detectors	0	0.0
		3	Other people crossing	2	1.4
		4	Looked and made sure was safe	6	4.2
		5	New system for improved safety	4	2.8
Q11B	Why not? *	0	No reason	3	7.7
		1	Could not see green man	10	25.6
		2	Traffic was moving	10	25.6
		3	Ped signals were red	1	2.6
		4	New system, not understood, new timings	2	5.1
		5	Special circumstances (eg. bike, wheelchair) hindered	2	5.1
		6	Busy junction	11	28.2
		7	Did not look	1	2.6
		8	Green time too short	1	2.6
Q12	Do you feel this new type of crossing is safer or less safe at this junction?	0	No opinion	22	11.7
		1	New crossing safer	86	45.7
		2	Old crossing safer	13	6.9
		3	About the same	32	17.0
		4	Didn't use old crossing	35	18.6
				New %	Old %
Q13	Why is that? (safer or not safer)	0	Don't know	42 49	2 15
		1	Red/green man better	4 5	6 46
		2	Audible noise on green better	5 6	0 0
		3	More time to cross/IR camera	8 9	0 0
		4	More cross on green/better behaviour	5 6	1 8
		5	Because new system (ie. better or more confusing)	5 6	2 15
		6	Feels safer	3 3	0 0
		7	Clearer to use/layout better	14 16	2 15

Question		Code	Answer	Results	%
Q14	Did you have any difficulty crossing the road?	1	Yes	4	2.1
		2	No	184	97.9
Q15	What was that?	1	Problems with new system	3	75.0
		2	Other	1	25.0
Q16	What is the purpose of your journey now?	1	Shopping	78	41.5
		2	To/from work	54	28.7
		3	To/from other business	20	10.6
		4	School/college/other	36	19.1
Q17	Have you seen any publicity about this new type of crossing?	1	Yes/think so	15	8.0
		2	No	173	92.0
Q18	Where did you see it?	0	Not sure/don't know	1	6.7
		1	Local paper	12	80.0
		2	Magazine	2	13.3
Q19	Do you usually press the button before crossing the road?	1	Yes	92	48.9
		2	Yes, if no one else has done so first	29	15.4
		3	Yes, unless safe to cross without doing so	42	22.3
		4	No	25	13.3
Q20	When you cross the road do you usually .....?	1	Cross before green man appears	6	3.2
		2	Cross before green man, but only if safe	108	57.4
		3	Wait for green man to appear	74	39.4
Q21	What did you do just now?	1	Crossed on red	56	29.8
		2	Crossed on green	113	60.1
		3	Not sure/don't remember	19	10.1

Characteristic	Code	Type	Results	%
Age group	1	10 - 20	42	22.3
	2	21 - 40	85	45.2
	3	41 - 59	35	18.6
	4	60+	26	13.8
Sex	1	Male	85	45.2
	2	Female	103	54.8
Physical disability	0	None	174	92.6
	1	Blind	1	0.5
	2	Partially sighted	2	1.1
	3	Deaf/hard of hearing	0	0.0
	4	Wheelchair user	0	0.0
	5	Walking difficulties	5	5.9
Other factors inhibiting ease of crossing	0	None	169	89.9
	1	Young children (walking/carried)	4	2.1
	2	Pram/pushchair	9	4.8
	3	Heavy load	2	1.1
	4	Shopping trolley	2	1.1
	5	Dog	1	0.5
	6	Headphones	1	0.5
Individual interviewed	0	Alone	140	74.5
	1	Adult accompanied by child(ren)	12	6.4
	2	Adult only group	35	18.6
	3	Child accompanied by adult	1	0.5

* *Percentages add to more than 100% resulting from coding of more than one response for some pedestrians*

APPENDIX 4. Woolwich: questionnaire, second 'after' survey

Question		Code	Answer	Results	%
Q1	How often have you used this crossing in the last month?	1	Once a day or more	92	49.5
		2	Once a week or more	63	33.9
		3	Once a month or more	11	5.9
		4	Just today	20	10.8
Q2	Did you use this crossing before it was changed?	1	Yes	154	82.8
		2	No	32	17.2
Q3	How frequently did you use it?	1	Once a day or more	77	50.0
		2	Once a week or more	59	38.3
		3	Once a month or more	14	9.1
		4	Less frequently	4	2.6
Q4	Did you notice the mat by the kerb?	1	Yes	135	72.6
		2	No	51	27.4
Q5	What do you think it does?	0	No idea/wrong answers	110	59.1
		1	Senses pedestrians waiting to cross	70	37.6
		2	Other	6	3.2
Q6	What do you need to do to get the pedestrian signal to come on?	0	No idea	4	2.2
		1	Stand on mat and press button	40	21.5
		2	Stand on mat only	3	1.6
		3	Press button only	139	74.7
Q7	Have you any comments on the new green and red man display? *	0	No opinion	53	27.3
		1	Prefer new system	56	28.9
		2	Prefer old system with display other side	59	30.4
		3	Other pedestrians obscured view	3	1.5
		4	Problem with colours	1	0.5
		5	Needs getting used to	3	1.5
		6	Did not notice it/look in wrong place	11	5.7
		7	Too small	2	1.0
		8	Should be in both positions	6	3.1
Q8	Have you any comments on the instruction board? *	0	No opinion	24	12.8
		1	Did not notice it	97	51.9
		2	Seemed clear	52	27.8
		3	Difficult to see/read	5	2.7
		4	Did not like its position	6	3.2
		5	Not clear	3	1.6

Question		Code	Answer	Results	%
Q9	How does the waiting time now compare with before?	0	No opinion	29	15.6
		1	Shorter now	45	24.2
		2	Longer now	31	16.7
		3	About the same	49	26.3
		4	Didn't use old crossing	32	17.2
Q10	Did you feel safe as you were crossing the road?	1	Yes	130	69.9
		2	No	50	26.9
		3	Not sure	6	3.2
Q11A	Were there any reasons why? *	0	No	48	36.9
		1	Ped signals on green/no traffic	61	46.9
		2	Extra time to cross	5	3.8
		3	Other people crossing	3	2.3
		4	Looked and made sure was safe	11	8.5
		5	New system for improved safety	2	1.5
Q11B	Why not? *	0	No reason	6	12.0
		1	Could not see green man	6	12.0
		2	Traffic was moving	6	12.0
		3	Ped signals were red	1	2.0
		4	New system, not understood	3	6.0
		5	Special circumstances (eg. bike, wheelchair) hindered	1	2.0
		6	Busy junction	25	50.0
		7	Never feel safe	1	2.0
		8	Green time too short	1	2.0
Q12	Do you feel this new type of crossing is safer or less safe at this junction?	0	No opinion	15	8.1
		1	New crossing safer	79	42.5
		2	Old crossing safer	23	12.4
		3	About the same	37	19.9
		4	Didn't use old crossing	32	17.2
				New	%	Old	%
Q13	Why is that? (safer or not safer)	0	Don't know	44	56	6	26
		1	Red/green man better	5	6	10	43
		2	Audible noise on green better	0	0	0	0
		3	More time to cross/IR camera	8	10	1	4
		4	More cross on green/better behaviour	6	8	2	9
		5	Because new system (ie. better or more confusing)	4	5	4	17
		6	Looks safer	5	6	0	0
		7	Clearer to use/layout better	7	9	0	0

Question		Code	Answer	Results	%
Q14	Did you have any difficulty crossing the road?	1	Yes	8	4.3
		2	No	178	95.7
Q15	What was that?	1	Problems with new system	1	13
		2	Disability	4	50
		3	Other	3	38
Q16	What is the purpose of your journey now?	1	Shopping	73	39.2
		2	To/from work	32	17.2
		3	To/from other business	35	18.8
		4	School/college/other	46	24.7
Q17	Have you seen any publicity about this new type of crossing?	1	Yes/think so	14	7.5
		2	No	172	92.5
Q18	Where did you see it?	0	Not sure/don't know	0	0.0
		1	Local paper	11	79.0
		2	National paper	1	7.0
		3	Council report	1	7.0
		4	TV	1	7.0
Q19	Do you usually press the button before crossing the road?	1	Yes	91	48.9
		2	Yes, if no one else has done so first	35	18.8
		3	Yes, unless safe to cross without doing so	39	21.0
		4	No	21	11.3
Q20	When you cross the road do you usually .....?	1	Cross before green man appears	10	5.4
		2	Cross before green man, but only if safe	110	59.1
		3	Wait for green man to appear	66	35.5
Q21	What did you do just now?	1	Crossed on red	62	33.3
		2	Crossed on green	97	52.2
		3	Not sure/don't remember	27	14.5

Characteristic	Code	Type	Results	%
Age group	1	10 - 20	43	23.1
	2	21 - 40	78	41.9
	3	41 - 59	36	19.4
	4	60+	29	15.6
Sex	1	Male	76	40.9
	2	Female	110	59.1
Physical disability	0	None	172	92.5
	1	Blind	0	0.0
	2	Partially sighted	5	2.7
	3	Deaf/hard of hearing	2	1.1
	4	Wheelchair user	0	0.0
	5	Walking difficulties	6	3.2
	6	Mentally disabled	1	0.5
Other factors inhibiting ease of crossing	0	None	104	88.2
	1	Young children (walking/carried)	7	3.8
	2	Pram/pushchair	7	3.8
	3	Heavy load	4	2.2
	4	Shopping trolley	3	1.6
	5	Dog	0	0.0
	6	Pushing bicycle	1	0.5
Individual interviewed	0	Alone	139	74.7
	1	Adult accompanied by child(ren)	14	7.5
	2	Adult only group	32	17.2
	3	Child accompanied by adult	0	0.0
	4	Children only group	1	0.5

* *Percentages add to more than 100% resulting from coding of more than one response for some pedestrians*

APPENDIX 5. Toulouse: questionnaire, 'after' survey

QUESTIONS	CODE	REPONSE	RESULTATS	%
Q1 Combien de fois avez-vous utilisé ce passage piéton au cours du mois qui vient de s'écouler ?	1	Au moins 1 fois/jour	121	47.3
	2	Au moins 1 fois/sem.	48	18.7
	3	Rarement, quelques fois dans le mois	45	17.6
	4	Aujourd'hui pour la première fois	42	16.4
Q2 Avez-vous remarqué ces modifications ?	0	Non	33	12.9
	1	Oui	223	87.1
	2	Ne connaissait pas le site avant travaux	0	0.0
Q3 Si oui, pensez-vous que ces modifications sont utiles ?	0	Non	21	9.4
	1	Oui	182	81.6
	2	Ne sait pas	20	9.0
Q4 Si oui, pourquoi ?	1	Facilités pour traverser	43	23.6
	2	Sécurité des piétons	128	70.3
	3	Accès au bus facilité	4	2.2
	4	Esthétique	6	3.3
	5	Davantage de place en terasse café	9	4.9
	6	Autre	37	20.3
Q5 Si non, pourquoi ?	0	Les barrières sont génantes	—	—
	1	Autres	16	76.2
Q6 Avez-vous utilisé ce passage piéton avant modification du système ?	0	Non	47	18.4
	1	Oui	208	81.3
	2	Ne sait pas	1	0.4
Q7 Si oui, combien de fois ?	1	Au moins 1 fois/jour	114	54.8
	2	Au moins 1 fois/sem.	49	23.6
	3	Au moins 1 fois/mois	18	8.7
	4	Rarement, moins d'une fois par mois	27	13.0
Q8 Aviez-vous remarqué le tapis entre les barrières ?	0	Non	67	26.2
	1	Oui	189	73.8
Q9 A votre avis, à quoi sert-il ?	0	Ne sait pas	51	19.9
	1	Détecte les piétons	171	66.8
	2	Autre	34	13.3
Q10 Que devez-vous faire pour pouvoir traverser ?	0	Ne sait pas	34	13.3
	1	Doit se tenir sur le tapis	181	70.7
	2	Autres réponse	41	16.0

QUESTIONS	CODE	REPONSE	RESULTATS	%
Q11 Quelle est à votre avis la signification du triangle clignotant ?	0	Ne sait pas	49	19.1
	1	Vous pouvez traverser	11	4.3
	2	Vous pouvez traverser avec prudence	154	60.2
	3	Vous ne devez pas traverser	11	4.3
	4	Autre	31	12.1
Q12 Quelle est à votre avis la signification du signal piéton vert ?	0	Ne sait pas	9	3.5
	1	Vous pouvez traverser	237	92.6
	2	Vous pouvez traverser	4	1.6
	3	Vous ne devez pas traverser	1	...
	4	Autre	5	2.0
Q13 Quelle est à votre avis la signification du signal piéton rouge ?	0	Ne sait pas	10	3.9
	1	Vous pouvez traverser	2	0.8
	2	Vous pouvez traverser avec prudence	1	0.4
	3	Vous ne devez pas traverser	243	94.9
	4	Autre	0	0.0
Q14 Avez-vous des remarques à faire sur la position des nouveaux signaux piétons ?	0	Pas de remarques	81	31.6
	1	Est favorable à cette nouvelle disposition	48	18.7
	2	Préfèrerait que les signaux soient en face	100	39.1
	3	Regrette de ne plus voir les signaux pendant la traversée	27	10.5
	4	Aimerait que les signaux soient à droite	4	1.6
	5	Signaux trop petits	7	2.7
	6	Signaux trop hauts	2	0.8
	7	Signaux trop bas	4	1.6
	8	Autre	46	18.0
Q15 Avez-vous lu les informations fournies par les panneaux explicatifs ?	0	Non	124	48.4
	1	Oui	126	49.2
	2	N'avait pas remarqué la présence de ces panneaux	6	2.3
Q16 Si oui, avez-vous des remarques à faire sur ces panneaux ?	0	Pas de remarques	39	31.0
	1	Sont clairs, faciles à comprendre	69	54.8
	2	Sont difficiles à comprendre	7	5.6
	3	Autre	11	8.7

QUESTIONS	CODE	REPONSE	RESULTATS	%
Q17 Pensez-vous que le temps d'attente est plus long ou moins long dans ce nouveau système que dans l'ancien ?	0	Ne sait pas	87	34.0
	1	Ne connaissait pas l'ancien système	3	1.2
	2	Nouveau plus court que l'ancien	65	25.4
	3	Nouveau plus long que l'ancien	26	10.2
	4	A peu près identique	75	29.3
Q18 Pensez-vous que le temps accordé soit suffisamment long ?	0	Non	19	7.4
	1	Oui	198	77.3
	2	Sans opinion	39	15.2
Q19 Quand vous avez traversé la rue, vous êtes-vous senti(e) en sécurité ?	0	Non, pas du tout	7	2.7
	1	Oui, tout à fait	124	48.4
	2	Plutôt en sécurité	77	30.1
	3	Plutôt en insécurité	40	15.6
	4	Pas d'opinion	8	3.1
Q20 Si vous vous êtes senti(e) tout à fait ou plutôt en sécurité, pourquoi ?	0	Ne sait pas	24	11.9
	1	Parce que le signal piéton était vert	23	11.4
	2	Parce que le signal piéton clignotait	16	8.0
	3	Parce que le signal piéton était rouge	0	0.0
	4	A remarqué la présence du détecteur infrarouge	5	2.5
	5	Parce qu'il n'y avait pas de circulation	24	11.9
	6	Parce que tous les véhicules étaient arrêtés	63	31.3
	7	Autre	46	22.9
Q21 Si vous vous êtes senti(e) tout à fait ou plutôt en insécurité, pourquoi ?	0	Ne sait pas	2	4.3
	1	Parce que le signal piéton était vert	1	2.1
	2	Parce que le signal piéton clignotait	8	17.0
	3	Parce que le signal piéton était rouge	4	8.5
	4	Parce que le signal piéton n'était pas visible	1	2.1
	5	Parce qu'il y avait des véhicules en circulation	12	25.5
	6	Parce que le signal piéton n'a pas été compris	6	4.3
	7	Autre	17	36.2

QUESTIONS	CODE	REPONSE	RESULTATS	%
Q22 Pensez-vous que ce nouveau type de système sur ce carrefour, offre plus de sécurité au piéton que l'ancien ?	0	Ne sait pas	49	19.1
	1	Ne connaissait pas l'ancien système	6	2.3
	2	Le nouveau système est plus sûr	122	47.7
	3	L'ancien système était plus sûr	12	4.7
	4	A peu près identiques	67	26.2
Q24 Avez-vous eu des difficultés (d'autres difficultés) en traversant la chaussée ?	0	Non	246	96.9
	1	Oui	8	3.1
Q26 Quel était le motif de votre déplacement ?	1	Courses	71	27.7
	2	Domicile/travail ou Travail/domicile	69	27.0
	3	Autres affaires	64	25.0
	4	Loisirs	28	10.9
	5	Autres	24	9.4
Q27 Combien de fois avez-vous utilisé ce nouveau système ?	0	Ne sait pas	5	2.0
	1	Au moins 1 fois/jour	111	43.4
	2	Au moins 1 fois/sem.	49	19.1
	3	Rarement, moins d'une fois par semaine	30	11.7
	4	C'est la première fois	61	23.8
Q28 En général, quand vous utilisez ce nouveau système, quelle est votre attitude ?	0	Ne sait pas, pas d'habitudes à ce sujet, 1ère fois	37	14.5
	1	Attend que figurine piéton soit verte pour traverser	83	32.4
	2	Attend que figurine ... pour traverser	0	0.0
	3	Attend l'apparition du triangle jaune clignotant	47	18.4
	6	Attend que les véhicules soient arrêtés	23	9.0
	4	Traverse s'il n'y a aucun véhicule à proximité sans se soucier de la couleur du signal piéton	46	18.0
	5	Autre	20	7.8
Q29 Vous venez de traverser la chaussée. Quelle était la couleur du signal piéton quand vous avez commencé à traverser ?	0	Ne sait pas, ne se souvient pas	79	30.9
	1	Vert	54	21.1
	2	Rouge	14	5.5
	3	Triangle jaune clignotant	109	42.6

CARACTERISTIQUES	CODE	TYPE	RESULTATS	%
CONDITION METEO	1	Beau temps	166	69.7
	2	Couvert sans pluie	65	27.3
	3	Pluie	7	2.9
SEXE	1	Homme	110	46.2
	2	Femme	128	53.8
AGE		8 - 20 ans	78	33.3
		21 - 40 ans	106	45.3
		41 - 59 ans	20	8.5
		60 ans et plus	30	12.8
HANDICAPS PHYSIQUES	0	Aucun	230	99.6
	1	Aveugle	0	0.0
	2	Mal voyant	0	0.0
	3	Sourd ou mal entendant	0	0.0
	4	Fauteuil roulant	0	0.0
	5	Se déplace difficilement	1	0.4
	6	Autre	0	0.0
AUTRES PARTICULARITES POUVANT INFLUER SUR LA MANIERE DE	0	Aucune	224	94.5
	1	Portant ou donnant la enfant	7	3.0
	2	Poussette ou landau	4	1.7
	3	Lourdement chargé	0	0.0
	4	Chariot	1	0.4
	5	Accompagné d'un chien	2	0.8
	6	Poussant un cycle	0	0.0
	7	Autre	0	0.0
APPARTENANCE A UN GROUPE	0	Seul	173	72.7
	1	Adulte avec un ou plusieurs enfants	31	13.0
	2	Adultes avec un ou plusieurs adultes	32	13.4
	3	Enfant avec un ou plusieurs adultes	0	0.0
	4	Enfant avec un ou plusieurs enfants	0	0.0
	5	Accompagné d'une personne handicapée	1	0.4
	6	Autre	1	0.4

APPENDIX 6. Heemstede: questionnaire, 'after' survey

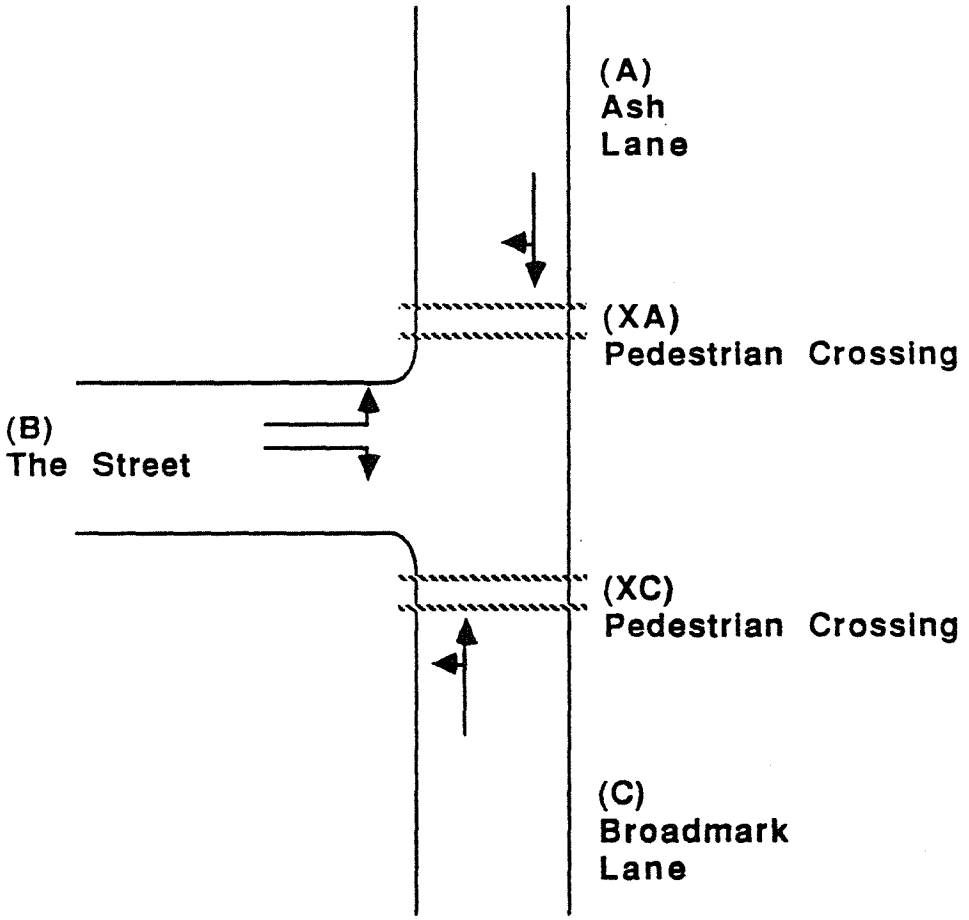
Question	Code	Answer	Results	
			N	%
Q1 How often have you used this crossing in the last time?	1	More than once a day	75	37
	2	Every day	46	23
	3	Once a week or more	37	18
	4	Once a month ore more	22	11
	5	Just today	21	10
Q2 Did you use this crossing before it was changed?	1	Yes	173	86
	2	No	28	14
Q3 How frequently did you use it?	1	More than once a day	75	37
	2	Every day	45	22
	3	Once a week or more	31	15
	4	Once a month ore more	20	10
	5	Less frequently	2	1
Q4 Did you notice the mat by the kerb?	1	Yes	184	92
	2	No	17	8
Q5 What do you think it does?	0	No idea	28	14
	1	You have to stand on it	23	11
	2	Senses pedestrians waiting to cross	124	62
	3	Other	22	11
	4	For blind people	10	5
Q6 What do you need to do to get the pedestrian signal to come on?	0	No idea	10	5
	1	Stand on mat and press button	58	29
	2	Stand on mat only	85	42
	3	Press button only	47	23
	4	Other	7	3
Q7A Have you any comments on the place of the new display?	0	No opinion	18	9
	1	Prefer old system	44	22
	2	Prefer old system with display other side	39	19
	3	Display not bright enough	5	2
	4	Other pedestrians obscured view	2	1
	5	Other:		
		Positive	33	16
		Negative	9	4
		Audible signal good	7	3
Q7B The display is yet on this side. What is your opinion about that? And why?	0	No opinion	9	4
	1	Makes no difference	22	11
	2	Prefer new system	42	21
	3	Prefer old system at the other side	87	43
	4	Other:		
		Good, handy	28	14
		Good position: close to eyes	14	7
		Good for elderly, kids or hard of hearing	6	3
		Needs getting used to	18	9
		Watch other side	18	9
		Bad, not handy	27	13
		bad postion, to close, to low/high, aside	25	12
		Needsto see becoming red	11	5
Q7C The display is different. What is your opinion about it? Why?	0	No opinion	15	7
	1	Makes no diference	42	21
	2	Prefer the old one	24	12
	3	Prefer the new one	60	30
	4	Other:		
		Good, nice, clear	33	16
		Good visible from different angles	9	4
		negative	10	5

Q8A Have you any comments on the instruction board with text?	0	No opinion	9	4
	1	Did not notice it	27	13
	2	Seemed clear	110	55
	3	Difficult to read	12	6
	4	Other:		
		Positive	23	11
		Negative	13	6
		Good position	3	1
		Bad position	24	12
Q8A Have you any comments on the instruction board with picture?	0	No opinion	12	6
	1	Did not notice it	31	15
	2	Seemed clear	110	55
	3	Difficult to see	11	5
	4	Other:		
		Positive	17	8
		Negative	16	8
		Bad position	9	4
Q9A How is your opinion about the time you just had to wait?	0	No opinion	7	3
	1	OK	80	40
	2	Too long	63	31
	3	Very short	19	9
	4	I went on red	22	11
Q9B How does this compare with before?	0	No opinion	26	13
	1	Shorter now	25	12
	2	Longer now	19	9
	3	About the same	73	36
	4	Can't remember	11	5
	5	Didn't use old crossing	11	5
Q10 Did you feel safe as you were crossing the road?	1	yes	174	87
	2	no	25	12
	3	I don't know	2	1
Q11A Were there any reasons why?	0	No	57	28
	1	Ped signals on green/no traffic	63	31
	2	Noticed infra-red detectors	7	3
	3	Other people crossing	9	4
	4	Other:		
		Know situation	10	5
		Looked	25	12
		Safe situation	10	5
Q11 Were there any reasons why not?	0	No reason	1	0
	1	Could not see the green light	6	3
	2	Traffic was moving	1	0
	3	Other:		
		Afraid for vehicles crossing on red	9	4
		Uncertain about traffic	9	4
Q12 Do you feel this new type of crossing is safer or less safe at this junction?	0	No opinion	28	14
	1	New crossing safer	40	20
	2	Old crossing safer	29	14
	3	About the same	74	37
	4	Can't remember	4	2
	5	Didn't use old crossing	7	3
	6	Other	7	3
Q13 Why is that?				
Q14 Did you have any difficulty crossing the road?	1	Yes	11	5
	2	No	190	95
Q15 Why was that?				

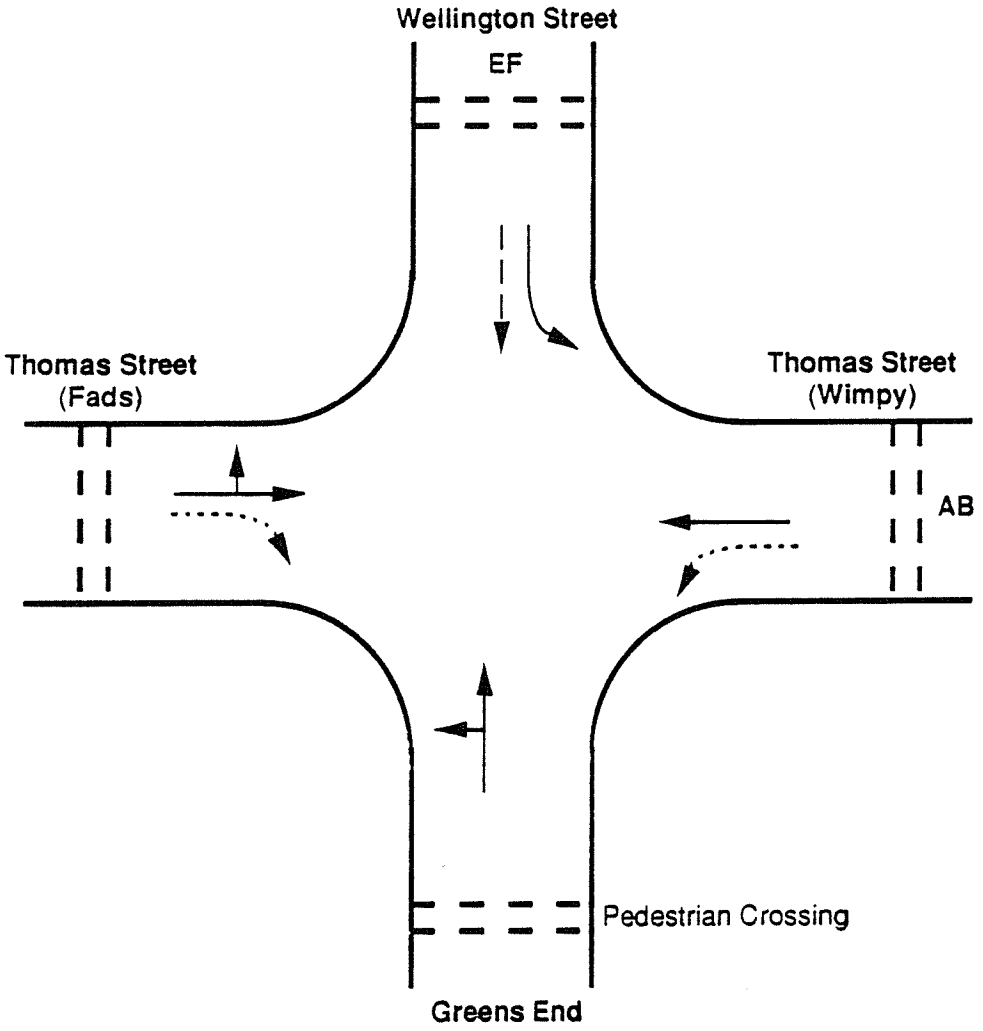
Q16A What is the purpose of your journey now?	1	Shopping	79	39
	2	To/from school	6	3
	3	To/from work	24	12
	4	To/from other business	43	21
	5	To/from train	50	25
Q16B If in group: Was your behaviour influenced by the other people?	1	Yes	7	3
	2	No	89	44
Q16C Why?				
Q17 Have you seen or heard any publicity about this new type of crossing?	1	Yes/think so	42	21
	2	No	159	79
Q18 Where?	1	Local paper	17	40
	2	Regional paper	6	14
	3	Paper	13	31
	4	Other	6	14
Q19A Do you usually press the button before crossing the road?	1	Yes	68	34
	2	Yes, if no one else has done so first	83	41
	3	Yes, unless safe to cross without doing s	19	9
	4	No	25	12
	5	Don't know	6	3
Q19b Do you press the button when cross on red?	1	Yes	23	11
	2	No	18	9
	3	Other	2	1
	4	Not asked	158	79
Q20 When you cross the road do you usually.....?	1	Cross before green appears	19	9
	2	Cross before green, but only if safe	109	54
	3	Wait for green to appear	71	35
	4	Don't know	2	1
Q21 What did you just now?	1	Crossed on red	69	35
	2	Crossed on green	131	65
Q22 What do you think that box (IR detector) does?	1	Lengthening pedestrian time	18	9
	2	Detection	44	22
	3	Camera	38	19
	4	Counting	8	4
	5	Safety	8	4
	6	Detects pedestrian offences	13	6
	7	Detects traffic offences	5	2
Q23 Still any complaints?	0	No	128	64
	1	Yes	73	36

Age group	1	'10-20'	31	15
	2	'21-40'	68	34
	3	'41-59'	53	26
	4	'60+'	49	24
Sex	1	Male	94	47
	2	Female	107	53
Physical disability	0	None	191	95
	1	Blind	0	0
	2	Partially sighted	3	1
	3	Deaf/hard of hearing	0	0
	4	Wheelchaire user	0	0
	5	Walking difficulties	5	2
	6	Mental handicap	1	0
Other factors inhibiting ease of crossing	0	None	163	81
	1	Young children (walking)	5	2
	2	Pram/pushchair	14	7
	3	Heavy load	4	2
	4	Shopping trolley	4	2
	5	Dog	5	2
	6	Pushing bike	9	4
Individual interviewed	0	Alone	167	83
	1	Adult accompanied by child(ren)	14	7
	2	Adult only group	9	4
	3	Child accompanied by adult	7	3
	4	With disabled adult	0	0
	5	Children only group	7	3
Crossed	1	Using button	68	34
	2	Using mat	116	58
	3	On green	123	61
	4	On red	69	34

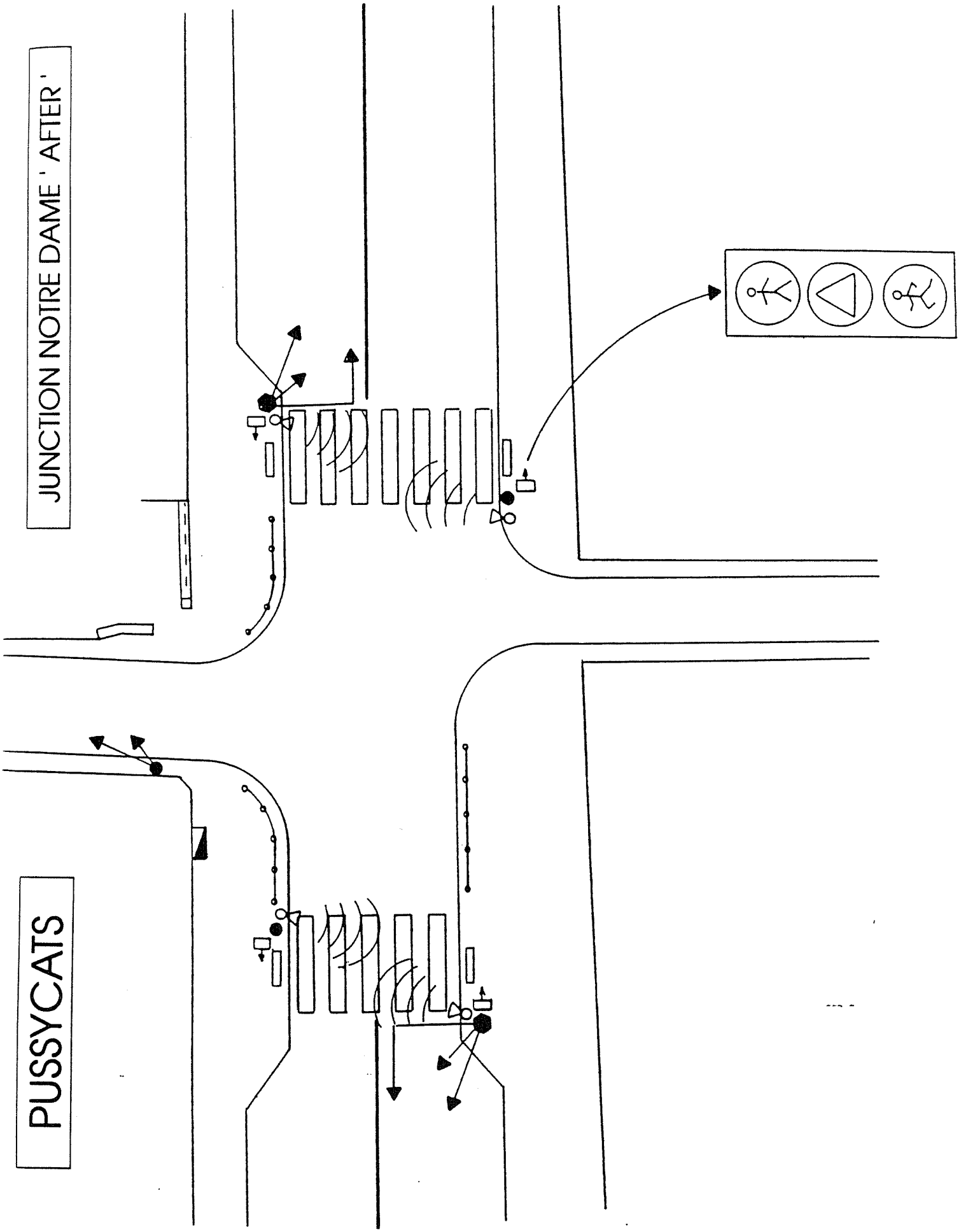
APPENDIX 7. Rustington: diagramme



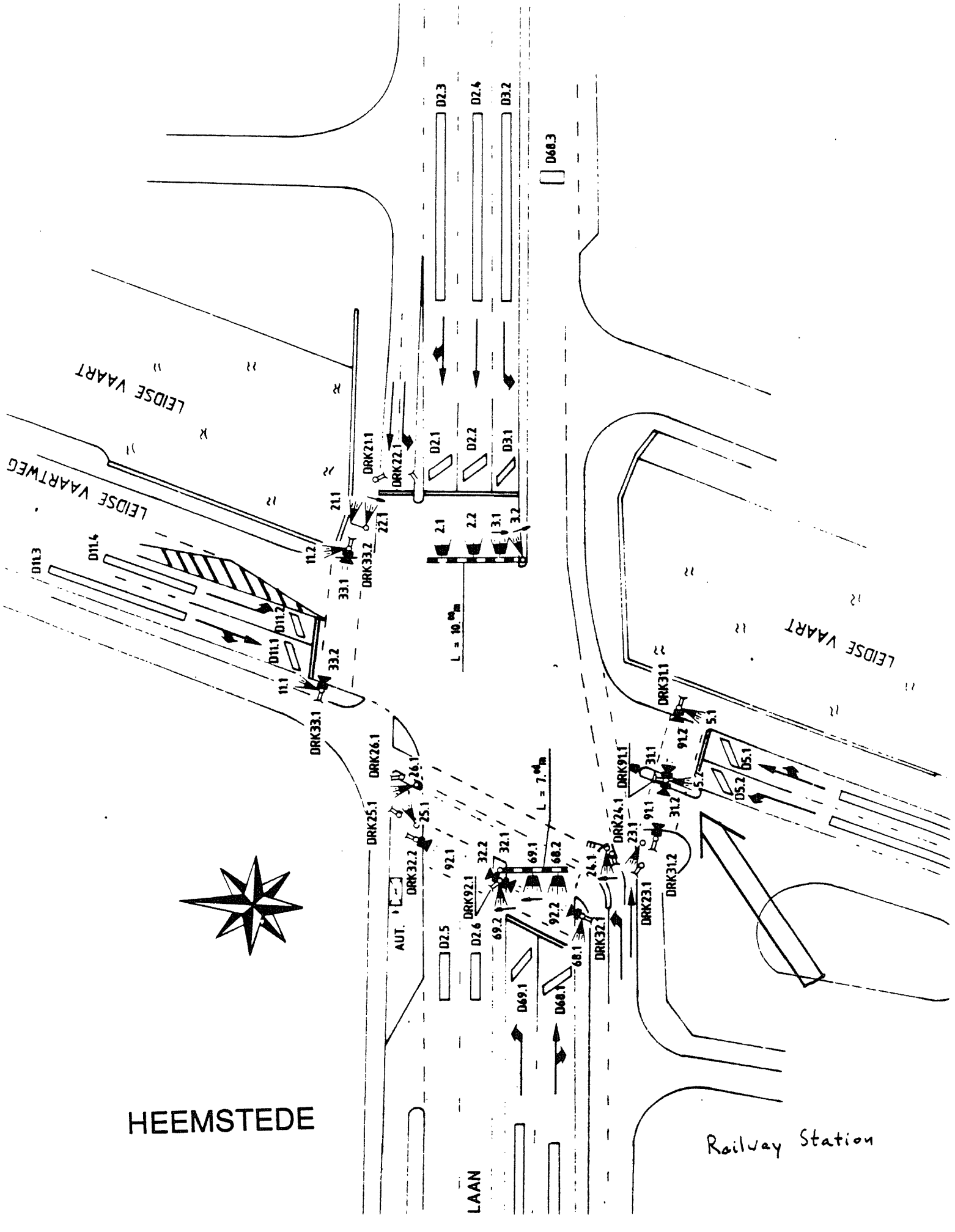
APPENDIX 8. Woolwich: diagramme



APPENDIX 9. Toulouse: diagramme



APPENDIX 10. Heemstede: diagramme



APPENDIX 11. Pro-forma video recordings

Research to Assess Changes to Pedestrian Facilities at Traffic Signals
VIDEO RECORD ANALYSIS - 'AFTER' SURVEYS

1) Date : _____ 2) Weather : _____

3	Time reference (video clock)								
4	Time reference (signal controller clock)								
5	Crossing number								
6	Direction								
7	Sex								
8	Age group								
9	Special circumstances								
10	Part of group								
10A	Pedestrian Signal on Arrival								
11	Wait lamp on on arrival (Y/N)								
12	Number waiting (both sides)								
13	Number on crossing (both directions)								
14	Press button (on arrival) (Y/N)								
15	Stand on mat (on arrival) (Y/N)								
16	Wait lamp on time (T)								
16b	Step off mat (T)								
17	Press button (after arrival) (T)								
18	Stand on mat (after arrival) (T)								
19	Wait lamp off (T)								
20	Wait lamp on again (T)								
21	Head movement - before crossing								
22	Start of pedestrian green (T)								
23	Pedestrian signal on start of crossing								
24	Crossing start time (T)								
25	Vehicle signal on start - Signal 1								
26	- Signal 2								
27	- Signal 3								
28	- Signal 4								
29	Head movement - while crossing								
30	Crossing between lines								
31	Crossing finish time (T)								
32	Pedestrian signal on finish								
33	Vehicle signal on finish - Signal 1								
34	- Signal 2								
35	- Signal 3								
36	- Signal 4								
37	Time of next vehicle (T)								
38	Direction of next vehicle								
39	Comments								

Codes for Rustington 'After' Survey

3 4	Time reference (video clock) Time reference (signal controller clock)	Time (hour and minute from video record) Time (hours, mins and secs from signal controller)
5	Crossing number	XA - Ash Lane XC - Broadmark Lane
6	Direction	1 : Walking away from camera 2 : Walking towards camera
7	Sex	0 : Male 1 : Female
8	Age group	1 : 0-10 2 : 11-14 3 : 15-20 4 : 21-60 5 : Over 60
9	Special circumstances	0 : None 1 : Blind/partially sighted 2 : Wheelchair user 3 : Walking difficulties 4 : Young children walking 5 : Pram/pushchair 6 : Heavy load 7 : Dog 8 : Bicycle 9 : Shopping trolley 10 : Other * Please specify
10	Part of group	0 : Walking alone 1 : Walking with very young child (≤ 3 years old) 2 : Walking with older child (4-10 years old) 3 : Walking with adult 4 : Walking with elderly person (> 60 years old)
11,14,15	(Y/N)	0 : No 1 : Yes
16,17,18,19,20 22,24,31,37	(T)	Time (secs) from arrival Blank means no event
21,29	Head movement	0 : Ahead only 1 : Away from junction only 2 : Towards junction only 3 : Both directions

23,32	Pedestrian signals	0 : Red 1 : Pre-'pedestrian green' (all signals red) 2 : Green 3 : Clearance red or extended red
25,26,27, 28,33,34, 3536	Vehicle signals	0 : Red 1 : Red/amber 2 : Green 3 : Amber
30	Crossing between lines	0 : Wholly crossing between lines (> 95%) 1 : Half or more of crossing between lines (≥ 50%) 2 : Less than half crossing between lines (< 50%) 3 : Wholly crossing outside lines (< 5%)
38	Direction of next vehicle	1 : Going away from junction 2 : Going towards junction
39,40	Comments on behaviour	1 : Pedestrian hurrying 2 : Pedestrian hesitating during crossing 3 : Potential conflict between pedestrian and vehicle (eg. vehicle has to slow, pedestrian has to stop) 4 : Uneasy behaviour on the mat 5 : Other comments * (Please specify) Leave blank if no comments