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Review of the 'Looked but Failed to See' Accident Causation Factor

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1 EXECUTIVE SUMMARY

Objectives

In-depth surveys of road traffic accidents have shown that a number of them are attributed to one or more of the involved road users having looked in the appropriate direction(s) but failed to see the person or vehicle with whom/which they collided. Such explanations almost invariably derive from subjective accounts of causation offered by offending road users and/or by police officers recording their accidents and/or by members of the multi-disciplinary research teams which launched these in-depth surveys at the sites of accidents shortly after they occurred.

This Review was therefore commissioned with the following objectives:

- To review the accident literature in order to estimate the magnitude of the problem, to investigate the types of road user for whom it is most likely to be recorded, and to evaluate the road and traffic situations in which it is most likely to be recorded.
- To evaluate the probability that the reported problem represents a genuine psychological phenomenon of attention, perception and cognition (that is, the road user at fault actually looked in the appropriate direction(s), the object collided with was visible within their visual field, yet the visible object did not enter consciousness as a relevant hazard), relative to a number of alternative predictable possibilities.
- To consider whether the phenomenon, if genuine, is researchable and, if so, to recommend methods by which its psychological basis may be most satisfactorily understood and appropriate counter-measures taken.

In-depth, at the scene studies

A study of the accident literature showed that the term ‘Looked but Failed to See’ (LBFTS) was first used in a variety of in-depth ‘on the spot’/‘at the scene’ accident investigations carried out by multi-disciplinary research teams in several countries during the 1970s and 1980s. All used a human factors/ergonomics approach, in that they attributed causation to the driver, the vehicle, the road and traffic environment, and to interactions between these main factors. Their results were reasonably consistent in finding that the road user was the sole contributor in about 65% of accidents, that human factors contributed to nearly 95% of accidents, that the environment contributed to between 20 and 30% of accidents and that vehicle factors contributed to between 3 and 13% of accidents. Driver errors recorded as LBFTS were found to contribute to upwards of 10% of accidents in these different surveys.

In the UK, an in-depth ‘on the spot’ survey of accidents conducted by the then

Transport and Road Research Laboratory (TRRL) between 1970 and 1974 showed that LBFTS was responsible for 10% of drivers' errors, ranking third in order of importance after 'lack of care' and 'driving too fast'. It was fourth in order of importance among pedestrians' errors, being responsible for over 8% of their accidents. A re-analysis of the TRRL data by the present author in 1983 showed that LBFTS constituted almost half of all perceptual errors made in daytime accidents by drivers who were unimpaired by alcohol, drugs, fatigue, illness, or stress; being far more important than 'distraction', 'lack of attention or alertness', 'faulty interpretation' and 'misjudged speed or distance'.

Linking contributory factors to STATS19

Recognising that the data on 'contributory factors' in accident reports would be of enhanced value if they were recorded in a more consistent fashion and linked to the STATS19 database, in 1996 the Department for Transport (DfT) commissioned the Transport Research Laboratory (TRL) to develop a prototype system and test it in the field with a number of police forces. The new system was given a three-month trial involving eight police forces. It required officers to ascertain the critical failure or manoeuvre which led up to an accident, (the 'Precipitating Factor'), and also to identify the factor or factors which contributed to this failure or manoeuvre (the 'Contribitory Factor') . One response could be selected from a list of 15 precipitating factors and a maximum of four responses could be selected from a list of 54 contributory factors. Officers were also asked to code each factor as 'Definite', 'Probable', or 'Possible'. The findings of specific relevance to LBFTS may be summarised as follows:

1. The overall incidence of recording LBFTS as a contributory factor was 7.5%, the fourth most frequently recorded factor after 'Failure to judge other person's path or speed' (10.7%), 'Behaviour-careless/thoughtless/reckless' (8.8%), and 'Inattention' (8.0%).
2. The obvious pairing of the precipitating factor 'Failed to give way' with LBFTS as the primary contributory factor accounted for 3.54% of all accidents recorded, the third most common pairing after 'Loss of control' with 'Excessive speed' (4.04%) and 'Failed to avoid vehicle or object' with 'Failed to judge other's path or speed'.
3. Where LBFTS was recorded as the primary contributory factor, this attribution was coded as 'Definite' in 9.0% of cases where this level of confidence was recorded, as 'Probable' in 8.3% of such cases, and as 'Possible' in 5.9% of such cases.
4. The incidence of recording LBFTS as a 'Definite' contributory factor in multi-vehicle, fatal or serious accidents on built-up roads was greater than that of all other contributory factors (15%), closely followed by 'Failure to judge other person's path or speed (13%) and 'Failed to look' (13%).

This field trial thus supported the view gained from earlier research that LBFTS appears to be one of the more important contributory factors in accident causation and it also suggested that LBFTS can be recorded with a reasonable level of confidence by investigating police officers.

Initial results from the linked system

More broadly based evidence on the importance of LBFTS errors became available in 1999 when 13 British police forces voluntarily began to collect data from this new system linking contributory factors in accidents to routinely collected STATS19 information. The main findings from the first year's collection of data from the new system which are of relevance to the understanding of the LBFTS problem may be summarised as follows:

a) Analysis of the data showed that inappropriately or inadequately executed driver or rider 'Perceptual' skills were the predominant contributory factor in accidents, accounting for 46% of all categories of contributory factor recorded. 'Motivation' was the second most frequently recorded contributory factor, accounting for 15% of all categories, followed by 'Behaviour' which accounted for 9%.

b) Within this 'Perceptual' category, LBFTS was the third most frequently recorded contributory factor, accounting for 17% of all perceptual factors. Inattention accounted for 28% and misjudgements of other road users' path or speed accounted for 21%.

c) Within the 'Motivation' category of contributory factors, 'Carelessness/ Thoughtlessness/Recklessness' comprised the most frequently recorded factor, accounting for 70% of all factors recorded here. Within the 'Behaviour' category of contributory factors, 'Excess speed' accounted for 56% of all factors recorded, with 'Close following' accounting for 41%. It may reasonably be speculated that these motivational and behavioural failings could underlie the relatively high incidence of 'Perceptual' factors in accident causation.

d) 'Emotion', 'Inexperience' and 'Impairment/Disability' categories contributed relatively infrequently to the total number of contributory factors recorded in the database, their respective contributions being 2.7%, 2.7% and 4.3%. Again, it may reasonably be speculated that these personal characteristics are unlikely to underlie the relatively high incidence of 'Perceptual' factors in the database. This is also true for 'Obscuration', 'Distraction' and 'Weather', which accounted for only 4.6%, 1.9% and 4.8% respectively of all contributory factors recorded.

e) In accidents where a contributory factor was assigned, over 17% of all drivers were recorded as having LBFTS.

f) Where LBFTS was the primary contributory factor, it was recorded on 56% of all occasions on which it was associated with drivers' or riders' 'Behavioural' failures, especially and unsurprisingly failures to give way or to avoid a vehicle, object, or pedestrian. When it was the primary contributory factor in pedestrians' accidents it was recorded on 43% of all occasions on which it was associated with 'Behavioural' failures such as, unsurprisingly, 'Entered carriageway carelessly'.

g) Where LBFTS was the primary contributory factor, it was also recorded on 53% of occasions on which it was associated with drivers' 'Manoeuvring' errors. It may reasonably be speculated that the perceptual and cognitive demands of steering a safe path through traffic increases the tendency to 'fail to see' hazards.

h) In order to increase the reliability of analyses of individual characteristics associated with road users' LBFTS errors, their prevalence was expressed as a percentage of accident-involved *vehicles* (and therefore drivers) where a contributory factor was assigned, rather than as a percentage of *accidents* where a contributory factor was assigned. Recording of LBFTS errors was found to increase monotonically with driver age, being 62% more frequent overall for the over-65s than for the under-21s. This difference was more pronounced in 'Fatal' than in 'Serious' or 'Slight' accidents and it was largely accounted for where LBFTS was recorded as the primary contributory factor.

i) The overall frequency of recording LBFTS errors was 17% higher for female drivers than for males. Given that inexperience with driving or unfamiliarity with the vehicle were infrequently recorded as subsidiary factors when LBFTS was recorded as the primary factor, it seems unlikely that 'inexperience' and 'unfamiliarity' were major contributors to this difference between male and female drivers. The overall lesser tendency for LBFTS to be recorded in fatal accidents seemed largely accounted for by its 41% lower assignment to male drivers in this category of severity. Whether this finding reflects a sex difference in the impact speed at which LBFTS accidents are incurred, or a greater tendency for males to be the victim of their LBFTS errors, remains unknown.

j) LBFTS was recorded as a contributory factor in almost 21% of accidents incurred at road junctions and in only just over 8% of accidents incurred away from a junction, reflecting the greater perceptual demands of junction negotiation.

k) LBFTS was recorded most frequently at private drives or entrances, but almost as frequently at mini-roundabouts. This latter finding is surprising, since mini-roundabouts would be expected to present drivers with few visual scanning problems and they have a relatively safe reputation, accounting for only just over 1% of all the accidents recorded in this survey.

l) LBFTS errors were recorded almost 23% more frequently in daylight than in darkness, which probably reflects the greater difficulty of visually scanning for hazards during periods of high traffic density, but it could also suggest that LBFTS derives from failures of attention, perception and cognition, rather than being of sensory origin.

m) Almost 17% of all drivers involved in daylight accidents were recorded as having LBFTS, 10% more often inside as compared with outside built-up areas. Less than 14% of drivers involved in accidents during darkness were recorded as having LBFTS, 32% more often when street lights were lit than when they were not.

In order to further explicate these findings, analyses were performed to reveal the order of importance with which other contributory factors were recorded as subsidiary to LBFTS when this error was the primary factor contributing to accidents. The results of these analyses may be summarised as follows:

i) Where LBFTS errors were recorded as the primary factor in accidents their main subsidiary contributing factors were inappropriately or inadequately executed 'Perceptual' skills, especially 'inattention' and 'misjudged speed or direction of travel', but they were also associated with 'Failed to look' errors. One explanation of this apparent incompatibility between simultaneous attributions of LBFTS and 'attentional' or 'judgemental' failures is that they related to different drivers involved in the same accident. Another is that they were recorded as errors made by a driver in relation to vehicles approaching from different directions. A third possibility is that a different criterion was used for recording LBFTS errors from that established by the objectives of this Review. There is some support for this latter explanation from the finding that 'attentional' and 'judgemental' contributory factors were recorded on almost 45% of all occasions where 'Perceptual' failures were associated with LBFTS. Any of these three possibilities casts doubt on the value of the present data in assessing the precise importance of the LBFTS phenomenon, as defined here.

ii) The main contributory factor subsidiary to LBFTS which was of a behavioural nature was 'excess speed', although this association was relatively infrequently recorded. Clearly, fast driving will limit the time available for drivers to scan the road and traffic scene effectively.

iii) The main contributory factors subsidiary to LBFTS which were of a motivational nature were 'carelessness', 'thoughtlessness' and 'recklessness'. Again, such behaviour could impinge on a driver's visual scanning of the environment for potential hazards.

iv) Where LBFTS was the primary contributory factor it was infrequently associated with 'emotion' factors as subsidiaries, or with 'inexperience', 'impairment' or 'disability'. Where 'impairment' was associated with LBFTS it was largely recorded as 'alcohol intoxication'.

v) 'Vehicle' factors were infrequently recorded as subsidiary to LBFTS. Given the definition of LBFTS adopted here, it is clear that such factors could only provoke that error indirectly via distraction of the driver or obscuration of a hazard.

vi) Where LBFTS was the primary contributory factor its main subsidiary was hazards occurring in a 'blind spot' on those occasions on which the driver's view was obscured, rather than from failure to see a hazard which was actually in the driver's visual field.

vii) 'Site-specific' environmental factors were subsidiary associates of LBFTS about as frequently as behavioural factors. They mainly related to bends or winding roads, suggesting that these associations resulted from a failure to recognise the hazardous potential of a site, rather than actually looking but failing to see.

viii) Where LBFTS was the primary contributory factor it was associated 2.6 times more often with the 'surroundings' of an accident site as subsidiaries than with its 'site-specific' features. 'Parked vehicles' appeared particularly important, which suggests that their influence on LBFTS errors operates via distraction rather than obscuration of a potential hazard. However, 'distraction' was infrequently recorded as a subsidiary to LBFTS, suggesting that this is not a dominant factor in limiting the time available for drivers to scan their environment.

ix) 'Weather' factors were more frequently recorded as subsidiary to LBFTS than were 'behavioural', 'emotional', 'inexperience', 'impairment/disability', 'vehicle', 'site-specific environmental', 'impaired view', or 'distraction' factors. 'Weather' may plausibly be a factor affecting a driver's ability to 'see' a potential hazard, but it could cause LBFTS errors as defined here only by perturbing normal visual scanning behaviour, e.g. by slowing it down, or by degrading perception of individual features of a hazard, such as its location, orientation, or speed.

Assessment of the evidence

Within the UK, as elsewhere, in-depth on the spot surveys have shown that errors recorded as LBFTS are a major contributory factor in road accidents, constituting around 10%, the third most important, of all driver errors and over 8%, the fourth most important, of all pedestrian errors. In one UK survey, LBFTS was found to have contributed to almost 23% of all accidents incurred by unimpaired drivers in daylight.

It was found to be the most important contributor to accidents attributed to 'perceptual' error, occurring almost twice as frequently as errors attributed to drivers' failure to perceive road and traffic hazards. LBFTS has been shown to play a part in almost half as many accidents as are attributed to all driver errors of a non-perceptual nature.

Evidence from the initial linking of contributory factors in accidents to STATS19 data in 1999 has supported that obtained from these earlier on the spot surveys. It has shown that LBFTS constitutes the third most important factor within the category of drivers’ perceptual failures contributing to accidents, accounting for over 17% of all these failures. LBFTS was recorded as the primary contributory factor in 56% of accidents precipitated by driver or rider failures categorised as ‘behavioural’; mainly failure to give way, or failure to avoid a vehicle or object. It was recorded as the primary contributory factor in 53% of accidents precipitated by drivers’ manoeuvring errors, mainly poor turns. However, the finding that inexperience of driving or unfamiliarity with the vehicle comprised less than 3% of all contributory factors recorded and that inexperience was seldom recorded when LBFTS was the primary factor contributing to accidents suggests that drivers LBFTS not because they *lack* skill, but because they misuse their skills or apply them inappropriately. There is some support for this view from the finding that motivational factors contributing to accidents, mainly carelessness, thoughtlessness, or recklessness, comprised 15% of all contributory factors recorded, the second most frequent contributory category after perceptual factors. Taken together these findings suggest that, if the drivers in question were indeed looking in the appropriate directions prior to their accident, their LBFTS errors were most likely to have resulted from a failure to spend sufficient time in fixating and identifying potential hazards.

The frequency of recording LBFTS errors was found to increase monotonically with the age of accident-involved drivers, being 62% more common among the over-65s than the under-21s. This positive association with age may plausibly be a function of sensory and/or neurological degradations in the perceptual and cognitive processes that drivers employ to assess traffic movements. It could also result from changes in the way that older people use their vehicles in response to perceived deteriorations in their driving ability. For example; they may choose to drive only on familiar roads and incur LBFTS errors as a result of bad habits, or they may drive less frequently and hence become unaware of recent changes in road and traffic demands.

The overall frequency of recording LBFTS errors was found to be 17% higher for female drivers than for males. Differences in driving experience or in familiarity with their vehicle seem unlikely to explain this finding, because these individual characteristics were seldom recorded as contributory factors in the surveyed accidents. If the recorded sex difference in commission of LBFTS errors is real, it may be attributable to inherent differences in spatial perception and/or cognition between males and females, or from differences in attitudes towards risk acceptance.

It is unsurprising that LBFTS was recorded in over 20% of all the accidents surveyed at road junctions. Clearly the potential for perceptual failures to occur is increased when drivers have to scan several different sources of information in rapid succession.

It is perhaps surprising that LBFTS errors were recorded most frequently at private drives or entrances, which would appear to present exiting drivers with similar visual scanning problems to those they face at T-junctions, where around 18% fewer LBFTS errors were recorded. However, the data are not clear as to whether these errors were made by drivers exiting private drives and junctions or by drivers passing them. It is even more surprising that LBFTS errors were recorded almost as frequently at mini-roundabouts, where visual, perceptual and cognitive demands on drivers would be expected to be lower than at, say, multi-arm junctions, because mini-roundabouts demand limited scanning, they present virtually no obscuration problems and their priority rules are clear. It is also puzzling that 27% fewer LBFTS errors were recorded at larger roundabouts than at mini-roundabouts, because the former would appear to present drivers with greater difficulties in visual scanning.

Whilst these results from the linked system broadly support those obtained from earlier on the spot studies on the importance of LBFTS as a contributory factor in road accidents, there is some evidence that caution should be exercised when interpreting the detailed findings. For example, LBFTS was frequently recorded in association with ‘attentional’ failures, or with misjudgements of the speed or heading of other vehicles but, clearly, drivers cannot be consciously ‘looking’ if they are not ‘attending’, nor can they make misjudgements about events they have ‘failed to see’. More importantly, LBFTS was sometimes recorded in association with seemingly incompatible ‘failed to look’ errors. These findings are explicable only if they reflect errors attributed to different drivers in the same accident, or if they reflect errors made by individual drivers in response to different hazards that provoked their accident. The data are not clear on this point.

It seems obvious that the stressful aftermath of a road traffic accident is not always conducive to the collection of perfectly reliable data on the factors which contributed to the accident. Subjective reports on their pre-accident behaviour by involved drivers may well be unreliable and police officers may find that the reporting system places constraints on the way in which they would like to report the factors that they perceive to have contributed to the accident. Therefore one interpretation of the joint recording of LBFTS and other apparently incompatible errors in driving behaviour is that the term LBFTS was employed to cover a wide range of errors of attention, perception and cognition that do not meet the criteria for LBFTS errors adopted here. These joint recordings accounted for 45% of all the perceptual failings recorded in LBFTS accidents during the 1999 survey. Thus, although genuine LBFTS errors are clearly important contributory factors in accidents, their actual individual contribution to causation may be slightly less than the survey findings suggest, by an amount that cannot be determined from the present data. In order to further understanding of this potential over-reporting of LBFTS accidents a conceptual analysis of the problem is presented.

Explanatory conception of the problem

An analysis of the driver’s search task shows that where there is a risk of conflict with other traffic they must search their environment for particular *objects*, in particular *locations,* with a particular *orientation* and with a particular *approach speed*. That is, they must scan the, possibly complex, road and traffic scene, identify, assess and integrate the various features of location, orientation and speed for each object visible in the scene and then decide whether they would be on a collision course with anything in this scene if they continued with their current course of action. Because this process will take a finite amount of time, it is clear that LBFTS errors will be more probable when available scanning time is short, for example at busy junctions and/or with fast speeds of approach to a potential conflict zone, than when more time is available. Given this task analysis, alternative explanations of drivers’ errors which are recorded as LBFTS may be conceptualised as follows.

LBFTS may simply be used as an excuse for their behaviour by faulty drivers, or as a default option by police officers in the absence of alternative evidence. This has been termed *Falsely attributed LBFTS*. Drivers may actually have looked in the appropriate direction(s), actually seen the clearly visible object and made a conscious decision about its hazardous potential, but failed to conclude that it represents a potential danger. This error represents *Misperception of hazard*. Drivers may look in the appropriate direction(s) but fail to see an approaching vehicle or pedestrian because they are temporarily obscured. This error is termed *Failure to appreciate obscuration of potential hazards*. Fatigued or drowsy drivers may subconsciously make head and eye movements that appear appropriate to scanning of the traffic scene, but which do not result in conscious processing of its potential danger. This is termed a *Subconscious scanning error*. Drivers may consciously direct attention to appropriate areas of the traffic scene for appropriate amounts of time, but fail to become aware of specific types of clearly visible hazard. This error is said to result from an *Inadequate search model*. Finally, drivers may look in the appropriate direction but for an insufficient period of time and thus fail to integrate all the relevant information about a clearly visible hazard into a coherent image representing danger. This error is attributed to *Incoherent feature detection*. Only the latter two errors represent LBFTS as defined in this Review, although it is understandable that the other four types of error could be reported as such. In order to understand the difference between these two genuine LBFTS errors and the four other behavioural failures which do not meet the criteria established by this Review, evidence is adduced from mainstream psychological research into human attention and performance.

Psychological bases of LBFTS errors

The psychological bases of these two types of genuine LBFTS error are explained by reference to a wide body of empirical research in the field of attention and performance. Progress in this field has been rapid in recent years, largely due to advances made in cognitive neuroscience, although certain theorising remains controversial. However, there is enough agreement here to support the view that there are three aspects to the LBFTS phenomenon:

1. Individuals' *limited capacity* for processing information means that visual stimuli must compete for attention (especially at busy road junctions) and some may be overlooked.
2. *Attentional selectivity* means that certain features of approaching vehicles, for example their size or location, may be given attention whereas other features, perhaps their orientation or speed, may not, resulting in failure to identify potential hazards.
3. The possibility of forming *illusory conjunctions* of features from hazards and non-hazards during rapid scanning of the environment means, for example, that a fast approaching vehicle may be 'seen' as non-hazardous because the vehicle temporarily alongside it, when both were briefly fixated, was approaching more slowly.

In brief, the problem caused by LBFTS errors in the road traffic system can be attributed to individuals' attentional biases and to their imperfect visual scanning capabilities or practices. These are common human deficiencies, especially under load and time stress, therefore the LBFTS problem is inherently important in a visually demanding traffic system, although there will obviously be individual differences in the tendency to commit such errors. Understanding these individual differences and the road and traffic situations which predispose drivers to LBFTS are essential requirements if counter-measures against this error are to be designed and introduced effectively.

Suggestions for research on the LBFTS error

It is concluded that the problem is essentially researchable and would most productively be understood by studies conducted using real-life data from the contributory factors system and by parallel experimental studies in the laboratory. However, following the present data analysis a consultation exercise conducted in 2002 showed that many users of the TRL system perceived it as a complication rather than a simplification of their task of reporting contributory factors in accident causation. As a result of this response, Road Safety Division in DfT sought impartial advice as to how the TRL reporting form could be modified to meet these concerns and the Transport Research Group (TRG) at Southampton University was contracted to research this issue. Following their report it was agreed that contributory factors in road accidents should continue to be included as part of the STATS19 requirement, but that the two-tier approach of TRL's system should be abandoned. Instead, a single-tier framework was adopted in which up to six listed contributory factors can be allocated to any of the participants in an accident, but there is no requirement to identify a precipitating factor. The new framework was implemented in January 2005. Within this system, LBFTS has been combined with 'Failed to look' in order to comprise an error coded as 'Failed to look properly'. Hence it is not possible to use data collected routinely under the new system in future studies of the LBFTS phenomenon, although there remains some scope for furthering our understanding of it by temporary manipulations of data collection.

Several different lines of research are suggested in order to understand the phenomenon and guide the design of counter-measures against LBFTS errors, as follows:

1. Since a number of accident-involved drivers are expected to continue reporting that they have LBFTS, it would be informative to quantify the possible extent of 'false reporting' of the phenomenon. A laboratory experiment is therefore suggested which examines this possibility by obtaining drivers' ratings of the seriousness of LBFTS as compared with a variety of other driving errors. The assumption here is that rated seriousness would reflect drivers' propensity to report that they had LBFTS rather than attributing their accident to some other failure of skill or attention. The results of this study could provide a 'correction factor', applicable to drivers' subjective reporting of LBFTS, in order to better estimate the true extent of the problem.
2. Further examination of the age and sex differences in propensity to report LBFTS errors seems indicated. These could initially be explored by recording accident-involved male and female drivers' reports of LBFTS errors for an experimental period of, say, one year and analysing their relationship with driver age. The results could be applicable to driver training and education.
3. In conjunction with suggestion 2 above, drivers' reports of LBFTS errors could be examined in relation to the road and traffic conditions within which they were committed and the manoeuvres being undertaken at the time they were made. The results could inform the need for specific driver training measures or engineering changes required to reduce LBFTS errors under particularly demanding conditions.
4. In association with suggestion 3 above, a laboratory study could be undertaken in order to reveal the specific nature of the pre-attentive failure which results in a LBFTS error. Eye-movement studies of drivers' responses to simulated traffic scenes could be designed to provide a fine-grained examination of their use of object size, location in the scene, orientation and approach speed in their search for potential hazards at junctions. Of particular interest would be drivers' prioritisation of these different features of traffic hazards and the order in which they fail to be integrated into a relevant perception of danger under conditions of increasing informational load and time stress. The results could further understanding of genuine LBFTS errors, as defined in this Review, and inform the identification of appropriate counter-measures against them.
5. The studies outlined in 2 and 3 above could be repeated in due course in order to evaluate any reduction in drivers' propensity to commit LBFTS errors which followed the introduction of counter-measures against them, indicated by findings from the suggested research.

2 INTRODUCTION

In-depth surveys of road traffic accidents have shown that a number of them are attributable to one or more of the involved road users having looked in the appropriate direction(s) but failed to see the person or vehicle with whom/which they collided. Such explanations almost invariably derive from subjective accounts of causation offered by offending road users and/or by police officers recording their accidents and/or by members of the multi-disciplinary research teams which launched these in-depth surveys at the sites of accidents shortly after they occurred.

These in-depth 'at the scene' or 'on the spot' surveys were introduced some 30 years ago, when road and traffic conditions were very different from those at present. However, a few similar studies conducted more recently have, in general, supported the earlier findings and there is now a perceived need to review existing evidence of this reported 'Looked but Failed to See' (LBFTS) problem and its possible psychological explanations in order to assess whether LBFTS accidents represent a genuine phenomenon of importance for road safety and, if so, to determine whether it is researchable.

3 OBJECTIVES

The objectives of this Review are:

- To review the road accident literature in order to estimate the magnitude of the problem, to investigate the types of road user most likely to report it and to evaluate the road and traffic conditions in which it is most likely to be recorded.
- To evaluate the probability that the reported problem represents a genuine psychological phenomenon of perception, attention and cognition (i.e. the road user at fault actually looked in the appropriate direction(s), the object or person collided with was clearly within their visual field, yet the visible object did not enter consciousness as a relevant hazard), relative to the alternative probabilities: (i) that the object/person collided with was actually seen, but consciously ignored as a non-threatening hazard (representing a perceptual and/or decision error for which the LBFTS accident descriptor is a misnomer), or (ii) that the object/person collided with could not be seen during the scanning time allocated by the offending road user because it was obscured by vehicular features (e.g. windscreen pillars or head restraints), or by situational features (e.g. other vehicles, roadside furniture, darkness or rain). This would represent a failure to assess and appreciate the hazard potential of the road and traffic scene, rather than a specific failure to 'see'.
- To consider whether the phenomenon, if genuine, is researchable and, if so, to recommend methods by which its psychological bases may most satisfactorily be understood and appropriate accident counter-measures indicated.

4 EVIDENCE OF A PROBLEM

4.1 In-depth, at the scene studies

As Broughton, Markey and Rowe (1996) have reported, subjective comments by the police on contributory factors in road accidents, such as LBFTS, were collected under the original system for recording information about road accidents, known as STATS19, established in 1949. Although this practice was terminated at the national level in 1959 on grounds of unreliability, these authors note that, '–in 1994 a TRL survey of the 43 police forces in England and Wales found that over one half were still collecting these data' (1996: p. 1). However, the more formal and perhaps more reliable use of LBFTS as a causal descriptor appears to have resulted from the realisation in the late-1960s that higher-quality data were needed if traffic authorities were to gain a better understanding of the causes of accidents and of the interrelationships between the various factors contributing to them. (See Grayson and Hakkert, 1987, for a brief history of in-depth accident analysis.) As a result of this realisation, a number of 'on the spot', 'at the scene' and similar in-depth accident investigations were conducted in various countries in the 1970s, (e.g. Clayton, 1971, 1972, Rodley, 1972, Sabey and Staughton, 1975, Treat, 1977, Treat *et al*., 1979, Wiseman, 1972,).

A common factor in all these investigations was the use of a human factors/ ergonomics approach to the understanding of failures in human-technological systems, whereby the independent and combined contributions to accident causation by the human operator, the vehicle and the road/traffic environment were examined in detail by a multi-disciplinary team of researchers (see OECD, 1988, for a conceptual account of this approach and Chenisbest *et al*., 1988, for an attempt to 'harmonise' the methodology). This approach identified inappropriate road user behaviour as the major contributor to accident causation. For example, a study carried out in the UK (see Sabey and Staughton, 1975) showed that human factors contributed to nearly 95% of the 2130 accidents investigated and that the road user was the sole contributor in 65% of these accidents. By contrast, road environment factors were judged to be contributory in only 28% of accidents, whereas vehicle factors played a part in less than 9%. A comparable study carried out in the USA (see Treat *et al*., 1979) reported that human factors contributed to over 92% of the 420 accidents examined by a multi-disciplinary team, whereas environmental factors 'probably' contributed to less than 34% and vehicular factors to less than 13%. A similar investigation was conducted later in Finland (see Karttunen and Hakkinen, 1986) where the causal factors in accidents were categorised as either 'direct' (immediate) or 'indirect' (background). This study revealed that, over both categories of causal factors, human factors accounted for 59–96% of accidents, environmental factors for 18–32% and vehicular factors for 3–9%. Given the differences in road infrastructure, vehicle design and climate among these countries, the remarkable similarity between their findings suggests that accidents result largely from the way in which the driving task is performed and, to an important extent, from the way in which drivers interact with their environment, rather than from any technological malfunctioning of system hardware.

Of specific importance for the present Review is the reporting by Treat *et al*. (1979) that ‘the major human direct causes were **improper lookout**, excessive speed, **inattention**, improper evasive action, and **internal distraction**’ (my emphases). The impression given by these findings is of accident-involved drivers having inappropriately scanned the road and traffic environment, perhaps because of their excessive speed, and failing to see the vehicle with which they collided until much too late. This scenario receives some support from Karttunen and Hakkinen’s (1986) investigation, where 6–15% of the accident-involved drivers and 40% of the motorcyclists were found to be speeding, with the reported result that ‘some 50% of the drivers had two seconds or less from noticing the other party to the moment of accident’. A similar exploration of the contribution of visual performance to accidents by Phillips *et al*. (1990) found that drivers ‘often report that they did not see what they hit, or that they saw it too late to do anything’. By contrast, a more recent analysis of police reports of accidents in an Australian metropolitan area (see Cairney and Catchpole, 1996) showed that, although at least one driver failed to see the other in between 69 and 80% of the vehicle-vehicle collisions studied, the authors report, ‘There was little attempt to attribute faulty behaviour such as speeding or failing to signal to the other driver. In many cases, the driver looked in the appropriate direction but failed to see the other vehicle’ (1996: p. 92). However, these authors go on to say that, ‘It is important to recognise that only rarely is there evidence of excess speed available in the [police] files’ and that ‘It should not be interpreted as showing that speed makes little contribution’ (1996: p. 92) (to LBFTS incidents). Indeed, common sense suggests that speeding is highly likely to provoke LBFTS accidents because it not only reduces the time available for visual scanning of the road and traffic environment, it also increases the probability of losing control of the vehicle when hazards are detected late and emergency avoidance measures have to be implemented. The reasons for ‘failure to see’ the other vehicle, including excessive speed, will be explored later. Prior to that, it seems important to examine evidence on the contribution of LBFTS to accident causation relative to other errors of attention and visual perception.

Fairly recent evidence of this has been produced by Wang, Knipling and Goodman (1996) from an in-depth study of accidents reported under the Crashworthiness Data System by the US National Highway Traffic Safety Administration. From the 1995 data collection these authors list the relative contributions of ‘driver inattention’ to accident causation as follows:

- Distraction – 13.2%
- Looked but did not see – 9.7%
- Sleepy/fell asleep – 2.6%

For a more detailed picture of the relative seriousness of LBFTS as a contributory factor to attentional and perceptual failures causing accidents within England, albeit from a very localised survey conducted around 30 years ago, it is necessary to re-examine the findings reported by Sabey and Staughton (1975) from the first TRRL in-depth, on the spot study (also reported by Staughton and Storie, 1977, and by Sabey and Taylor, 1980). Table 2A of Sabey and Staughton's report listed, in rank order, the total of 3704 drivers' errors subjectively assessed as contributing to the 2130 accidents surveyed by the multi-disciplinary TRRL team. These are reproduced in Table 1, below.

Table 1: Drivers' errors contributing to accidents

Categorised driver error	No. of errors
Lack of care	905
Too fast	450
Looked but failed to see	**367**
Distraction	337
Inexperience	215
Failed to look	183
Wrong path	175
Lack of attention	152
Improper overtaking	146
Incorrect interpretation	125
Lack of judgement	116
Misjudged speed and distance	109
Following too close	75
Difficult manoeuvre	70
Irresponsible or reckless	61
Wrong decision or action	50
Lack of education or roadcraft	48
Faulty signalling	47
Lack of skill	33
Frustration	15
Bad habit	12
Wrong position for manoeuvre	7
Aggressive	6
Total	3704

[Extracted from Sabey & Staughton (1975), Table 2A]

If one accepts this categorisation of drivers' errors, it is clear that LBFTS was an important contributory factor to causation of the accidents surveyed by these authors, ranking third in order of importance among errors committed by these drivers and contributing to 9.9% of such errors.

LBFTS was not just a driver's problem, as Table 2B in Sabey and Staughton's report illustrated and which is reproduced next. LBFTS was categorised as contributing to 8.3% of the 276 accidents in which pedestrians were considered at fault, roughly comparable with the proportion attributed to drivers. This tends to cast doubt on the explanation that LBFTS results largely from the adverse effects on attentional sampling of excessive speed among drivers, as does the finding by Rasanen and Summala (1998) that in 37% of collisions between drivers and cyclists 'neither driver **nor cyclist —** [my emphasis] — realised the danger or had time to yield' (1998: p. 657). What appears to be of crucial importance is **speed of visual sampling** of environmental hazards, rather than actual vehicle speed, although the former will clearly be constrained by the latter in many instances.

Table 2: Pedestrian errors contributing to accidents

Pedestrian errors	No. of errors
Lack of care	116
Failed to look	68
In dangerous position	38
Looked but failed to see	**23**
Distracted	20
Misjudged speed and distance	10
Wrong decision	1
Total	276

[Extracted from Sabey & Staughton (1975), Table 2B]

In an attempt to explore in greater detail the attentional and perceptual errors among drivers that were recorded in Sabey and Staughton's 1975 report, with a view to considering ways of reducing them via engineering counter-measures, a joint working party was set up in 1983 by the Transport Committee of the Medical Commission on Accident Prevention (MCAP) and the Transportation Board of the Institution of Highways and Transportation (IHT). Its findings of relevance to the present Review were reported publicly by Brown (1984) and also as an unpublished internal MCAP/IHT report by Brown *et al*. (1985). In order to concentrate on perceptual problems among the drivers' errors reported by Sabey and Staughton (1975), rather than on sensory difficulties or errors of judgement, Brown (1984) re-analysed their data from daylight accidents only and excluded accidents involving drivers impaired by alcohol, drugs, fatigue, illness or stress. His findings are shown in Table 3.

It is clear from this re-analysis that drivers' perceptual errors contributed to roughly as many accidents as were associated with non-perceptual human factors, 49% vs. 51%, respectively. It is also of relevance that perceptual errors were found to be relatively **less** common during darkness than during daylight, where the proportions were 39% vs. 61%, respectively. However, the major finding from this re-analysis of TRRL's 1975 in-depth, on the spot accident survey is that LBFTS was the most important perceptual factor contributing to unimpaired drivers' accidents during daylight. It is also of interest that LBFTS, which may be construed as 'hazard *detection*', was found to contribute to almost **twice** as many drivers' errors as 'faulty interpretation' and 'misjudged speed and distance' combined, both of which may be construed as 'hazard *perception*' (22.8% vs. 12.2%)

Table 3: Percentage contributions of perceptual and non-perceptual human factors to errors committed by unimpaired drivers during daylight

Perceptual factor	% contribution to drivers' accidents
Looked but failed to see	22.8
Distraction	15.4
Lack of attention or alertness	8.1
Faulty interpretation	6.6
Misjudged speed or distance	5.6
Any perceptual factor	49.0*
Any non-perceptual factor	51.0**

[Extracted from Brown's 1984 re-analysis of drivers' errors reported by Sabey & Staughton, 1975]

* This is not simply the sum of contributions by the individual listed factors because some accidents were associated with more than one perceptual factor.

** This is the percentage contribution by all factors listed in Table 1 other than the five factors identified here as 'Perceptual'.

To summarise this published evidence, it is clear that LBFTS has been identified as a consistent contributor to drivers' accident causation in a number of investigations conducted in different countries during the past 30 years or so. The reported extent of this contribution is less consistent, ranging from around 10% (see Wang *et al*., 1996) to over 60% (see Cairney and Catchpole, 1996), although this variation is almost certainly a function of the types of accident examined by the different investigators and the different traffic environments in which those accidents occurred.

In terms of its relative importance, LBFTS has been found to be the major attentional/perceptual contributory factor in accidents incurred by unimpaired drivers during daylight. It appears almost twice as important as 'hazard perception', which has received considerable interest and research support during recent years because of its empirical association with accident involvement, especially among new drivers (see, for example, McKenna and Horswill, 1997). It also appears to contribute to around 45% as many accidents as are attributed to all 'non-perceptual' human errors in drivers' accidents (see Brown, 1984, after Sabey and Staughton, 1975). If LBFTS is a genuine contributor to accident causation, rather than a typical 'excuse' by involved drivers for their inappropriate behaviour, or the 'default option' in investigating police officers' accident reports, then it must obviously be considered an important problem for accident reduction and prevention in both absolute and relative terms.

The crucial question here is whether LBFTS is, in fact, a genuine contributor to accident causation and it must be accepted that this question can never be answered *conclusively* using evidence which rests entirely on subjective reporting by involved individuals, such as drivers or police officers, or by researchers making *post hoc* attributions of accident causation. This is particularly true where the evidence on LBFTS as a contributory factor comes from earlier studies which categorise it simply as a 'Driver Error' (see Sabey and Staughton, 1975). Clearly this is an incomplete description of the phenomenon, which actually represents a failure of attention and/or perception at the interface between the driver and the road and traffic environment. In other words, LBFTS errors will tend to occur when a driver scans inefficiently over a road and traffic environment which is specifically demanding in terms of its visual complexity, albeit that this demand may be exacerbated by inappropriate driver behaviour, such as speeding. In order to improve our understanding of such failures, studies 'linking' the principal contributory factors to assigned accident causes are a necessary step towards any valid exploration of how specific characteristics of the driver and of the road and traffic environment interact and, in combination, increase the probability of occurrence of LBFTS errors. Such studies, described in the following section, do not avoid the criticism that they rely on subjective assessments of certain interacting variables in accident causation, but they can provide considerable insight into the individual and environmental factors which tend to exacerbate LBFTS errors and thus they highlight the more important needs for controlled experimental studies of this contributory factor in accidents.

4.2 Contributory factors linked to STATS19 data

4.2.1 The 1996 TRL field trial

Although the 'contributory factors' data collected under the original STATS19 system were considered to be unreliable, local authorities continued to use this information after its collection ceased to be a national requirement in 1959. It was mainly employed in the development of local remedial measures at known accident blackspots and for road safety publicity. Recognising that the value of these 'contributory factors' would be enhanced if they were recorded in a consistent fashion and linked to the STATS19 database, in 1996 the Department for Transport commissioned the Transport Research Laboratory to develop a prototype system and test it in the field with a number of police forces. This development work has been reported by Broughton, Markey and Rowe (1997) and their findings of specific relevance to LBFTS are reported below.

The new system was tested in a three-month trial during the summer of 1996 and involved eight police forces. The approach adopted by Broughton *et al*., using preliminary findings by Broughton and Markey (1996), was as follows:

1. Ascertain the critical failure or manoeuvre which led up to an accident (what went wrong?), referred to as the 'Precipitating Factor' and record it using the appropriate code.

2. From the evidence available, identify the factors which contributed to this failure or manoeuvre (why did something go wrong?), accepting that there may be more than one such factor, and record them also using the appropriate code.

One list of 15 precipitating factors was drawn up and another list of 54 contributory factors, (see Appendix II, page 82). In view of the subjective nature of these attributions, investigators were asked to code each factor as ‘Definite’, ‘Probable’, or ‘Possible’. It was decided to allow only one precipitating factor and a maximum of four contributory factors per accident. Only one form was to be completed for each accident, identifying the principal failure or manoeuvre which led to the accident and the person responsible, and the data provided were designed to be linked with corresponding STATS19 information.

A major concern in the trial was consistency of reporting by the different police forces involved. Although some significant differences were found, such as in the reporting of alcohol involvement, the investigators concluded that: ‘Overall, the level of consistency is probably acceptable’. The validity of any general conclusion on this point may be debatable, given that certain environmental contributory factors are likely to be inherently more prevalent in some regions than others; for example ‘slippery road’, or ‘bend/winding road’. However, this criticism obviously does not apply to most of the attentional, perceptual, judgmental, or behavioural contributory factors, of which LBFTS is one, and it is the consistency of these psychological factors which is of importance in the present Review.

The relevant findings from this trial may be summarised as follows:

1. The overall incidence of recording LBFTS as a contributory factor was 7.5%; the fourth most frequently recorded factor after ‘Failure to judge other person’s path or speed’ (10.7%), ‘Behaviour-careless/thoughtless/reckless’ (8.8%), and ‘Inattention’ (8.0%). It was followed in recorded incidence by ‘Excessive speed’ (7.3%), ‘Lack of judgement of own path’ (6.3%) and ‘Failed to look’ (6.2%). Among factors recorded as ‘Definite’, the incidence of LBFTS was 7.1% – the third most frequently recorded factor, with ‘Inattention’ at 6.0%.
2. The obvious pairing of the precipitating factor ‘Failed to give way’ with LBFTS as the primary contributory factor accounted for 3.54% of all accidents recorded; the third most common pairing after ‘Loss of control of vehicle’ with ‘Excessive speed’ as the primary contributory factor (4.04%) and ‘Failed to avoid vehicle or object’ with ‘Failure to judge other’s path or speed’ as the primary contributory factor (4.50%). It is interesting and somewhat puzzling, given this apparent relative importance of LBFTS in causing ‘Failure to give way’, that it did not appear in the 12 commonest pairings alongside ‘Failed to avoid vehicle or object’, although this may have resulted from a tendency by the police to regard ‘Failure to give way’ as an obvious intermediate factor in the precipitation of a collision.

3. Where LBFTS was recorded as the primary contributory factor, this attribution was entered as 'Definite' in 9.0% of the cases where this level of confidence was recorded, as 'Probable' in 8.3% of cases where this level was recorded and as 'Possible' in 5.9% of cases where this level was recorded. These levels of confidence were exceeded only by the contributory factors 'Failure to judge other person's path or speed' and 'Behaviour-careless/thoughtless/reckless', which averaged 14.2% and 13.3% respectively. The investigators considered these findings to reflect 'an intelligent use of the system by reporting officers', although they concluded that 'improved wording of the form might lead to greater recording of confidence levels'.
4. Officers were asked to identify the most significant precipitating factor in each accident, so that responsibility for the accident could be subjectively assigned. In accidents involving pedal cyclists and motorcyclists, the police were *less* likely to find a pedal cyclist or motorcyclist responsible than a car driver. However, in pedestrian accidents they were *more* likely to find a pedestrian responsible than a driver. Male drivers were considered significantly *more* likely than female drivers to be principally responsible for car to car accidents in which they were involved, whether younger or older.
5. The incidence of recording LBFTS as a 'Definite' contributory factor in multi-vehicle, fatal or serious accidents on built-up roads was greater than that of all other contributory factors (15%), closely followed by 'Failure to judge other person's path or speed' (13%) and 'Failed to look' (13%), and by 'Behaviour-careless/thoughtless/reckless' (9%) and 'Inattention' (5%). It was also most commonly recorded (13%) for slight accidents. The incidence of recording LBFTS was lower for multi-vehicle accidents on non-built-up roads (5% for fatal and serious, 7% for slight accidents) and also for pedestrian accidents (4% for fatal and serious, 10% for slight accidents).

Broughton *et al*. (1997) compared these findings with those of earlier TRL studies and found them to be acceptably similar, given that attributions of causality were made by reporting police officers in the former and by multi-disciplinary teams of scientists in the latter. At the general level of comparison, 'Human Factors' were found to account for 69.9% of the contributory factor combinations in their field trial, compared with 65% in the 1970–74 'On the Spot' study, 76.5% in the 1978–81 'At the Scene' study and 69.6% (for fatal accidents) and 67.2% (for non-fatal accidents) in the 1995 study. At a level more relevant to the LBFTS question, the interacting 'Human/Environment' factors were found to account for 21.2% of the contributory factor combinations in the field trial, compared with 24% in the 1970–74 'On the Spot' study, 16% in the 1978–81 'At the Scene' study and 19.6% (for fatal accidents)/11.9% (for non-fatal accidents) in the 1995 study.

This field trial thus supports the view gained from earlier research that LBFTS appears to be one of the more important contributory factors in accident causation and that it can be recorded with a reasonable level of confidence by investigating police officers. Where LBFTS was recorded as a ‘Definite’ contributory factor, it appears to have made a more important contribution to multi-vehicle accidents on built-up roads than any other contributory factor, exceeding, although perhaps not significantly in some cases, the contribution of inadequacies in judgement, visual scanning, care, attention, speed-setting and driving experience, as well as impairment by alcohol. It is not surprising that, in such multi-vehicle accidents on built-up roads, the commonest precipitating factor was found to be ‘Failed to avoid vehicle or object in carriageway’, closely followed by ‘Failed to give way’. As Broughton *et al*. conclude, ‘The commonest Contributory Factors reflect failures to interact safely: ‘Looked but did not see’, ‘Failure to judge other person’s path or speed’, ‘Behaviour-careless/thoughtless/reckless’, and ‘Inattention’.’ (1997, p. 26) Given this conclusion they also point out that, although the value of the STATS19 system in improving road safety is widely recognised, it also has potential value as a contributor to the effective management of traffic policing and that this demands greater attention.

4.2.2 Adoption of the contributory factors system linked to STATS19

Following acceptance of the report by Broughton *et al.*, the linked system was adopted on a voluntary basis by a number of police forces in England and Scotland. Data from this system collected during 1999 have been provided by the Road Accident Statistics Branch at DTLR (TSR5) and the findings of particular relevance to LBFTS can be used to progress our insight into the phenomenon. However, because the data were still at a provisional stage during the preparation of this Review, the following points must be borne in mind when interpreting the results of all analyses of factors contributing to accident causation within this data base.

First, it is possible that the data are not representative of the national problem, because they were submitted by only 13 police forces (see Appendix I, page 81).

Second, not all participating forces started using the new system at the beginning of 1999, hence the data may be biased by seasonal factors, although TSR5 report that ‘significant bias has not so far been found’.

Third, the system requests the police to code one precipitating factor in each accident they investigate and at least one, with a maximum of four contributory factors, but in this early stage of the system’s implementation, such a procedure was not followed in all cases. Therefore the following analyses deal only with records which contained a precipitating factor and a correct vehicle/casualty reference number matching STATS19.

Fourth, although the police are requested to code one precipitating factor in each accident and attribute it to one vehicle or casualty, analyses of the data suggest that they may sometimes have coded contributory factors which derived from more than one participant in an accident. Hence ‘blameworthiness’ cannot be assessed reliably by multi-factorial analyses of interactions between precipitating factors and contributory factors. Furthermore, this probability could lead to confusion and ‘double-counting’ in analyses of biographical factors (e.g. age and sex) in accident causation. Hence the following analyses of contributory factors by age and sex of drivers are based on the number of vehicles and hence drivers involved, rather than the number of accidents recorded in the condition in question.

Fifth, because only 13 police forces contributed to the survey, estimates of the magnitude of the LBFTS problem in this Review will be calculated by expressing the number of accidents (or accident-involved vehicles/drivers) where LBFTS was recorded as a contributory factor as a percentage of all relevant accidents (or accident-involved vehicles/drivers) where a contributory factor was recorded for the condition in question.

Sixth, since no data on the precise traffic conditions at the time of the accident are available, there is no direct way of estimating the sensory, perceptual and cognitive demands on drivers at the moment they became involved in it, although one may speculate about such demands by reference to the complexity of the different road junctions at which accidents were incurred, or to visual problems associated with ambient illumination at different accident sites.

Seventh, *quantitative* data were not collected specifically on the driving experience of the individual at fault in reported accidents, nor were *qualitative* data collected on their familiarity with the road system on which the accident occurred; therefore the direct implication of these individual factors in causation of the accident cannot be explored. Geographical data on the accident site and data on the post codes of involved individuals are recorded on STATS19 and might be compared to provide a tenuous indication of their familiarity with the road system. However, even if these data were generally available, they would be of limited reliability.

Finally, at the time of writing this Review evidence was not yet available from multi-factorial analyses of the data. Hence it was not possible to explore the effects of certain interactions between driver characteristics and road or traffic conditions at the site of reported accidents. (Whether it will ever be possible to explore such interactions validly using this database is discussed later.)

Given these current statistical difficulties in extracting certain aspects of psychologically useful information from the 1999 database, the following results should be seen as a guide to further research on the LBFTS phenomenon rather than as an immediate and reliable indication of counter-measures against it.

In the following tables, some of the contributory factors are not categorised as shown in Appendix II; they have been re-categorised to provide a clearer distinction between the human, vehicle and environmental factors, and their various interactions, which contribute to accidents, and also to distinguish between the various behavioural, motivational, skill and other driver attributes which comprise the human factor. Many of these tables show the order of importance with which each contributory factor was recorded; that is, the number of times it was recorded as the primary factor (CF 1), the number of times it was recorded as the secondary factor (CF 2), and so on for the maximum of four factors which investigating officers were allowed to record. The totals in each table reveal the relative order of importance of each contributory factor and of the different categories to which they have been assigned here.

Tables 4–16 explore the relative importance of 'Perceptual' factors in accident causation, as compared with other human, vehicle and environmental factors, in order to provide a context within which the perceptual failure LBFTS is examined.

Table 4 shows that LBFTS was recorded as contributing to 8896 (17.35%) of the total of 51,261 'Perceptual' failures in these accidents. It contributed to 4859 (18.89%) of the 25,726 'Perceptual' failures recorded as the primary factor. It was the third most important contributory factor among these 'Perceptual' failures, both overall and where it was recorded as the primary factor in the accident. It was recorded less frequently than 'Inattention', or 'Misjudged other's path/speed', but comparably with 'Failed to look'. This rank order of importance is roughly comparable with that found in the TRL trial reported previously, although the relative importance of LBFTS is slightly lower than that found in earlier in-depth, on the spot, accident investigations (see Table 3). It should be pointed out here that it is impossible to distinguish within these findings between errors committed because the individuals involved possessed *an inadequate level* of the 'Perceptual' skill in question and errors committed because a potentially adequate level of skill was *inappropriately executed* for some motivational, emotional, or other personal reason. This issue is addressed later.

Table 4: Frequency of recording 'Perceptual' failures, in order of importance

'Perceptual' failure	Order of importance of 'Perceptual' failure				Total
	CF 1	CF 2	CF 3	CF 4	
Inattention	6668	4893	2224	682	14,467
Misjudged other's path/speed	6626	2859	943	275	10,703
LBFTS	**4859**	**2742**	**1023**	**272**	**8896**
Failed to look	4481	2771	875	221	8348
Misjudged own path/speed	1925	2801	1680	777	7183
Personal, other	1167	294	129	74	1664
All 'Perceptual' failures	25,726	16,360	6874	2301	51,261

Table 5 indicates the relative importance of 'Excess speed' and 'Close following' as contributory factors in accidents, highlighting the implications these 'Behavioural' factors have in reducing the time available to perceive and respond to traffic hazards.

However, it remains to be seen whether these factors are significantly associated with LBFTS errors.

Table 5: Frequency of recording 'Behavioural' factors, in order of importance

'Behavioural' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Excess speed	2168	2161	1012	319	5660
Close following	1369	1899	630	203	4101
Ignored lights	177	121	44	9	351
All 'Behavioural' factors	3714	4181	1686	531	10,112

Table 6 illustrates the relative importance attributed to carelessness, thoughtlessness and recklessness in motivating drivers to behave in ways which increase the probability of their accident involvement, although again the implication of these 'Motivational' contributory factors in LBFTS accidents remains to be established.

Table 6: Frequency of recording 'Motivational' factors, in order of importance

'Motivational' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Careless/thoughtless/reckless	6536	3361	1371	217	11,485
In a hurry	1212	1056	470	258	2996
Aggressive	342	483	444	270	1539
Competitive	121	178	130	43	472
All 'Motivational' factors	8211	5078	2415	788	16,492

Table 7 reflects the relative importance of the involved individuals' state of mind, as recorded at the accident scene, with 'Panic' being the predominant contributory factor. However, there must remain some uncertainty as to the bases for the attribution of all these 'Emotional' factors (that is, did these attributions originate from the person at fault, or from the investigating officer) and whether these states of mind were *causally* implicated or simply the *effect* of accident involvement.

Table 7: Frequency of recording 'Emotional' Factors, in order of importance					
'Emotional' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Panic	664	372	155	72	1263
Nervous/uncertain	411	255	123	70	859
Stress	424	229	120	67	840
All 'Emotional' factors	1499	856	398	209	2962

Table 8, unsurprisingly, illustrates the relative importance of 'Driving Experience' as a contributory factor, as compared with inexperience with the vehicle in question. It seems noteworthy that neither 'Inexperience' factor figured largely as the primary factor, but was more frequently recorded as subsidiary to some other factor, as yet undetermined. Multi-factorial analyses of the associations between these 'Inexperience' factors and the 'Perceptual' factors listed in Table 4 should provide a greater understanding of the nature and extent to which 'Inexperience' underlies LBFTS errors in accident causation.

Table 8: Frequency of recording 'Inexperience', in order of importance					
'Inexperience' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Inexperience of driving	550	1008	580	213	2351
Inexperience with vehicle	110	257	177	87	631
All 'Inexperience' factors	660	1265	757	300	2982

Table 9 highlights the relative importance of 'Alcohol intoxication' as a contributory factor in accidents and the association of this factor with LBFTS in accidents will be examined later.

Table 9: Frequency of recording 'Impairment/Disability' factors, in order of importance					
'Impairment/Disability' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Alcohol	2610	210	97	37	2954
Illness	503	94	26	13	636
Fatigue	420	109	57	34	620
Drugs	175	105	19	20	319
Disability	70	59	26	11	166
All 'Impairment/Disability' factors	3778	577	225	115	4695

Tables 4–9 have thus revealed the extent to which 'Human' factors were recorded as contributing to accidents.

Tables 10–12 reveal the extent to which factors associated with the vehicle and the road environment were seen to contribute to accidents.

Table 10 supports earlier studies in showing that the contribution of 'Vehicle' factors to accidents was very much less than that of 'Human' factors. None of these tabulated factors seems likely to have implications for the production of LBFTS errors, unless certain defects were known to the driver and represented a source of distraction from the driving task. 'Distraction' factors are considered later.

Table 10: Frequency of recording 'Vehicle' factors, in order of importance

'Vehicle' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Defective brakes	157	80	57	22	316
Puncture	169	33	14	9	225
Worn tread	23	53	51	22	149
Defective lights	35	44	26	6	111
Tyre pressure	22	15	20	11	68
Other	321	83	51	20	475
All 'Vehicle' factors	727	308	219	90	1344

Table 11 again supports earlier studies in showing that 'Environmental' factors at an accident site were recorded as having made a greater contribution to causation than 'Vehicle' factors, but considerably less of a contribution than 'Human' factors. They also figured more as subsidiary contributory factors than as the primary factor.

Table 11: Frequency of recording site-specific 'Environmental' factors in order of importance

'Environmental' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Bend/winding road	201	627	597	295	1720
Narrow road	112	201	168	94	575
Poor road surface	165	138	77	38	418
Poor street lighting	58	157	121	60	396
Steep hill	32	111	88	41	272
Roadworks	52	75	78	44	249
Inadequate signing	51	77	55	33	216
All site-specific 'Environmental' factors	671	1386	1184	605	3846

Table 12 shows that road and traffic features ‘Surrounding’ the accident site were seen to contribute to causation to a similar extent as ‘Site-specific’ factors and, again, they figured more as subsidiary contributors than as the primary factor. The relative importance of stationary vehicles as contributory factors in accidents is evident, and some indication of the part they may play in obscuring approaching vehicles from view, or distracting the attention of drivers involved in these accidents, is provided in Tables 13 and 14 which follow.

Table 12: Frequency of recording ‘Surrounding’ environmental factors in order of importance

‘Surroundings’ factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Stationary vehicle	299	593	461	266	1619
Bend/winding road	106	278	311	275	970
Buildings/vegetation	98	155	139	98	490
Moving vehicle	58	112	113	90	373
Local, other	246	205	166	84	701
All ‘Surroundings’ factors	807	1343	1190	813	4153

Table 13 demonstrates the obvious importance of ‘Obscuration’ factors in accident causation, both in terms of the relative frequency with which they were recorded and the fact that they figured largely as the primary factor in these data. Within this category of contributory factors, the relative frequency of recording ‘Parked vehicle’ hints at its probable importance in certain types of accidents recorded as ‘Failed to see’ but, in contrast to the other factors in this table, it will not be relevant to LBFTS accidents as they have been defined in the objectives of this Review.

Table 13: Frequency of recording ‘Obscuration’ factors, in order of importance

‘Obscuration’ factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Parked vehicle	1518	420	198	54	2190
Sun glare	387	333	213	112	1045
Blind spot	155	317	290	218	980
Low contrast pedestrian	140	221	127	64	552
Windows obscured	37	49	39	15	140
Headlight glare	37	39	37	23	136
All ‘Obscuration’ factors	2274	1379	904	486	5043

Table 14 shows that 'Distraction' was a relatively unimportant factor in accidents (although more important than 'Vehicle' factors) but, when it was recorded, it tended to be the primary contributory factor. In principle, 'Distraction' will be associated with 'Failed to look' accidents, although it could be indirectly related to LBFTS accidents if the period of distraction left drivers with insufficient time to scan the traffic environment adequately for potential hazards.

Table 14: Frequency of recording 'Distraction' factors, in order of importance

'Distraction' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Outside vehicle	641	157	44	19	861
In/on vehicle	478	150	80	45	753
Out-of-control animal	253	85	44	28	410
Earlier accident	12	24	37	15	88
All 'Distraction' factors	1384	416	205	107	2112

Table 15: Frequency of recording 'Weather' factors, in order of importance

'Weather' factor	Order of importance				Total
	CF 1	CF 2	CF 3	CF 4	
Slippery road	1375	1197	1054	480	4106
Mist, sleet, etc.	164	367	343	225	1099
High winds	51	44	44	16	155
All 'Weather' factors	1590	1608	1441	721	5360

Table 15 illustrates the relative importance of 'Weather' factors in accident causation, although their main contributions ('Slippery road' and 'High winds') appear associated with loss of vehicle control, rather than with any visual obscuration (e.g. by 'Mist, sleet, etc.') that may have implications for LBFTS.

All of the findings shown in Tables 4–15 have been collated in Table 16 and listed in order of the total frequency with which each category was recorded as a contributory factor, in order to compare their relative importance.

Table 16: Overall frequency of recording categories of contributory factor, in order of importance					
Category of contributory factor	**Order of importance of category**				**Total**
	CF 1	**CF 2**	**CF 3**	**CF 4**	
Perceptual failure	25,726	16,360	6874	2301	51,261
Motivation	8211	5078	2415	788	16,492
Behaviour	3714	4181	1686	531	10,112
Weather	1590	1608	1441	721	5360
Obscuration	2274	1379	904	486	5043
Impairment/Disability	3778	577	225	115	4695
Surroundings	807	1343	1190	813	4153
Environment	671	1386	1184	605	3846
Inexperience	660	1265	757	300	2982
Emotion	1499	856	398	209	2962
Distraction	1384	416	205	107	2112
Vehicle	727	308	219	90	1344
All categories of contributory factor	51,041	34,757	17,498	7066	110,362

As Table 16 shows, the 51,261 ‘Perceptual’ failures accounted for around 46% of the total of 110,362 contributory factors recorded. They were recorded far more frequently as primary or subsidiary factors than any of the other factors in accident causation: more than three times as often in total as the next most frequently recorded category, here termed ‘Motivational’ factors. Given the relatively infrequent recording of ‘Inexperience’, either with driving or with the vehicle, it could be speculated that this dominant category reflects inappropriately or inadequately executed ‘Perceptual’ skills rather than a lack of such skills. As was shown in Table 4, LBFTS accounted for over one-sixth of all the ‘Perceptual’ failures recorded, both as the primary factor and overall. In order to examine this contribution of LBFTS in more detail, Tables 17–19 show the frequency with which it was associated with failures categorised as ‘Precipitating Factors’ in these accidents.

Table 17 shows that where LBFTS was recorded as the primary factor it accounted for 56% of all occasions on which it precipitated a driver’s ‘Behavioural’ failure (largely ‘Failure to give way’ or to avoid something). Table 18 shows that where LBFTS was recorded as the primary factor it also accounted for 43% of all occasions on which it precipitated a pedestrian’s ‘Behavioural’ failure (overwhelmingly and unsurprisingly ‘Entered carriageway carelessly’). Comparison between the findings in Tables 17 and 18 shows that, in driver/pedestrian collisions, the pedestrian was seen to be at fault more frequently than the driver; a fact noted by Broughton *et al*. (1997).

Table 17: Frequency of recording LBFTS as contributing to drivers' or riders' 'Behavioural' failures which precipitated the accident, in order of importance

Drivers' or riders' 'Behavioural' failure	Order of importance of LBFTS factor				Total
	CF 1	CF 2	CF 3	CF 4	
Failed to give way	1969	907	298	68	3242
Failed to avoid vehicle/object in carriageway	1030	653	272	68	2023
Failed to avoid blameless pedestrian	282	124	30	14	450
Failed to stop	105	95	34	10	244
Loss of vehicle control	47	55	21	8	131
Failed to signal clearly	32	22	9	4	67
All drivers'/riders' 'Behavioural' failures	3465	1856	664	172	6157

Table 18: Frequency of recording LBFTS as contributing to pedestrian failures which precipitated the accident, in order of importance

Pedestrian 'Behavioural' failure	Order of importance of LBFTS factor				Total
	CF 1	CF 2	CF 3	CF 4	
Entered carriageway carelessly	315	257	120	36	728
In or near PSV	6	4	2	0	12
All pedestrian 'Behavioural' failures	321	261	122	36	740

Table 19 shows that where LBFTS was recorded as the primary factor it accounted for 53% of all occasions in which it precipitated a driver's 'Manoeuvring' error, although it seems highly probable that 'Sudden braking' and 'Swerved to avoid object' were actually indications of emergency reactions consequent upon 'Late detection of a hazard', rather than indications of a complete 'Failure to see'.

The findings in Tables 17–19 are collated in Table 20 to illustrate the overall frequency with which LBFTS was recorded as precipitating the different categories of error committed by drivers or riders.

Table 19: Frequency of recording LBFTS as contributing to 'Manoeuvring' errors which precipitated the accident, in order of importance					
'Manoeuvring' errors	**Order of importance of LBFTS factor**				**Total**
	CF 1	**CF 2**	**CF 3**	**CF 4**	
Poor turn/manoeuvre	738	401	136	35	1310
Poor overtaking	98	92	47	17	254
Sudden braking	35	36	22	4	97
Opened door carelessly	48	15	7	1	71
Swerved to avoid object	11	12	3	0	26
Drove wrong way	9	4	4	0	17
All 'Manoeuvring' errors	939	560	219	57	1775

Table 20: Frequency of recording LBFTS as contributing to the different categories of error which precipitated the accident, in order of importance					
Category of precipitating factor	**Order of importance of LBFTS factor**				**Total**
	CF 1	**CF 2**	**CF 3**	**CF 4**	
Driver/rider failures	3465	1856	664	172	6157
Manoeuvring errors	939	560	219	57	1775
Pedestrian failures	321	261	122	36	740
Other	134	65	18	7	224
All precipitating factors	4859	2742	1023	272	8896

Table 20 shows that LBFTS was recorded as a contributory factor 3.5 times more often when it precipitated drivers'/riders' 'Behavioural' failures than when it precipitated their 'Manoeuvring' errors. Clearly, LBFTS was a major contributor to 'Behavioural' failures by drivers, riders and pedestrians, appearing as the primary factor on over 45% of all occasions on which it precipitated such failures.

Tables 21–23 examine the implication of drivers in LBFTS accidents as a function of age and accident severity. As mentioned earlier, because contributory factors may have been assigned to different drivers in the same accident, it is necessary to use as a baseline the percentage of all vehicles, and thus all drivers, in the data base which had a contributory factor assigned to them. This is shown in Table 21.

Table 21 shows that, on average, just under 23% of drivers had a contributory factor assigned to them. 'Fatal and serious' accidents were just as likely as 'Slight' accidents to have a contributory factor recorded. This is perhaps surprising, given the greater difficulties faced by an investigation officer in the former two categories and the fact that there are fewer victims to provide evidence in fatal accidents. The table also shows that, across all categories of accident severity, the recording of contributory factors varied little with driver age, although it was slightly higher for under-age drivers.

Table 21: Percentage of all cars and taxis (excluding minibuses) which had a contributory factor assigned to them, by age of driver and accident severity

Age group	Accident severity			
	Fatal	Serious	Slight	All categories
0–16	0	30.00	27.81	27.88
17–21	22.77	24.19	23.83	23.86
22–25	25.20	22.49	23.04	23.00
26–29	23.56	22.48	22.91	22.87
30–64	21.47	22.00	22.33	22.28
65+	21.43	23.97	23.75	23.73
Age missing	19.88	21.42	21.36	21.36
All ages	22.12	22.50	22.63	22.61

Table 22 shows the percentage of all drivers with a contributory factor assigned to them which were recorded as LBFTS.

Table 22: Percentage of all cars and taxis (excluding minibuses) with a contributory factor which was recorded as LBFTS, by age of driver and accident severity

Age group	Accident severity			
	Fatal	Serious	Slight	All categories
0–16	0	16.67	1.83	4.51
17–21	8.70	13.84	15.76	15.42
22–25	12.90	16.39	16.39	16.31
26–29	8.97	15.53	16.92	16.68
30–64	12.24	17.91	18.57	18.43
65+	18.39	24.68	25.25	25.03
Age missing	9.09	10.06	11.59	11.43
All ages	12.03	16.91	17.58	17.44

Table 22 reveals that LBFTS was recorded for over 17% of all drivers who were assigned a contributory factor. The table also demonstrates that across all categories of severity the frequency of recording LBFTS as a contributory factor increased monotonically with driver age. Drivers over 65 were recorded as LBFTS 62% more often than those in the 17–21 age group. This difference was most pronounced for fatal accidents. Whether this relationship was mediated by age-related decrements in performance at the sensory, perceptual or cognitive level remains to be determined. The table also shows that, across the age groups, LBFTS was recorded over 40%

more frequently in 'Serious' and 'Slight' accidents than in 'Fatal' accidents. This is unsurprising, given the difficulty in obtaining evidence on drivers' pre-collision visual attention when the victim in question does not survive.

It may be noted, by reference to Table 21, that the lower frequency of recording LBFTS in fatal accidents was not simply a function of reduced recording of contributory factors in this category of severity.

Table 23 examines the order of importance with which LBFTS was recorded by driver age across all categories of accident severity. It shows that the positive correlation between drivers' age and frequency of recording LBFTS as a contributory factor in their accidents is largely accounted for by those accidents where LBFTS was recorded as the primary factor (CF 1). This further emphasises the importance of driver age in relation to their tendency to be assigned LBFTS errors.

Table 23: Percentage of all cars and taxis (except minibuses) with a contributory factor which was recorded as LBFTS, by age group and by order of importance of LBFTS

Age group	Order of importance of LBFTS factor			
	CF 1	CF 2	CF 3	CF 4
0–16	3.01	0.75	0	0.75
17–21	7.64	5.02	2.10	0.66
22–25	8.84	5.07	2.03	0.41
26–29	8.83	5.33	2.12	0.40
30–64	8.98	5.77	2.17	0.58
65+	12.92	8.10	3.27	0.74
Age missing	4.80	4.22	1.78	0.63
All ages	9.14	5.56	2.17	0.57

Tables 24–26 examine the implication of drivers in LBFTS accidents as a function of sex group and accident severity. Again, it is necessary to use as a baseline the percentage of all vehicles and thus drivers in the database who had a contributory factor assigned to them. This is shown in Table 24, which reveals that the recording of contributory factors was similar for both male and female accident-involved drivers, both overall and also within the different categories of accident severity.

Table 24: Percentage of all cars and taxis (excluding minibuses) which had a contributory factor assigned to them, by sex of driver and accident severity

Driver sex	Accident severity			
	Fatal	Serious	Slight	All categories
Male	22.63	22.30	22.34	22.34
Female	21.16	23.03	23.46	23.40
Not traced	16.18	22.13	20.70	20.84
All drivers	22.12	22.50	22.63	22.61

Table 25 examines the implication of male and female drivers in LBFTS accidents, by accident severity.

Table 25: Percentage of all cars and taxis (excluding minibuses) which had a contributory factor assigned to them in which LBFTS was recorded, by driver sex and accident severity

Driver sex	Accident severity			
	Fatal	Serious	Slight	All categories
Male	10.43	15.74	17.04	16.79
Female	17.71	20.52	19.59	19.67
Not traced	10.52	10.60	9.76	9.87
All drivers	12.03	16.91	17.58	17.44

Table 25 shows that, overall, LBFTS was recorded 17% more frequently in accidents incurred by female drivers than by male drivers. Again, the locus of this apparent sex difference in commission of LBFTS errors (attitudinal, motivational, experiential, etc.) remains to be determined. It is noteworthy that the overall lesser tendency for LBFTS to be recorded in 'Fatal' accidents than in 'Serious' or 'Slight' accidents is largely accounted for by the 41% lower recording of male drivers in this category of severity. One possible interpretation of these findings is that male and female drivers commit LBFTS errors under different road and traffic conditions, resulting in higher impact speeds for females' accidents from those in which male drivers LBFTS. Another is that male drivers are more frequently the victim in fatal accidents provoked by their LBFTS error, which obviously can never be established conclusively.

Table 26 examines the order of importance with which LBFTS was recorded by driver sex, across the different categories of accident severity.

Table 26: Percentage of all cars and taxis (excluding minibuses) with a contributory factor which was recorded as LBFTS, by driver sex and by order of importance of LBFTS as a contributory factor				
Sex of driver	**Order of importance of LBFTS factor**			
	CF 1	**CF 2**	**CF 3**	**CF 4**
Male	8.79	5.38	2.04	0.57
Female	10.47	6.16	2.48	0.57
Not traced	4.03	3.61	1.69	0.54
Both sexes	9.14	5.57	2.17	0.57

Table 26 shows that the greater frequency with which LBFTS was recorded as contributing to accidents incurred by female drivers is similar across contributory factors 1, 2 and 3, averaging around 17%. This suggests that the sex difference may be of some relevance in the frequency of recording LBFTS errors, even when other contributory factors are of primary importance in accident causation.

Eighty-one percent of accidents where LBFTS was recorded as a contributory factor were found to occur at road junctions. However, 61.21% of all accidents in this database were recorded at junctions. In order to examine the relationship between junction type and LBFTS errors in greater detail, Table 27 first shows the percentages of all types of junction accident where a contributory factor was recorded.

Table 27: Percentages of all junction accidents which had a contributory factor assigned to them	
Junction type	**Accidents assigned a contributory factor (%)**
Private drive/entrance	26.98
Mini-roundabout	28.98
Multiple junction	17.96
Crossroads	21.39
T, Y, or staggered junction	21.84
Other junction	22.36
Roundabout	24.39
Slip road	19.20
All junctions	22.40
Not at a junction or within 20 metres	21.13

Table 27 demonstrates that accidents were more frequently assigned a contributory factor when they occurred at private drives/entrances, mini-roundabouts and larger roundabouts. It may be speculated that, at these types of junction where priority rules are clear, it is easier to assign a contributory factor than at more complex junctions.

Table 28 examines the percentages of accidents at junctions and away from junctions which were assigned a contributory factor where LBFTS was recorded.

Table 28 shows that in almost 21% of all these junction accidents LBFTS was recorded as a contributory factor, mainly the primary factor. It was recorded as a contributory factor in only 8.14% of all accidents which did not occur at a junction. Thus, overall and unsurprisingly, LBFTS errors were recorded 2.5 times more often in accidents at junctions than away from a junction.

Table 28: Percentages of accidents with a contributory factor where LBFTS was recorded, by junction type and order of importance

Junction type	Order of importance of LBFTS factor				Total
	CF 1	CF 2	CF 3	CF 4	
Private drive/entrance	14.98	7.22	2.34	0.67	25.21
Mini-roundabout	14.29	7.41	2.53	0.54	24.77
Multiple junction	10.60	8.21	3.13	0.75	22.69
Crossroads	12.44	6.14	1.82	0.45	20.86
T, Y, or staggered junction	11.89	5.97	2.37	0.50	20.73
Other junction	10.08	5.71	2.48	0.45	18.72
Roundabout	10.11	5.45	2.07	0.47	18.10
Slip road	4.99	5.30	1.56	0.31	12.17
All junctions	11.82	6.09	2.24	0.50	20.65
Not at a junction or within 20 metres	3.85	2.83	1.05	0.40	8.14

The highest frequency of recording LBFTS errors was at private drives or entrances. All these LBFTS errors may, of course, have been attributed appropriately both to drivers emerging from these junctions and to those on the main road. However, this finding raises the possibility that drivers in the main traffic stream may often not be actively scanning for such emerging vehicles because they are off-road and therefore that a proportion of the accidents which are incurred at these sites result from drivers having 'failed to look', rather than having LBFTS. It is somewhat puzzling that LBFTS accidents occurred next most frequently at mini-roundabouts, given that these are relatively safe junctions (accounting for only 1.33% of all the junction accidents recorded in this study and only 1.72% of all junction accidents in which a contributory factor was recorded). In addition, they are usually open sites occupying a relatively small area of the visual field compared with, say, larger roundabouts (where the frequency of recording LBFTS was actually 27% *lower*), or other types of junction. Mini-roundabouts should therefore not require drivers to engage in wide-ranging visual scanning, during which hazards may be overlooked, nor would they be expected to be sites where approaching vehicles are obscured for long periods of time by physical features of the driver's vehicle or of the traffic environment. This finding must therefore raise the possibility that many accidents at mini-roundabouts where LBFTS was recorded as a contributory factor may actually have resulted from drivers having 'failed to look', or aggressively or recklessly assumed right of way, or misperceived the hazardous potential of vehicles approaching from their right.

It was found that 78% of all LBFTS accidents occurred during daylight. However, accidents are more frequent during the day, therefore Tables 29 and 30 take this into account. Table 29 shows the percentage of all accidents in which a contributory factor was recorded, by ambient lighting conditions.

It demonstrates that contributory factors were recorded fairly comparably in daylight and darkness, apart from the tendency to under-record them when street lights were not lit at night.

Table 29: Percentage of all accidents in which a contributory factor was recorded, by lighting conditions

Lighting conditions	Accidents with a contributory factor (%)
Daylight:	
Lights present	23.20
No lighting	19.57
Lighting unknown	21.06
All daylight	22.22
Darkness:	
Lights lit	21.03
Lights unlit	7.14
No lighting	23.97
Lighting unknown	16.83
All darkness	21.04

Table 30 shows the percentage of all accidents with a contributory factor in which LBFTS was recorded, for each of the lighting conditions.

It demonstrates that LBFTS errors were recorded almost 23% *more* frequently in daylight accidents than in darkness, which could indicate that the phenomenon is not essentially of sensory origin, but it is more likely to reflect the greater perceptual difficulty of driving in higher density daytime traffic, as suggested by the fact that LBFTS was recorded some 10% more frequently in daylight when lights were present, that is in built-up areas, than when they were not. Street lighting at night was associated with almost a tripling in the frequency of recording LBFTS errors, as compared with unlit streets, which may reflect the greater conspicuity of vehicles' headlights in complete darkness.

Table 30: Percentage of all accidents with a contributory factor where LBFTS was recorded, by lighting condition and by order of importance of LBFTS as a contributory factor

Lighting condition	Order of importance of LBFTS factor				Total
	CF 1	CF 2	CF 3	CF 4	
Daylight:					
Lights present	9.79	5.08	1.78	0.40	17.06
No lighting	7.47	5.32	2.05	0.66	15.50
Lighting unknown	8.80	5.50	2.49	0.77	17.56
All daylight	9.25	5.15	1.88	0.48	16.77
Darkness:					
Lights lit	8.58	4.37	1.69	0.40	15.05
Lights unlit	6.82	3.79	0.76	0	11.36
No lighting	4.38	3.04	1.16	0.58	9.17
Lighting unknown	7.92	3.55	1.37	0.27	13.11
All darkness	7.61	4.05	1.55	0.43	13.65

The main findings of relevance to LBFTS errors may be summarised as follows:

- Inappropriately or inadequately executed driver or rider 'Perceptual' skills were the predominant contributory factors recorded in accidents, accounting for 46% of all categories of contributory factor, with 'Motivation' the next most frequently recorded contributory factor, accounting for 15%, followed by 'Behaviour' which accounted for 9%.
- Within the 'Perceptual' skills category, 'Inattention' was the most frequently recorded contributory factor, accounting for 28% of all factors recorded here. This was followed by 'Misjudged other's path or speed', accounting for 21%, with LBFTS the third most frequently recorded contributory factor, accounting for 17% of the total in this category.
- Within the 'Motivation' category of contributory factors, 'Carelessness', 'Thoughtlessness' or 'Recklessness' comprised the most frequently recorded factor, accounting for 70% of all factors recorded here.
- Within the 'Behaviour' category of contributory factors, 'Excess speed' accounted for 56% of all factors recorded, with 'Close following' accounting for 41%.
- 'Emotion', 'Inexperience' and 'Impairment/Disability' categories contributed relatively infrequently to the total number of contributory factors recorded in the database, their respective contributions being 2.7%, 2.7% and 4.3%.

- ‘Vehicle’, ‘Environment’ and ‘Surroundings’ were also recorded infrequently, their respective contributions to the total number of contributory factors being 1.2%, 3.5% and 3.8%.
- ‘Obscuration’ and ‘Distraction’ accounted for only 4.6% and 1.9%, respectively, of all the contributory factors recorded.
- ‘Weather’ contributed to 4.8% of all contributory factors recorded.
- In accidents where a contributory factor was assigned, over 17% of all drivers were recorded as having LBFTS.
- When LBFTS was the primary contributory factor it was recorded on 56% of all occasions on which it was associated with drivers’ or riders’ ‘Behavioural’ failures, especially and unsurprisingly failures to give way, or to avoid a vehicle, object, or pedestrian. When it was the primary contributory factor in pedestrian accidents it was recorded on 43% of all occasions on which it was associated with ‘Behavioural’ failures, unsurprisingly, ‘Entered carriageway carelessly’.
- When LBFTS was the primary contributory factor it was recorded on 53% of all occasions on which it was associated with drivers’ ‘Manoeuvring’ errors.
- Recording of LBFTS errors increased monotonically with driver age, being 62% more frequent overall for the over-65s than for the under-21s. This difference was more pronounced in ‘Fatal’ than in ‘Serious’ or ‘Slight’ accidents and it was largely accounted for where LBFTS was recorded as the primary contributory factor.
- The overall frequency of recording LBFTS errors was 17% higher for female drivers than for males. The lesser tendency for LBFTS to be recorded in ‘Fatal’ accidents seems largely accounted for by its 41% lower assignment to male drivers in this category of severity. Whether this finding reflects a sex difference in the impact speed at which LBFTS accidents are incurred, or a greater tendency for males to be the victim of their LBFTS errors, remains unknown.
- Unsurprisingly, 2.5 times as many drivers were recorded as having LBFTS at road junctions than away from junctions. LBFTS was recorded most frequently at private drives or entrances. However, it is puzzling that drivers were recorded as having LBFTS almost as frequently at mini-roundabouts, where visual demand on drivers/riders would be expected to be lower than at more complex types of junction.
- Almost 17% of all drivers involved in daylight accidents were recorded as having LBFTS, 10% more often in built-up areas than outside them. Less than 14% of drivers involved in accidents during darkness were recorded as having LBFTS; three times more often when street lights were lit than when they were unlit.

To further explicate the findings, Tables 31–44 reveal the order of importance with which other contributory factors were recorded as subsidiary to LBFTS.

Table 31: Frequency and importance of recording ‘Perceptual’ failures where LBFTS was CF 1

‘Perceptual’ failure	Order of importance of ‘Perceptual’ failure			Total
	CF 2	CF 3	CF4	
Inattention	645	150	31	826
Misjudged others’ path/speed	334	106	32	472
Misjudged own path/speed	249	94	35	378
Failed to look	198	54	21	273
Personal, other	33	5	6	44
All ‘Perceptual’ failures	1459	409	125	1993

One puzzling finding in Table 31 is that LBFTS was sometimes recorded as the primary contributory factor in association with ‘Failed to look’. This association is illustrated in more detail in Table 32.

Table 32 shows that LBFTS was recorded as a subsidiary factor to ‘Failed to look’ in 556 accidents and that ‘Failed to look’ was recorded as a subsidiary factor to LBFTS in 273 accidents. Clearly this is possible only: (a) in multi-vehicle accidents, where a driver may ‘fail to look’ in one direction and LBFTS a vehicle approaching from another direction, or (b) in accidents where LBFTS is attributed to one driver whilst ‘failed to look’ is attributed to another involved driver. These possibilities highlight the difficulty of understanding the relative importance of LBFTS as a contributory factor in accidents, using this database.

Table 32: Frequency of recording LBFTS in association with ‘Failed to look’

Importance of ‘Failed to look’ factor	Importance of LBFTS factor				Total
	CF 1	CF 2	CF 3	CF 4	
CF 1	–	493	48	15	556
CF 2	198	–	276	36	510
CF 3	54	83	–	63	200
CF 4	21	18	14	–	53
Total	273	594	338	114	1319

A second puzzling finding in Table 31 is that LBFTS errors were frequently associated with attentional failures, or with misjudgements of speed, or of vehicle heading. Clearly such failures and misjudgements can neither be *caused by* nor *result in* a LBFTS error as defined here, since conscious ‘looking’ is incompatible with ‘inattention’ and ‘misjudgements’ cannot be made about events which one has ‘failed to see’. These findings suggest that the descriptor LBFTS may often be used to record attentional, perceptual, or cognitive errors which do not meet the criteria for LBFTS given by the objectives of this Review. This possibility is explored in Table 33.

Table 33: Frequency of recording ‘Perceptual’ failures and LBFTS as associated contributory factors in accidents

‘Perceptual’ failure (PF)	Total CFs	Total ‘PF’ when LBFTS = CF 1	Total LBFTS when ‘PF’ = CF 1	Total LBFTS associated with ‘PF’	Total as percentage of all LBFTS
Inattention	14467	826	263	1089	12.24
Misjudged others’ approach	10703	472	1090	1562	17.56
Failed to look	8348	273	556	829	9.32
Misjudged own approach	7183	378	74	452	5.08
Personal, other	1664	44	16	60	0.67
All other PFs	51261	1993	1999	3992	44.87
LBFTS	**8896**				**100.00**

Table 33 shows that on almost 45% of the occasions when LBFTS was recorded as a contributory factor it was associated with another ‘Perceptual’ failure. On over 9% of occasions this involved a ‘Failed to look’ error which, as indicated above, would be possible only under certain circumstances. Almost 23% of occasions involved a failure of judgement, either of other drivers’ path or speed, or of the driver’s own approach and over 12% of those occasions involved inattention. Again, such associations would be possible only: (a) in multi-vehicle accidents where drivers LBFTS in one direction and failed to attend to, or misjudged, vehicles approaching from another direction, or (b) where LBFTS was attributed to one driver and another ‘Perceptual’ failure to a second driver. These findings would appear to confirm the view that the criteria used by investigating police officers to record LBFTS errors are not always those adopted here and that up to almost half of all such errors may, instead, represent errors of attention, perception or judgement. The true extent of LBFTS errors could be investigated only by eliminating these latter types of error from the data analysis, although this would seriously deplete the data pool. In general, these different ways in which LBFTS may be recorded cast doubt on the validity with which the genuine nature and the importance of LBFTS as a contributory factor can be assessed using this data collection system and they indicate a possible need for closer specification of the LBFTS descriptor.

Table 34 shows that ‘excess speed’ was the main subsidiary to LBFTS errors within the category of ‘Behaviour’ factors, although not a frequent one. This association is plausible, since speeding reduces the time available for visual scanning of traffic streams at junctions. However, the data showed that it was recorded as the primary

Factor on only 34 occasions when LBFTS was recorded as subsidiary, suggesting perhaps that ‘excess speed’ may more frequently be inferred from the perceptual error than supported by evidence. ‘Close following’ is less plausibly related causally to LBFTS, although such behaviour is highly demanding of a driver’s attention, which could also reduce the time available for visual scanning of the traffic environment. In fact, the data show that it was recorded as the primary factor on only 40 occasions when LBFTS was subsidiary, again suggesting that it may sometimes simply be inferred as a contributor to perceptual errors.

Table 34: Frequency and importance of recording ‘Behaviour’ factors where LBFTS was CF 1

‘Behaviour’ factor	Order of importance of ‘Behaviour’ factor			
	CF 2	CF 3	CF 4	Total
Excess speed	68	39	20	127
Close following	56	17	2	75
Ignored lights	4	1	2	7
All ‘Behaviour’ factors	128	57	24	209

Table 35 shows that the ‘Careless/thoughtless/reckless’ factor was the main subsidiary to LBFTS within this ‘Motivation’ category. The data also revealed that it was recorded as the primary factor on 764 occasions when LBFTS was recorded as the subsidiary factor. The latter finding supports the common-sense view that carelessness, thoughtlessness and recklessness can motivate drivers/riders to scan the traffic environment unduly quickly and hence provoke a LBFTS error, although the findings in Table 35 could be interpreted as suggesting that these attitudes may sometimes simply be inferred from the prior attribution of a LBFTS error.

Table 35: Frequency and importance of recording ‘Motivation’ factors where LBFTS was CF 1

‘Motivation’ factor	Order of importance of ‘Motivation’ factor			Total
	CF 2	CF 3	CF 4	
Careless/thoughtless/reckless	163	141	25	329
In a hurry	55	25	16	96
Competitive traffic interaction	17	5	1	23
Aggression	5	8	2	15
All ‘Motivation’ factors	240	179	44	463

Table 36 shows that 'Emotion' factors were relatively infrequently subsidiary to LBFTS errors. Where they were so associated, nervousness or uncertainty figured more often than 'Stress' or 'Panic'.

Table 36: Frequency and importance of recording 'Emotion' factors where LBFTS was CF 1

'Emotion' factor	Order of importance of 'Emotion' factor			Total
	CF 2	CF 3	CF 4	
Nervous/uncertain	16	14	5	35
Stress	7	7	3	17
Panic	10	4	0	14
All 'Emotion' factors	33	25	8	66

Table 37: Frequency and importance of recording 'Inexperience' factors where LBFTS was CF 1

'Inexperience' factor	Order of importance of 'Inexperience' factor			Total
	CF 2	CF 3	CF 4	
Of driving	90	32	12	134
Of vehicle	11	10	2	23
All 'Inexperience' factors	101	42	14	157

Table 37 shows that 'Inexperience' was subsidiary to LBFTS very infrequently and, where they were so associated, it was inexperience of driving, rather than unfamiliarity with the vehicle, which made the main contribution.

Table 38 shows that 'Impairment' or 'Disability' were seldom subsidiary to LBFTS errors. 'Alcohol' was the principal associate among these factors, but its effects on behaviour are well known and some influence on the tendency to LBFTS would be expected.

Table 38: Frequency and importance of recording 'Impairment/Disabled' factors where LBFTS is CF 1

'Impairment/Disabled' factor	CF 2	CF 3	CF 4	Total
Alcohol	7	5	1	13
Fatigue	4	2	2	8
Illness	0	4	1	5
Disability	3	1	1	5
Drugs	3	0	0	3
All 'Impairment/Disabled' factors	17	12	5	34

Table 39 shows that ‘Vehicle Faults’ were seldom subsidiary to LBFTS errors. Where they were, the principal associate was, unsurprisingly, ‘Defective lights/ Indicators’.

Table 39: Frequency and importance of recording ‘Vehicle Faults’ where LBFTS was CF 1

‘Vehicle Fault’	Order of importance of ‘Vehicle Fault’			Total
	CF 2	CF 3	CF 4	
Defective lights/indicators	15	7	1	23
Other	6	7	3	16
Defective brakes	1	4	1	6
Worn tread	2	2	0	4
Tyre pressure	0	0	0	0
Puncture	0	0	0	0
All ‘Vehicle Faults’	24	20	5	49

Table 40 shows that ‘Site-specific environment’ factors were quite often subsidiary to LBFTS errors, about as often as ‘Behaviour’ factors listed in Table 30. The principal associate was ‘Bend/winding road’, which figured almost as often as ‘Excess speed’. It is plausible that a driver may be recorded as having LBFTS because an approaching vehicle has not yet come into view from around a bend, although this error is more properly categorised as a failure of hazard perception.

Table 40: Frequency and importance of recording ‘Site-specific environment’ factors where LBFTS was CF 1

‘Site-specific environment’ factor	Order of importance of ‘Site-specific environment’ factor			Total
	CF 2	CF 3	CF 4	
Bend/winding road	59	30	15	104
Poor street lighting	27	16	5	48
Inadequate signing	12	8	3	23
Steep hill	12	7	0	19
Roadworks	7	7	3	17
Narrow road	8	5	2	15
Poor road surface	9	3	2	14
All ‘Site-specific Environment’ factors	134	76	30	240

Table 41 shows that ‘Surroundings’ factors were more frequently subsidiary to LBFTS errors; over twice as frequently in fact as ‘Site-specific environment’ factors or ‘Behaviour’ factors, and with ‘Stationary/parked vehicle’ being the principal associate. It is difficult to understand any causal association there may be between these contributory factors, since non-site-specific stationary or parked vehicles are unlikely to have obscured potential hazards at the accident site. It is, however, plausible that encountering a stationary or parked vehicle may distract drivers, or interfere with their visual scanning of the traffic environment in some other way, and hence provoke a LBFTS error.

Table 41: Frequency and order of importance of recording 'Surroundings' factors where LBFTS was CF 1

'Surroundings' factor	Order of importance of 'Surroundings' factor			Total
	CF 2	CF 3	CF 4	
Stationary/parked vehicle	170	88	30	288
Bend/winding road	38	43	19	100
Buildings/fences/vegetation	42	34	19	95
Moving vehicle	46	19	8	73
Local, other	26	27	6	59
All 'Surroundings' factors	322	211	82	615

Table 42 shows that 'Blind spot' and 'Sun glare' were the main 'Obscuration' factors subsidiary to LBFTS errors. The former factor represents a reduced field of view and the latter a contrast difficulty. Both could plausibly cause a 'failure to see' a hazard approaching from the direction fixated by a driver, although in the former case the hazard would not strictly be visible within the driver's visual field and the error should more properly be termed a failure of hazard perception.

Table 42: Frequency and order of importance of recording 'Impaired view' factors where LBFTS was CF 1

'Impaired view' factor	Order of importance of 'Impaired view' factor			Total
	CF 2	CF 3	CF 4	
Blind spot	134	85	41	260
Sun glare	152	58	23	233
Poor-contrast pedestrian	82	24	8	114
Parked vehicle	38	10	0	48
Windows obscured	19	11	1	31
Headlight glare	10	4	1	15
All 'Impaired view' factors	435	192	74	260

Table 43 shows that distractions, either in or outside the vehicle, were seldom subsidiary to LBFTS errors. Their influence in reducing the time available for drivers to scan the traffic environment for potential hazards therefore appears to be minimal.

Table 43: Frequency and order of importance of recording 'Distraction' factors where LBFTS was CF 1

'Distraction' factor	Order of importance of 'Distraction' factor			Total
	CF 2	CF 3	CF 4	
Outside vehicle	15	4	0	19
In/on vehicle	9	5	2	16
Earlier accident	0	3	1	4
Out of control animal	1	0	0	1
All 'Distraction' factors	25	12	3	40

Table 44: Frequency and order of importance of recording 'Weather' factors where LBFTS was CF 1

'Weather' factor	Order of importance of 'Weather' factor			Total
	CF 2	CF 3	CF 4	
Slippery road	72	67	24	163
Mist, sleet, etc.	60	47	22	129
High winds	4	3	2	9
All 'Weather' factors	136	117	48	301

Table 44 shows that 'Weather' factors were quite often subsidiary to LBFTS errors, although 'Slippery road' could contribute only as a 'distraction' factor and 'Mist, sleet, etc.' will result in a LBFTS error only via obscuration of potential hazards

To summarise the conclusions from results shown in Tables 31–44:

- Where LBFTS errors were recorded as the primary factor in accidents their main subsidiaries were inappropriately or inadequately executed 'Perceptual' skills, especially inattention and misjudgement of speed or direction of travel, but they were also associated with 'Failed to look' errors. One explanation of this apparent incompatibility between simultaneous attributions of LBFTS and attentional or judgemental failures is that they related to different drivers involved in the same accident. Another is that they were recorded as errors made by a driver in relation to vehicles approaching from different directions. A third possibility is that investigating police officers use a different criterion for recording LBFTS errors from that established by the objectives of this Review. There is some support for this latter explanation from the finding that attentional and judgemental contributory factors were recorded on almost 45% of all the occasions where 'Perceptual' failures were associated with LBFTS. Any of these three possibilities casts doubt on the value of the current data in understanding the true nature and importance of the LBFTS phenomenon, as defined here.

- Where LBFTS was the primary contributory factor its main 'Behavioural' subsidiary was 'Excess speed', although this association was relatively infrequently recorded and speeding may sometimes have simply been inferred from the LBFTS error. Nevertheless, fast driving could obviously limit the time available for drivers to scan the road and traffic environment effectively.
- Where LBFTS was the primary factor its main 'Motivational' subsidiary was 'carelessness', 'thoughtlessness', or 'recklessness'. Again, such behaviour could impinge on the driver's visual scanning of the environment for potential hazards, although it may occasionally have simply been inferred from a prior attribution of LBFTS.
- Where LBFTS was the primary factor it was infrequently associated with 'emotion' factors as subsidiaries.
- Where LBFTS was the primary factor it was infrequently associated with 'inexperience' factors as subsidiaries.
- Where LBFTS was the primary factor it was infrequently associated with 'impairment' or 'disability' as subsidiary factors. Where they were so associated, 'alcohol intoxication' was the main subsidiary.
- Where LBFTS was the primary factor it was infrequently associated with 'vehicle factors' as subsidiaries and clearly such factors could only be so associated indirectly as possible sources of distraction.
- Where LBFTS was the primary factor its subsidiaries were 'site-specific environmental' factors about as frequently as 'behavioural' factors. The main subsidiary associations were with bends or winding roads, suggesting that they resulted from a failure to recognise the hazardous potential of the site, rather than actually looking but failing to see.
- Where LBFTS was the primary factor it was associated 2.6 times more often with the surroundings of an accident site as subsidiaries than with its site-specific features. Parked vehicles appeared particularly important, which suggests that their influence on LBFTS errors operates via distraction rather than via obscuration of a potential hazard.
- Where LBFTS was the primary factor its main subsidiary was 'hazard occurring in a blind spot' on those occasions in which the driver's view was impaired. This suggests that the association results from obscuration, rather than from failure to see a hazard which is actually in the visual field fixated by the driver.
- Where LBFTS was the primary factor it was infrequently associated with 'distraction' as a subsidiary, suggesting that this is not a dominant factor in limiting the time available for drivers to scan their environment.

- Where LBFTS was the primary factor it was more frequently associated with ‘weather factors’ as subsidiaries than with behavioural, emotional, inexperience, impairment/disability, vehicle, site-specific environmental, impaired view, or distraction factors. To some extent, ‘Weather’ may be causally related to ‘Failure to see’ (but not LBFTS) errors via obscuration of potential hazards, but it may also be a source of distraction which adversely affects drivers’ visual scanning of the traffic environment.

4.3 Assessment of the evidence

It must be accepted that, for a variety of reasons, in-depth on the spot accident investigations are likely to provide more reliable evidence on LBFTS errors than can be obtained from police reports on contributory factors linked to STATS19 data, although the latter should be more representative of the national problem. The former method involves a considered assessment of the facts by a multi-disciplinary team of experts, whereas the latter method involves assessments made by an individual police officer in the stressful aftermath of a road accident. Thus although the latter method may appear to offer more broadly based information on the possible causes of LBFTS errors it may not permit individuals’ LBFTS errors to be associated reliably with other personal factors recorded as having contributed to their accident. For example, in the present survey it seems possible that a LBFTS error and a perceptual failure could both have been recorded as contributory factors in an accident with no certainty that these were attributed to the same individual. Of course, where a LBFTS error was recorded in association with other ‘Perceptual’ failings, this error and these failings may indeed have been made by one driver in relation to vehicles approaching from different directions. However, not being able to distinguish between these alternative explanations, it is possible to conclude only that, in up to 45% of all accidents where LBFTS was recorded, this term may have been used to describe an error that is more explicable as a failure of attention, perception, or judgement. This uncertainty casts doubt on the reliability of the database used here as a way of increasing understanding of the true nature and importance of the LBFTS phenomenon, as defined for the purpose of this Review. Linking contributory factors data to STATS19 can provide valid information on the road environment and weather conditions in which they are recorded. However, a major problem with both types of data collection, as with any system which relies on subjective reporting, is that accident-involved individuals may falsely admit to a LBFTS error in preference to admitting an actual failure of driving skill. It is also possible that investigating police officers may occasionally record a LBFTS error as a default option in the absence of alternative confirmatory evidence on a faulty driver’s behaviour. With these provisos, evidence on the LBFTS problem available from earlier research and this initial database may be assessed as follows.

Within the UK, as elsewhere, in-depth, on the spot surveys have shown that errors recorded as LBFTS represent an important contributory factor in road accidents. They have been reported as constituting around 10%, the third most important, of all driver errors and over 8%, the fourth most important, of all pedestrian errors. They have been reported as contributing to almost 23% of all errors committed by unimpaired drivers in daylight accidents. They are the most important error in the ‘Perceptual’ category, where they occur almost twice as frequently as errors which may be construed as ‘hazard perception’. They have been shown to contribute to almost half as many accidents as are attributed to all ‘non-perceptual’ driver errors.

The UK system linking contributory factors data to STATS19 which was adopted in 1999 has produced data indicating that LBFTS constitutes the third most important factor within the category of ‘Perceptual’ failures that are recorded as contributing to accidents, accounting for over 17% of all these failures. However, it is possible that up to 45% of the errors recorded as LBFTS in the database analysed here were actually other types of ‘Perceptual’ failure, such as inattention, failing to look, or misjudgement of a vehicle’s approach speed. This initial database does not permit these possibilities to be examined reliably.

Where LBFTS was the primary contributory factor it was recorded in 56% of accidents precipitated by driver or rider ‘Behavioural’ failures, (mainly failure to give way, or to avoid a vehicle or object) and to 53% of accidents precipitated by drivers’ ‘Manoeuvring’ errors (mainly poor turns). However, the finding that inexperience of driving or unfamiliarity with the driven vehicle comprised less than 3% of all contributory factors recorded, and that inexperience was seldom recorded when LBFTS was the primary factor, suggests that LBFTS occurs not because drivers *lack* skill, but because they *misuse* their skills or apply them inappropriately. This view is supported by the fact that ‘Motivation’ factors (mainly carelessness, thoughtlessness or recklessness) were found to comprise 15% of all contributory factors recorded; the second most frequent contributor after ‘Perceptual’ failures.

Taken together, these findings suggest that if drivers were indeed ‘looking’ in the appropriate directions their LBFTS errors were most likely to have resulted from a failure to spend sufficient time in identifying potential hazards. In general, however, the possibility that contributory factors may have been recorded for different participants in an accident means that any attempt to use this initial database in order to relate LBFTS errors to failures of skill, behaviour, motivation, emotion, inexperience, or to impairment, at the individual level is inherently unreliable. This ambiguity in the data would need to be eliminated, if the true nature and extent of the LBFTS problem are to be fully understood.

The frequency of recording LBFTS errors was found to increase monotonically with the age of drivers, being 62% more frequent for the over-65s than for the under-21s. This positive association with age may be a function of sensory or neurological degradations in the perceptual and cognitive processes that drivers employ to assess traffic movements. However, it may also result from changes in the way that older drivers use their vehicles in response to perceived changes in their ability: for example, they may drive only on familiar roads and incur LBFTS errors as a result of bad habits, or they may drive infrequently and hence become unaware of recent changes in road and traffic demands. This age-related increase in recording of LBFTS errors would require further research if it is to be addressed by counter-measures directed at drivers' attitudes, skills and behaviour.

The frequency of recording LBFTS errors was found to be 17% higher for female drivers than for males. The fact that inexperience of driving was seldom recorded as a contributory factor in accidents suggests that differences in driving experience are unlikely to underlie the sex difference in recorded LBFTS errors and further research seems necessary to determine whether it resulted from inherent differences in spatial perception and/or cognition between males and females, or from differences in attitudes towards risk and hazard. The data show that around 36% fewer LBFTS errors were recorded for male drivers in fatal accidents than in serious or slight accidents. Among female drivers, this difference was only around 12%. The data cannot reveal whether this sex difference resulted from a difference in the speed at which male and female drivers were travelling prior to their accident, or from the greater tendency of male drivers to be the victim of their own LBFTS errors. Clearly, it is impossible for LBFTS to be recorded reliably as a contributory factor in the latter case. Further research would be needed to elucidate this point.

Unsurprisingly, LBFTS was recorded in more than 20% of all the junction accidents in this study which were assigned a contributory factor. It was recorded most frequently at private drives or entrances where, clearly, the driver exiting such a site would be expected to experience similar search problems to those of a driver at a T-junction and where drivers on the main road could make errors attributed to failures of expectancy. Hence both types of error at such junctions are explicable. Unexpectedly, LBFTS was recorded almost as frequently in accidents incurred at mini-roundabouts, where the visual, perceptual and cognitive demands on drivers would be expected to be lower than at, say, multi-arm junctions, because mini-roundabouts demand limited scanning and attention. In addition, they present virtually no obscuration problems and their priority rules are clear, but this is also true for larger roundabouts where 27% fewer LBFTS errors were recorded. This puzzling difference in findings would require further research to elucidate it.

On 45% of occasions where LBFTS was recorded, other 'Perceptual' failings were also recorded, either as primary or subsidiary contributory factors. These were mainly errors of judgement, but also of inattention and even of failure to look, raising doubts as to the validity with which LBFTS was recorded using the definition implied by the objectives of this Review. Environmental 'Surroundings' were the most frequently recorded factors subsidiary to LBFTS, occurring more often than 'Site-specific' factors. The findings suggest that this association was more likely to have been a function of 'Distraction' than of 'Obscuration'. 'Motivational' factors were the next most important subsidiary of LBFTS, suggesting that the error mainly results from carelessness, thoughtlessness, or recklessness. 'Weather' was the third most important contributory factor subsidiary to LBFTS, again suggesting that ‘Obscuration’ (by mist, sleet, etc.) may often have caused a ‘failure to see’, rather than LBFTS as defined here. ‘Behaviour’ and ‘Inexperience’ were much less often recorded as contributory factors subsidiary to ‘LBFTS’, and ‘Emotion’, ‘Vehicle’ factors and ‘Impairment/disability’ were very seldom recorded as subsidiary factors.

If these personal and environmental factors underlying LBFTS errors are to be fully understood, it seems necessary to conceptualise the various different ways in which perceptual errors might be recorded by investigating police officers, so that the contribution of genuine LBFTS errors, as defined for this Review, can be assessed, further research questions identified and practical accident counter-measures designed. These different conceptions of the LBFTS error are set out in the following section.

5 EXPLANATORY CONCEPTIONS OF THE REPORTED PROBLEM

In order to offer alternative explanations for the implication of LBFTS as a contributory factor in accidents, it is first necessary to analyse the specific driving task which produces these errors, as follows. Where there is a risk of conflict with other traffic, drivers, riders and pedestrians must search their environment for hazards represented by particular *objects*, in particular *locations*, with a particular *orientation* and a particular *speed of approach*. In other words, they must visually scan the, possibly complex, road and traffic scene, identify, assess and integrate the various features of location, orientation and speed for each object visible in the scene and then decide whether they would be on a collision course with anything in this scene if they continued with their current course of action, or if they initiated another intended course of action. Where they are intending to cross and/or join a stream of traffic, they will of course be identifying safe gaps demarcated by such perceived objects. It follows from this brief analysis of the task in question that LBFTS errors could result from failure at the levels of sensation, perception, or cognition. The above findings have been interpreted as suggesting that sensory contributions to LBFTS errors may be few, although these errors will obviously be more likely when location, orientation, or speed of surrounding objects is difficult to perceive and assess for reasons associated with the physical environment. It is also clear that, because the integration of location, orientation and speed features of each object in the traffic scene will take a finite amount of time, LBFTS errors will be more probable when available scanning time is short, for example at busy junctions and/or with fast speeds of approach to the potential conflict zone, than when more time is available. As visual 'dwell time' on potential hazards when scanning the traffic scene tends towards zero, perception of the speed and orientation of approaching vehicles will of course become highly unreliable, although object detection may improve.

Given this task analysis, alternative explanations of drivers' errors which are recorded as LBFTS by investigating police officers may be conceptualised as follows:

1. Falsely attributed LBFTS

Here, LBFTS is simply an excuse or default option, rather than a genuine 'failure to see' the object collided with; that is, the driver at fault claims to have looked in the appropriate direction but did not do so and the investigating police officer can find no evidence to support alternative explanations for the collision.

There is no valid method of quantifying this explanation using existing subjectively derived data; indeed, it will never be possible to quantify it with certainty from routine accident reports of any kind. The extent to which drivers falsely report having LBFTS in an accident can also not reliably be quantified by operational research or experimentation, although research could be designed to produce an estimate of the likelihood that drivers prefer to report LBFTS rather than other accident-provoking failings and this is discussed later.

2. Misperception of hazard

In this case the driver at fault actually looks in the appropriate direction(s), actually sees the clearly visible object and makes a conscious decision about its hazardous potential, but fails to conclude that it represents a potential danger which requires an avoidance response.

This is strictly a failure of hazard perception, represented earlier in Table 1 by 'incorrect interpretation', 'lack of judgement' and perhaps 'misjudged speed and distance', rather than a 'failure to see'. Drivers may report it, falsely, as LBFTS for one of two reasons. First, they may not wish to admit to a perceptual error which brings into question their driving skill or state of alertness. Second, having misjudged a hazard and acted on other inputs to their decision-taking about appropriate responses, they may not actually be able to recall seeing the collided-with object. This type of error should not, however, be recorded as LBFTS, as defined by the Review's objectives, because although the collided-with object was clearly visible within the faulty driver's visual field it was ignored as a result of conscious deliberation. It may be noted here that misjudgements of the speed and distance away of approaching vehicles are readily understandable where drivers rely upon rapid scanning of the road and traffic environment, because objects on a collision course with an observer have no substantial lateral movement relative to the viewer. The main cue to their speed of approach is simply an increase in apparent size of their frontal area and this increase is extremely slow until they are relatively close. (See Groeger, 2000:20, for a graphical illustration of this perceptual difficulty.) If the observer scans the environment rapidly and samples this approach cue sequentially with cues presented by other fixated hazards, the rate of increase in apparent size of the approaching vehicle will thus provide little information on its speed until the vehicle is too close to avoid if such action is required. Peripheral vision can often warn of approaching hazards, which then require fixation and interpretation if an appropriate response is to be initiated, but this will be of little help in alerting drivers to the approach of a vehicle on a collision course while they are scanning other parts of their visual field, because the visual periphery is essentially sensitive to movement and the above discussion illustrates that lateral movement or apparent expansion of such a vehicle is minimal until it is dangerously close.

Hence, whether an object on a collision course with a driver is fixated in central vision or detected in peripheral vision, its approach speed may be seriously misjudged where scanning time is short because of excess speed or carelessness.

This misjudgement will be more serious for the approach of vehicles such as motorcycles or pedal cycles, because they present a narrow frontal area to the observer and the rate of increase in size of their visual image will therefore be even less detectable than that of larger vehicles. In addition, as Groeger (2000) has pointed out, a small vehicle approaching quickly can present the same expansion characteristics as a larger vehicle approaching slowly. Hence if time-to-collision is estimated solely on the basis of angular expansion of a vehicle’s frontal area, it may be difficult to distinguish between the danger presented by, say, a slow lorry and that presented by a fast motorcycle. This possibility indicates that any study of the contributory factors in accidents must take account of the type of vehicle struck by the driver at fault, if LBFTS errors are to be distinguished from other errors, such as failures of hazard perception.

This type of failure of hazard perception is obviously of general importance for road safety, for two main reasons: a) if a stationary driver’s direction of gaze is observed by an approaching driver, the latter may assume that right-of-way will be ceded and therefore fail to take avoiding action if it is not; and b) if an at-fault driver has misjudged the hazard presented by an approaching vehicle, he/she may react too late and lose control of their own vehicle. However, this failure is not LBFTS as defined in this Review.

3. Failure to appreciate obscuration of potential hazards

In this case the driver at fault actually looks in the appropriate direction(s), but fails to see an approaching vehicle because it is temporarily obscured by some part of his/her own vehicle (e.g. a windscreen pillar, or a head restraint), or by some piece of roadside furniture (e.g. a road sign, or a bollard), or by another vehicle, or because it occupies the ‘blind spot’ in a rear-view mirror. These alternatives literally represent a ‘failure to see’ a potential hazard and they may be reported as such by errant drivers and by investigating police officers, although they do not meet the criteria for LBFTS errors established by the objectives of this Review because the collided-with object was not immediately visible within the at-fault driver’s visual field. Such errors will be considered here as errors of judgement in the perception of hazard, because they will almost invariably have resulted from a lack of appreciation that vehicles on a potential collision course could temporarily be masked by one of the obscuring features mentioned above, leading to a failure to scan the relevant area of the visual field for the appropriate length of time.

This possibility requires any analysis of contributory factors in accidents to take obscuration factors into account, as well as the road and traffic conditions obtaining at the time an accident is recorded, if these errors of perception and judgement are to be distinguished from LBFTS errors as strictly defined in this Review.

4. Subconscious scanning error

As Rumar has explained, this,

> *'–detection error of cognitive aetiology may be caused by internal distraction. People are preoccupied by some personal problem to such an extent that that their normal information search patterns are destroyed or they are looking without seeing' (1990: p. 1285).*

In other words, their head and eye movements are subconsciously determined and the presence of potential hazards fails to be consciously processed. This type of error is also common when prolonged vigilance is required under boring task conditions (see, for example, Warm, 1984) although, as Robertson and Manly have pointed out, it generally occurs in 'situations which clearly require sustained *performance* but which actually make relatively limited demands on what might be termed attention' (1999: p. 298). It may also occur when drivers are fatigued or drowsy, as could be predicted from the work of, for example, Eysenck (1982), Hockey (1970), Hockey (1970), Pribram and McGuinness, (1975). It seems particularly likely to occur when drivers on very familiar journeys implement habitual search patterns involving autonomous head and eye movements that are unaccompanied by conscious information processing. (See Groeger, 2000, Chapter 4, for a more detailed discussion of the importance of attention, automaticity and distraction in our understanding of driver behaviour.) Again, failures of this type may be recorded as LBFTS errors in accident reports, but they are not considered here to meet the Review's criteria for the error because they do not involve conscious, active looking for potential hazards.

5. Inadequate search model

Here the at-fault driver consciously directs attention in the appropriate direction(s) for the appropriate amount of time, but fails to become aware of a particular type of clearly visible hazard until it is too late to avoid a collision.

This is one variety of the type of error which meets the criteria for LBFTS errors as adopted for the purpose of this Review. As Rumar has described it below.

> *Detection error of cognitive aetiology occurs when a road user has a partly correct expectation. He or she has a functional model of the traffic which is appropriate in terms of when and where to look, but inappropriate in terms of what to look for. That is, the model is correct in spatial and temporal relationships but wrong in terms of target selection. The road accident history is full of such examples. Road users look in the appropriate direction at the appropriate moment, but they usually look for cars. This is very natural behaviour since cars are often the largest, heaviest, fastest, and consequently the most dangerous object visible.*

> *Unfortunately, after doing this and seeing no car within a critical distance, they complete the action they had planned and hit or are hit by a cyclist, a motorcyclist or even by a pedestrian. This is a cognitive detection error which probably has a considerable motivational component (1990: p. 1284).*

In other words, drivers tend to scan their environment selectively for hazards they most expect to see and/or which they regard as particularly dangerous. This process of selective attention is predictable from the early work of Broadbent (1958) and his followers and the effect of motivation on the orienting of spatial attention has been reported more recently by Derryberry (1989). The psychological basis for this type of error is discussed in the following section. It will be appropriately recorded as LBFTS in accident reports because it meets the criteria for LBFTS errors adopted by this Review in that it results from a cognitively determined 'failure to see' a particular type of visible hazard.

6. Incoherent feature detection

Here the at-fault driver actually looks in the appropriate direction(s), but for an insufficient period of time and thus fails to integrate all the relevant visual information from a clearly visible hazardous object into a coherent image, or erroneously combines features (such as orientation or speed) from other objects in the scene with actual features of the hazardous object, to produce an illusory percept.

This is the second type of error which meets the LBFTS criteria as strictly defined for the purpose of this Review. It differs from the other type of attentional failure described in 5 above, in that it results from comprehensive but hasty scanning for potential hazards, rather than over-selective search. This type of error was described many years ago by Broadbent (1977) as a failure of 'pre-attentive processing'. It will tend to occur more readily in complex traffic scenes which enforce rapid scanning for potential hazards and it results from a failure to integrate the crucial features of a potential hazard, i.e. its shape, location, orientation and speed, into a coherent whole which is clearly distinguishable from other potential hazards and from non-hazardous objects in the immediate environment. This explanation, which is examined in more detail in the following section, again indicates the need to record details of prevailing traffic and also of the driver's motivation (for example, if he/she is in a hurry), if genuine cases of LBFTS error are to be distinguished from other contributory factors in routine accident reports and appropriate remedial measures indicated.

To summarise these explanatory conceptions of errors which may be recorded as LBFTS by the police, or by researchers, it seems clear that accident reports provide considerable scope for presenting an *inaccurate* account of the frequency and importance of genuine LBFTS errors, as defined by the objectives of this Review, as a contributory factor in road accidents. '*Falsely attributed LBFTS' errors* are unquantifiable within routine accident data files, although simultaneously recorded contributory factors may provide a clue to their likelihood. Further empirical research would clarify the extent to which these false reports are likely, if the genuine LBFTS problem is to be investigated and understood. *'Misperception of hazard*' and *'Failure to appreciate obscuration of potential hazards'* are both judgmental failures of hazard perception, even though the latter involves an actual failure to see the hazard in question. There is evidence that both of them are sometimes reported by the police in association with LBFTS as joint contributory factors in the same accident, which may indicate that the criteria used by the police to define LBFTS errors in the contributory factors system includes misjudgement of potential hazards. Some indication of the extent to which these two types of error are reported as LBFTS may be identifiable in accident reports from the recordings of associated contributory factors (such as 'misjudgement', or 'obscuration', respectively) and from evidence on the road and traffic conditions obtaining at the time the accident occurred. None of this evidence will be conclusive, although it seems necessary to use it in order to gain some understanding of the implication of these errors of hazard perception in accidents, and hence of the implication of genuine LBFTS.

'S*ubconscious scanning errors*' may be recorded as LBFTS because changing direction of gaze is misinterpreted as 'looking', although they do not meet the criteria adopted by this Review. Again, it seems necessary to understand the extent to which these errors are recorded as LBFTS and specific research could be directed at their causal antecedents, which may be attitudinal, skill-related, task-dependent, or environmentally determined. However, the fundamental reasons for this type of failure have been researched for many years and counter-measures against it, involving training, legislation and engineering solutions, are fairly well understood.

Errors defined by the term '*inadequate search model'* meet the criteria for LBFTS adopted by this Review and, again, their existence has been known for many years. Counter-measures against it have been implemented; for example the 'Think Bike!' publicity campaign designed to increase motorists' awareness of two-wheel vehicles. However, the extent to which they are recorded as LBFTS errors in the contributory factors system remains unknown. '*Incoherent feature detection*' represents the second failure which meets the criterion adopted here for genuine LBFTS errors. It has received little attention from road safety researchers, its contribution to accidents is unknown and remedial measures against it remain to be determined. If both of these genuine LBFTS errors are to be accurately recorded in accident reports, investigated experimentally and appropriate counter-measures designed, it is necessary to explicate their nature in more detail, as follows.

6 PSYCHOLOGICAL BASES OF 'LOOKED BUT FAILED TO SEE' ERRORS

The foregoing sections have shown that up to 45% of all errors recorded as LBFTS in the contributory factors system may not meet the criteria on which that error is defined by the objectives of this Review. In part, this apparent inaccuracy with which genuine LBFTS errors are recorded results from the loose wording of the term 'Looked but failed to see' (or 'Looked but did not see'). For example, there is evidence that drivers may exhibit appropriate head and eye movements at a road junction without actually 'looking', in the sense that they are actively searching for anticipated hazards and consciously processing the visual input. There is also evidence that drivers may actually 'see' an approaching vehicle, but then misjudge its hazardous potential, execute an inappropriate response and subsequently forget that the vehicle was 'seen' at all. It is also clear that drivers may actively 'look' for anticipated environmental hazards and may actually 'fail to see' them because they are obscured by some feature of their vehicle or the road and traffic environment. In the aftermath of an accident, these and other different types of error may appear to be adequately described as LBFTS, but they need to be distinguished from genuine LBFTS errors, as defined here, because some of them are already well researched and because counter-measures against them will almost certainly need to differ from those appropriate to the genuine LBFTS error.

LBFTS appears to be used to describe many errors which are actually shortcomings of hazard perception. In some cases the true failure is not in 'seeing,' but in conscious misjudgement of the dangerous potential of clearly visible vehicles, pedestrians or objects which are then ignored. The cause of the failure may be misjudgement of the appropriate areas to be scanned for hazards, or misjudgement of the direction or speed of approach of a hazard. These human shortcomings in perception and cognition are well understood by psychologists and research on remedial measures involving selection and training are already well in hand against this type of error (see, for example, Hull and Christie, 1992; McKenna and Crick, 1994; McKenna and Horswill, 1997). In other cases a hazard may not be seen because it is temporarily obscured, but an experienced and alert driver should be aware of this possibility and scan the visual scene accordingly. This type of error therefore also represents a shortcoming in the appreciation of hazardous potential. It too may respond to measures involving training, but the principal remedial measures will probably require little more than a common-sense redesign of physical features of the vehicle and/or of the road environment and thus involve only limited operational research by traffic engineers and vehicle designers.

The psychological bases of the error which has been termed 'subconscious scanning error' are well researched: they lie in the field of physiological arousal, attention and distraction. Counter-measures against this error would essentially be directed at maintaining road users' alertness and concentration using a variety of well-known approaches, including hours-of-work legislation for professional drivers, informative and alerting road signs, and in-vehicle driver-support systems. The psychological basis of the error which has been termed 'inadequate search model' is multi-faceted. It may simply result from the well-known effect of probability on individuals' conscious search strategies: drivers will tend to direct their attention to locations where experience suggests that hazards are more likely to appear, and to types of vehicle which are more frequently encountered, or which appear more dangerous because of their size or speed of approach. Training counter-measures aimed at correcting errors in drivers' understanding of these probabilities are already known. However, an unknown proportion of this category of error may have its origins in pre-attentional failures, bordering on the category which has been termed 'incoherent feature detection' and which is explicated below. For example, drivers may attend to only one feature of a potential hazard, such as the proximal location of a vehicle, or the size of vehicles which appear dangerous because of their mass, or the display of lit headlights in poor daytime visibility. If other features are given little or no attention, particularly the speed of a more distant, smaller, approaching vehicle, collisions are almost inevitable. Remedial measures against such errors will, again, include reshaping of the subjective probabilities drivers attach to different traffic hazards, but the extent to which such an approach can alter subconscious attentional performance is unknown.

For an improved understanding of *'selective search inadequacy'* and of '*incoherent feature detection*', and to achieve a greater appreciation of viable counter-measures against these errors, it is necessary to introduce a discussion of basic research in the field of attention, perception and performance. This field of study, which can be traced back at least to the work of William James (1890) and which remains of fundamental importance to our understanding of human information processing (for example, see Shapiro, 2001) is still not without its theoretical controversies, as Driver (2001) has recently pointed out. However, it provides an empirical background to reports of 'failure to see' an object which is clearly visible in the viewer's environment and it represents a prime source of recommendations for research on the LBFTS phenomenon. The following brief overview of this area of work aims to establish that the LBFTS phenomenon represents a genuine human error, of importance for road safety, which is essentially and specifically researchable.

'Seeing', as defined earlier in relation to LBFTS accidents, is clearly more than a simple photographic-type process. As Hampson and Morris have pointed out,

> *We see our world of organised scenes and moving objects by combining information from the light which reaches our eyes with knowledge stored in memory about the structure and identity of objects and scenes. We understand our surroundings partly by seeing them, but also by inferring*

> *what is there…Vision is therefore a genuine cognitive function, not merely a sensory one.*

Furthermore,

> *— human cognition is a unique blend of powerful memory systems, highly developed pattern recognition abilities and general purpose skills to interact with a changing environment. All of these elements of cognition are important in the case of vision (1996: p. 68).*

Just how important they are in relation to our understanding of LBFTS accidents is indicated by Hampson and Morris's citation of work by Humphreys and Bruce (1989) and by Bruce and Green (1985) with brain-injured patients, showing that,

> *— although mutually supportive, the (cognitive) systems which analyse form and motion are not completely identical and are at least partly dissociable.*

Research of this kind, using Positron Emission Tomography (PET) and Functional Magnetic Resonance Imaging (FMRI) to locate brain activity, suggests that different areas of the brain are responsible for analysis of the form and orientation of an approaching vehicle and the nature of its approach towards the observer. This poses the question as to how these different brain areas work together in the identification and perception of hazard and why they may sometimes fail to work together. Given answers to these questions, a variety of explanations of the 'failure to see' phenomenon become possible and these will suggest appropriate counter-measures against the phenomenon.

Central to these explanations is the commonly experienced and empirically supported finding that visual attention extends beyond the boundaries of the area currently fixated (for example, see Posner, 1980). This has led to the adoption of the 'spotlight' analogy of visual attention, in which information processing occurs at the focus of attention in the visual field but tails off towards the periphery of that area. (See, for example, Eriksen and Eriksen, 1974, for empirical support of this model of attention.) An alternative analogy, which also receives some empirical support, is that of the zoom lens, which can be closely focused or drawn back to cover a larger area in less fine detail. (See, for, example, Eriksen and Murphy, 1987.) However, whilst being helpful in describing the parameters of visual attention, further theorising is required in order to understand how attention actually constitutes the principal factor in the processing of sensory information.

Psychologists have researched attention and perception for many years. For example, Broadbent (1971, 1977) has described two types of conscious selective attention which he called *filtering* and *pigeonholing*. He suggests that,

> *Filtering is the selection of a stimulus for attention because it possesses some one feature that is absent from irrelevant events*.

As pointed out earlier, this means that drivers approaching a potentially dangerous conflict zone may select for attention only those vehicles which are in a proximal location, or which display an orientation suggesting they are on a collision course with the viewer, or which are of a particular size. Broadbent goes on to point out that:

> *In the case of pigeonholing, however, the relevant and irrelevant stimuli do not differ by any single feature. Rather, there is a set of responses or pigeonholes which are distinguishable from each other by various combinations of sensory features and into which any event in the environment will be forced if possible, or rejected if it fails to fit any of them.*

Again, using as an example the driver approaching a potential conflict zone, hazards will be distinguished from non-hazards by recognisable combinations of features representing proximal location, collision-course orientation, and possibly speed of approach. As Broadbent pointed out,

> *Pigeonholing requires more processing of information than filtering does, although it still saves a certain amount of processing since one need not bother to discriminate between irrelevant events (1997: p. 110)*.

For example, drivers at a potential conflict point could safely ignore approaching vehicles which combined the features distant/not oriented on a collision course/travelling slowly.

The main point of interest here is that filtering and pigeonholing produce different patterns of error. Because filtering relies on the viewer making a decision about the presence or absence of one feature of a stimulus, if an error is made in identifying that feature a completely incorrect decision will result. This does not happen with pigeonholing, because it relies on recognition of combinations of sensory features. Importantly, as Broadbent (1977) points out, both types of attention are constrained, although in different ways, by what Neisser (1967) has called '*pre-attentive processes*'. There is evidence here for at least two stages of perceptual selection. An early and relatively 'passive' global stage segments environmental information into 'packages' with different interpretations having differing probabilities. The most likely and the most task-relevant of these interpretations is then verified by 'active' interrogation of the sensory field in order to check whether certain stimulus features are present which have not previously been detected.

The nature of errors made during this pre-attentive stage seem informative for our understanding of genuine LBFTS errors. For example, some of Broadbent's research showed that if stimuli are presented rapidly in the same part of the visual field, features (such as colour) can intrude into a percept from the following stimulus. If stimuli are presented rapidly in different parts of the visual field, features have been shown to intrude into a percept from the next-but-one stimulus. If this processing phenomenon happens during rapid scanning of complex traffic scenes, it seems possible that drivers may ignore a vehicle approaching on a collision course because the percept they have formed of this vehicle during pre-attentive processing of the global scene falsely includes, say, an orientation cue that has intruded from the ‘safe’ vehicle they glanced at previously.

Further contributions towards our understanding of this phenomenon have been made by Treisman and colleagues (see, for example, Treisman, 1982, 1999, Treisman and Gelade, 1980). They approach it by posing the basic question:

> *How do we achieve the experience of a coherent world of integrated objects and avoid seeing a world of disembodied or wrongly combined shapes, colours, motions, sizes and distances?*

They point out that:

> *The problem is not an intuitively obvious one, which is probably a testimony to how well, in general, our brains solve it. We are simply not aware that there is a problem to be solved (1999: p. 91).*

This statement essentially explains why attentional failures are typically accepted as ‘failures to see’. It seems intuitively less likely that clearly visible features of the world will be incorrectly integrated into a coherent object perception than that they will be overlooked. However, Treisman (1999) draws on anatomical, physiological and, especially, neurological evidence from PET scans and fMRI, to show that the visual system analyses a scene along a number of different dimensions in various specialised modules of the brain. Her research addresses the question; if specialised areas of the brain code different aspects of the visual scene, how do we get from dispersed brain representations to the unified percepts that we experience? The arguments providing answers to that question are too complex to pursue here. Suffice it to say that *attention* is identified by Treisman as the process which binds features together into a coherent percept and that, as she concludes, ‘*Without attention, the only information recorded is the presence of separate parts and properties*’ (1999: pp. 107–108), (that is, features of objects).

To summarise the views of Treisman and her co-workers, they follow Broadbent (1977) in presenting visual perception as a two-stage process, the first of which rapidly detects simple features of stimuli such as shape, colour, orientation, etc., and which does not involve active attention. They conclude that the second stage comes into play when target objects and irrelevant objects in the visual field can only be distinguished by combinations of two or more features (for example, when a small red car has to be identified in a traffic scene containing a mixture of small black cars, larger red cars, small red taxis, and different vehicles featuring other combinations of size and colour). Identifying the target object in such circumstances is seen to be a serial process, requiring processing time as attention is directed in turn at the different combinations of features in the visual field until the target is found. Treisman likens visual attention to a '*glue*' which binds features together and allows us to '*see*' coherent objects. It follows from this conception of the process that, if the attention given by a driver to a hazardous object in a complex traffic scene is deficient in processing time, the essential features of that object may not be bound into a coherent and recognisably dangerous percept. Instead, the driver could form what Treisman has termed an '*illusory conjunction*' of features from different objects and would therefore respond inappropriately, possibly with no memory of having seen the real object at all.

In a series of publications, Duncan (1980, 1984, 1993, 1996, 1999, Duncan, Humphries and Ward, 1997) has developed an alternative view of the role of attention in our understanding of the visual world. Whilst accepting the evidence that '*Many brain systems are currently activated by visual input*', he presents the view that,

> *Our hypothesis suggests that, in many and perhaps most of these systems, processing is competitive: enhanced response to one object is associated with decreased response to others. For example, responses to different objects may be mutually inhibitory. At the behavioural level, we take competition to be reflected in the interference that generally occurs when a person must divide attention between different objects in a visual scene (1999: p. 113).*

He goes on to report that:

> *There is evidence for preferential target processing: in particular, performance depends more on the number of targets than the number of non-targets in a display. — Thus many different visual properties can be used to direct attention or assign limited processing capacity to objects of relevance to current behaviour (1999: p. 113).*

This view of attention emphasises the influences of individual biases on the way in which the world is perceived. With specific reference to the LBFTS error, drivers may 'fail to see' a vehicle, pedestrian, or object, because they are biased towards attending to other types of hazard. As mentioned earlier, this explanation can account, at least partially, for the type of error resulting from what has been termed an 'inadequate search model'. This highlights the need to explore these perceptual biases among drivers, if we are to investigate the extent to which they contribute to errors reported as LBFTS and hence fully understand the true involvement of 'incoherent feature detection' in the LBFTS phenomenon. Duncan, Ward and

Shapiro (1994) have also shown that detecting a target object during rapid visual scanning can cause interference, lasting around 500 milliseconds, with detection of a second target, which they refer to as the '*attentional blink*'. This interference has obvious implications for drivers' error-prone behaviour if they attempt to scan a complex traffic scene hurriedly.

Taken together, these views suggest that there are three aspects to the LBFTS phenomenon:

1. An individual's *limited capacity* for processing information, which means that there will be competition between visual stimuli for the viewer's attention, perhaps resulting in an 'attentional blink'
2. *attentional selectivity*, which means that certain features of a stimulus may be given attention whereas others may not, resulting in a failure to 'see' it
3. *illusory conjunctions* of stimulus features from target and non-target objects, which means that some objects may be 'seen' but not correctly identified.

It follows that the problem caused by LBFTS errors in the road traffic system results from individuals' attentional biases and their imperfect visual search. Research would be needed in order to understand whether the problem is best dealt with by attempting to tackle those individual deficiencies directly, by education and training, or by mitigating their effects via engineering counter-measures.

7 EXPLICATION OF THE PROBLEM

This account of the psychological bases of the phenomenon reported as LBFTS shows that a good deal of theorising and empirical research supports its existence as a genuine human error which meets the criteria established by the objectives of this Review. Its importance lies in the fact that it represents a pre-attentive failing, which means that drivers will almost certainly not be aware at the time that they have made it nor, subsequently, why it occurred, and hence they will find it difficult to learn how to guard against it without external assistance. However, the term LBFTS is capable of being misapplied to a variety of other human errors and it seems clear that our understanding of the phenomenon is incapable of being progressed by completely relying on subjective reporting of the kind reviewed here.

It would in any case be impossible to conduct further research on the phenomenon using routinely recorded contributory factors linked to STATS19 because of recent changes to the reporting system. A consultation exercise conducted in 2002, following the present data analysis, showed that many users of the TRL system perceived it as a complication rather than a simplification of their task of reporting contributory factors in accident causation. As a result of this response, Road Safety Division in DfT sought impartial advice on how the existing TRL reporting form could be modified to meet the expressed concerns and the Transport Research Group (TRG) at Southampton University was contracted to research this issue. Following their report it was agreed that contributory factors in road traffic accidents should still be included as part of the STATS19 requirement, but that the two-tier approach of TRL's system should be abandoned. Instead, a single-tier framework was adopted in which up to six contributory factors can be allocated to any of the participants in an accident, but there is no requirement to identify a precipitating factor. The new framework was implementated in January 2005. Of most relevance to the present Review of the LBFTS phenomenon is the fact that the new system does not offer it as a specific option among the factors which may be recorded as having contributed to an accident. It has, instead, been combined with 'Failed to look' into an error coded as 'Failed to look properly'. Any further research on the LBFTS phenomenon must therefore rely on other sources of data, or on some temporary manipulation of the new coding system for experimental purposes.

8 RESEARCH POSSIBILITIES

Research is indicated on those individual characteristics of road users which predispose them to incur LBFTS errors. Age and sex differences in the tendency to LBFTS have been found, but it is not clear whether these operate at the sensory, perceptual, or cognitive level of information processing. Over-hasty visual scanning of the traffic scene is a logical contributor to LBFTS errors, but it is not clear to what extent this hastiness derives from carelessness and/or recklessness, or from a perceived need to scan rapidly because of experienced deficiencies in visual information processing. There is evidence that biases in selective attention can provoke LBFTS errors, but it is not clear to what extent these biases result from inadequate driver training, inexperience of driving, or from an inappropriate transfer of visual scanning behaviour from one part of the traffic system to another. It could be inferred from the work of Goodenough (1976), Shinar (1978) and Witkin (1950) that a pre-disposition to commit LBFTS errors is a function of individual differences in cognitive style, with ‘field dependent’ drivers being most at risk, but there is no specific evidence of this connection. Finally, there is evidence supporting the view that some LBFTS errors, particularly among older drivers, may derive from basic visual deficiencies in dynamic visual acuity, contrast sensitivity and useful field of view (see, for example, Wood, 1998). This is consistent with the finding from the contributory factors system that LBFTS errors increase with the age of drivers.

Given the empirically based view of ‘failure to see’ explicated above, it follows that there is indeed a genuine LBFTS phenomenon and that it is essentially researchable. It is clearly of specific importance for road safety because it represents a common human attentional failing and most humans participate in the road traffic system, although individual differences in the propensity to commit LBFTS errors are to be expected. However, subjectively based evidence obtained from accident reports surveyed here has not allowed that importance to be quantified reliably and recent changes to the accident reporting system appear to rule out further use of routinely collected data from the system for this purpose. This section therefore summarises the principal research questions which would need to be addressed if we are to further understand the various human and environmental factors contributing to the problem.

1. Evaluation of falsely reported LBFTS errors

Although LBFTS is not a valid option among the contributory factors recorded within the new reporting system it seems clear that this will remain an explanation offered by accident-involved drivers, because it is a recognised genuine phenomenon and it may also be offered falsely as the preferred alternative to an error of skill or judgement. It would therefore be of general interest to investigate the extent to which drivers are prepared to offer LBFTS incorrectly as their accident-provoking error, rather than some alternative explanation.

One approach to this question would be a partial replication of the questionnaire study run by Brown and Copeman (1975) on drivers' attitudes to the seriousness of traffic offences. This study provided guidance on the design of a European penalty points system (see Council of Europe, 1979) and it therefore collected data on attitudes towards a wide variety of traffic offences. However, in order specifically to address the question of falsely reported LBFTS the range of traffic offences and personal failings compared for perceived seriousness could be reduced to more manageable proportions. It would be particularly important to compare shortcomings which are like to result in offences such as 'Failed to give way', 'Failed to stop' and 'Failed to avoid person/vehicle/object in the carriageway'. Apart from 'LBFTS' these are 'Inattention', 'Carelessness/thoughtlessness/recklessness', 'Failed to judge another's path or speed', 'Failed to look', 'Lack of judgement of own path', 'Excessive speed', 'Following too close', 'In a hurry', 'Inexperience of driving', 'Aggressive driving', 'Distraction', 'Nervous/uncertain behaviour', 'Inexperience with the vehicle' and 'Ignored lights at a crossing'. This smaller range of personal factors would allow the perceived seriousness of tested offences and shortcomings to be contrasted using the simpler 'paired comparison' method, rather than the 'rating scale' method adopted by Brown and Copeman (1975), although the latter method does permit additional estimates to be made of the magnitude of differences found between perceptions of seriousness.

The assumption underlying this approach is that drivers' ratings of the seriousness of traffic offences are consistent with their views on the relative acceptability of responsibility for committing those errors, and this assumption could be tested empirically. The main application of the results would be in considerations of a 'correction factor' to be applied to measures of the LBFTS error obtained from the earlier system linking contributory factors data to STATS19 information, as presented in this Review, with the aim of allowing statistically for false reporting. This 'correction factor' could also be used in future investigations of the LBFTS phenomenon using contributory factors data obtained for experimental purposes from the new system, as suggested below.

2. Exploration of age and sex differences in propensity to commit LBFTS errors

The present survey has revealed age and sex differences in the recording of drivers' LBFTS errors. This could be explored further by requiring investigating officers using the new system to note accident-involved drivers' reports of LBFTS errors, together with their age and sex, for an experimental period of, say, one year. The results could be used together with other findings on the specific causation of LBFTS errors for advisory, educational, or training purposes. If the drivers reporting these LBFTS errors could be identified, the results could also form the basis for examinations of the implication of individual differences in attention, perception and cognition in the propensity to LBFTS.

3. Investigation of environmental factors contributing to LBFTS errors

In conjunction with suggestion 2 above, drivers’ reports of LBFTS errors could be investigated in relation to the road and traffic conditions within which they were committed. Of particular importance would be the type of junction at which the error was made, the traffic manoeuvre being attempted and the driver’s speed at the time they committed their LBFTS error. The results of this study could inform the need for specific driver training measures, or for engineering changes required to reduce LBFTS errors under particularly demanding conditions.

4. Understanding the specific nature of LBFTS errors

In association with suggestion 3 above, a laboratory experiment could be undertaken to reveal the specific nature of the pre-attentive failure which results in a LBFTS error. Eye-movement studies of drivers’ responses to simulated traffic scenes could be designed to provide a fine-grained examination of their use of features such as object size, location in the traffic scene, orientation with respect to the viewer and approach speed, in their search for potential hazards at junctions. Of particular interest would be drivers’ prioritisation of these different features of traffic hazards as a function of their propensity to LBFTS. Also of interest would be the order in which these features of size, location, orientation and speed fail to be integrated into a relevant perception of danger under conditions of increasing informational load and time stress. The results could further our understanding of LBFTS errors, as defined in this Review, and inform the identification of counter-measures against them.

5. Assessing the impact of counter-measures against LBFTS errors

The studies outlined in suggestions 2 and 3 above could be repeated in due course in order to evaluate any reduction in drivers’ propensity to commit LBFTS errors which followed the introduction of counter-measures against them, indicated by the suggested research. The aim would be to fine-tune the implemented counter-measures and to identify any aspects of the LBFTS problem which may require further research.

Finally, there is a need to ensure that specific research on the LBFTS phenomenon remains informed by, and develops in parallel with, more fundamental research on selective attention, because this is a field where controversial theorising and technologically dependent methodology make it difficult for researchers in the road safety field to make independent progress.

9 SUMMARY AND CONCLUSIONS

A number of previous in-depth, at the scene surveys of road accidents have shown that ‘looked but failed to see’ (LBFTS) is the third most frequently recorded contributory driver error. In these surveys it comprised around 10% of all drivers’ errors and over 8% of all pedestrian’ errors. Analysis of more recent data from a 1999 study of contributory factors linked to the STATS19 accident reporting system has confirmed that LBFTS represents the third most frequently recorded perceptual failure in accidents, in this case contributing to over 17% of all perceptual failures. However, this analysis showed that LBFTS errors were recorded in association with attentional and judgemental errors in the same accident, bringing into question the reliability with which it is possible to identify genuine LBFTS errors in the contributory factors system from which the data were obtained. It is impossible to ‘attend’ to a visible object without ‘looking’ at it, using those terms in their normal sense. It is also impossible to make a conscious misjudgement about the hazardous potential of an object that has not actually been ‘seen’. These joint recordings of apparently incompatible errors by investigating police officers could occur only if the errors were made by different participants in the accident, or if they resulted from a driver’s differing directions of gaze. The data are not clear on this point. Together with the possibility that LBFTS errors may be falsely reported in preference to admissions of failures of driving skill, this uncertainty means that up to 45% of all errors recorded as LBFTS in the data analysed here may not actually have been genuine, as defined by the criteria established by the objectives of this Review. The LBFTS problem remains important, but caution seems required in attempting to understand its nature and identify counter-measures against it simply by interpreting currently available accident data.

The data reviewed here suggest that LBFTS errors are made more frequently by female drivers than by males and by older drivers rather than younger. As would be expected, LBFTS errors occur mainly at road junctions, although detailed analyses of the specific relationships between them, the attentional demands imposed on drivers by different types of journey, different types of junction and the different manoeuvres required to negotiate them, must remain the subject of future research.

A study of the scientific literature identifies failure of selective attention as the genuine LBFTS error. Important causal contributors to this failure are shown to be informational overload, imperfect selectivity of object features demanding attention, and incoherent integration of those features which distinguish a hazard from a non-hazard in the visual scene.

It is concluded from the above findings that LBFTS errors represent a genuine and important problem for road safety and that further research would be required if the true nature of the phenomenon and its precise magnitude are to be understood and counter-measures against it identified. Recent changes to the accident reporting system exclude the specific recording of LBFTS as a contributory factor, making it impossible to use routinely collected accident data in further research on the phenomenon. Three different approaches to the problem are therefore suggested:

1. an examination of the extent to which accident-involved drivers may falsely attribute their error to LBFTS
2. an experimental manipulation of the contributory factors system designed to explore age and sex differences among drivers' tendencies to report having LBFTS
3. laboratory-based investigations of the attentional factors which underlie the LBFTS phenomenon.

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APPENDIX I

List of police forces contributing data to the survey

Lancashire
Greater Manchester
Humberside
Cleveland
West Midlands
West Mercia
Essex
Thames Valley
Sussex
Gloucestershire (from 2000)
Wiltshire
Fife
Central (Scotland)

APPENDIX II

Variables and values available in the QSTAT databases

DETR/SO/WO

Accident Record Attendant Circumstances

STATS19 (1999)

1.1 Record Type [1 _]

11 New accident record
15 Amended accident record

1.2 Police Force [_ _]

1.3 Accident Ref No [_ _ _ _ _ _ _]

1.5 Number of Vehicle Records [_ _ _]

1.6 Number of Casualty Records [_ _ _]

1.7 Date Day [_ _] Month [_ _] Year [_ _]

1.9 Time of Day Hours [_ _] Mins [_ _]
24 hour

1.10 Local Authority [_ _ _]

1.11 Location
10 digit OS Grid Reference number
Easting [_ _ _ _ _] Northing [_ _ _ _ _]

1.12 1st Road Class [_]

1 Motorway
2 A(M)
3 A
4 B
5 C
6 Unclassified

1.13 1st Road Number [_ _ _ _]

1.14 Road Type [_]

1 Roundabout
2 One way street
3 Dual carriageway - 2 lanes
4 Dual carriageway - 3 or more lanes
5 Single carriageway - single track road
6 Single carriageway - 2 lanes (one in each direction)
7 Single carriageway - 3 lanes (two way capacity)
8 Single carriageway - 4 or more lanes (two way capacity)
9 Unknown

1.15 Speed Limit (mph) [0 _ _]

1.16 Junction Detail [0 _]

00 Not at or within 20 metres of junction
01 Roundabout
02 Mini roundabout
03 T or staggered junction
05 Slip road
06 Crossroads
07 Multiple junction
08 Using private drive or entrance
09 Other junction

Junction Accidents Only

1.17 Junction Control [_]
1 Authorised Person
2 Automatic traffic signal
3 Stop sign
4 Give way sign or markings
5 Uncontrolled

1.18 2nd Road Class [_]
1 Motorway
2 A(M)
3 A
4 B
5 C
6 Unclassified

1.19 2nd Road Number [_ _ _ _]

1.20a Pedestrian Crossing - Human Control [_]

0 No crossing facility within 50 metres or physical crossing facility not controlled by authorised person
1 Control by school crossing patrol
2 Control by other authorised person

1.20b Pedestrian Crossing - Physical Facilities [_]

0 No physical crossing facility within 50 metres
1 Zebra crossing
4 Pelican, puffin, toucan or similar non-junction pedestrian light crossing
5 Pedestrian phase at traffic signal junction
8 Central refuge - no other controls
9 Footbridge or subway

1.21 Light Conditions [_]

1 Daylight: street lights present
2 Daylight: no street lighting
3 Daylight: street lighting unknown
4 Darkness: street lights present and lit
5 Darkness: street lights present but unlit
6 Darkness: no street lighting
7 Darkness: street lighting unknown

1.22 Weather [_]

1 Fine without high winds
2 Raining without high winds
3 Snowing without high winds
4 Fine with high winds
5 Raining with high winds
6 Snowing with high winds
7 Fog or mist - if hazard
8 Other
9 Unknown

1.23 Road Surface Condition [_]

1 Dry
2 Wet / Damp
3 Snow
4 Frost / Ice
5 Flood (surface water over 3cm deep)
6 Oil or diesel
7 Mud

1.24 Special Conditions at Site [_]

0 None
1 Automatic traffic signal out
2 Automatic traffic signal partially defective
3 Permanent road signing or marking defective or obscured
4 Roadworks present
5 Road surface defective

1.25 Carriageway Hazards [_]

0 None
1 Dislodged vehicle load in carriageway
2 Other object in carriageway
3 Involvement with previous accident
4 Dog in carriageway
5 Other animal or pedestrian in carriageway

1.26 Place Accident Reported [_]

1 At scene
2 Elsewhere

1.27 DETR Special Projects [_ _ _ _]

Vehicle Record

2.1 Record Type [2][ ]

21 New vehicle record
25 Amended vehicle record

2.2 Police Force

2.3 Accident Ref No

2.4 Vehicle Ref No

2.5 Type of Vehicle

01 Pedal cycle	15 Other non-motor vehicle
02 Moped	16 Ridden horse
03 Motor cycle 125 cc and under	17 Agricultural vehicle (includes diggers etc.)
04 Motor cycle over 125cc	18 Tram / Light rail
08 Taxi	19 Goods vehicle 3.5 tonnes mgw and under
09 Car	20 Goods vehicle over 3.5 tonnes and under 7.5 tonnes mgw
10 Minibus (8 - 16 passenger seats)	21 Goods vehicle 7.5 tonnes mgw and over
11 Bus or coach (17 or more passenger seats)	
14 Other motor vehicle	

2.6 Towing and Articulation

0 No tow or articulation	3 Caravan
1 Articulated vehicle	4 Single trailer
2 Double or multiple trailer	5 Other tow

2.7 Manoeuvres

01 Reversing	12 Changing lane to right
02 Parked	13 Overtaking moving vehicle on its offside
03 Waiting to go ahead but held up	14 Overtaking stationary vehicle on its offside
04 Stopping	15 Overtaking on nearside
05 Starting	16 Going ahead left hand bend
06 U turn	17 Going ahead right hand bend
07 Turning left	18 Going ahead
08 Waiting to turn left	
09 Turning right	
10 Waiting to turn right	
11 Changing lane to left	

2.8 Vehicle Movement Compass Point — From / To

1 N	5 S	Parked:
2 NE	6 SW	not at kerb [0][0]
3 E	7 W	
4 SE	8 NW	at kerb [*][0]

* code 1 - 8

2.9a Vehicle Location at Time of Accident - Road

1 Leaving the main road
2 Entering the main road
3 On the main road
4 On the minor road

2.9b Vehicle Location at Time of Accident - Restricted Lane/ Away from Main Carriageway

0 On main carriageway - not in restricted lane
1 Tram / Light rail track
2 Bus lane
3 Busway (including guided busway)
4 Cycle lane (on main carriageway)
5 Cycleway (separated from main carriageway)
6 On lay-by or hard shoulder
7 Entering lay-by or hard shoulder
8 Leaving lay-by or hard shoulder
9 Footway (pavement)

2.10 Junction Location of Vehicle at First Impact

0 Not at junction (or within 20 metres)
1 Vehicle approaching junction or parked at junction approach
2 Vehicle in middle of junction
3 Vehicle cleared junction or parked at junction exit
4 Did not impact

2.11 Skidding and Overturning

0 No skidding, jack-knifing or overturning
1 Skidded
2 Skidded and overturned
3 Jack-knifed
4 Jack-knifed and overturned
5 Overturned

2.12 Hit Object in Carriageway

00 None	06 Bridge - side
01 Previous accident	07 Bollard / refuge
02 Roadworks	08 Open door of vehicle
03 Parked vehicle - lit	09 Central island of roundabout
04 Parked vehicle - unlit	10 Kerb
05 Bridge - roof	11 Other object

2.13 Vehicle Leaving Carriageway

0 Did not leave carriageway
1 Left carriageway nearside
2 Left carriageway nearside and rebounded
3 Left carriageway straight ahead at junction
4 Left carriageway offside onto central reservation
5 Left carriageway offside onto central reservation and rebounded
6 Left carriageway offside and crossed central reservation
7 Left carriageway offside
8 Left carriageway offside and rebounded

2.14 Hit Object Off Carriageway

00 None
01 Road sign / Traffic signal
02 Lamp post
03 Telegraph pole / Electricity pole
04 Tree
05 Bus stop / Bus shelter
06 Central crash barrier
07 Nearside or offside crash barrier
08 Submerged in water (completely)
09 Entered ditch
10 Other permanent object

2.16 First Point of Impact

0 Did not impact	3 Offside
1 Front	4 Nearside
2 Back	

2.17 Other Vehicle Hit
Ref no of other vehicle

2.18 Part(s) Damaged

0 None	3 Offside	6 Underside
1 Front	4 Nearside	7 All four sides
2 Back	5 Roof	

2.21 Sex of Driver

1 Male 2 Female 3 Not traced

2.22 Age of Driver
Estimated if necessary — Years

2.23 Breath Test

0 Not applicable	5 Driver not at time of
1 Positive	6 Not provided (medical
2 Negative	
3 Not requested	
4 Refused to provide	

2.24 Hit and Run

0 Other	2 Non-stop vehicle, not hit
1 Hit and Run	

2.25 DETR Special Projects

2.26 Vehicle Registration Mark (VRM)
Special codes:

2 Foreign / Diplomatic	4 Trade plates
3 Military	9 Unknown

2.27 Driver Postcode
Special codes:

1 Unknown	2 Non-UK resident
	3 Parked and unattended

Casualty Record

3.1 Record Type [3][ ]

31 New casualty record
35 Amended casualty record

3.2 Police Force [ ][ ]

3.3 Accident Ref No [ ][ ][ ][ ][ ][ ][ ]

3.4 Vehicle Ref No [ ][ ][ ]

3.5 Casualty Ref No [ ][ ][ ]

3.6 Casualty Class [ ]

1 Driver or rider
2 Vehicle or pillion passenger
3 Pedestrian

3.7 Sex of Casualty [ ]

1 Male
2 Female

3.8 Age of Casualty [ ][ ] Years
Estimated if necessary

3.9 Severity of Casualty [ ]

1 Fatal
2 Serious
3 Slight

3.10 Pedestrian Location [ ][ ]

00 Not a pedestrian
01 In carriageway, crossing on pedestrian crossing facility
02 In carriageway, crossing within zig-zag lines at crossing approach
03 In carriageway, crossing within zig-zag lines at crossing exit
04 In carriageway, crossing elsewhere within 50 metres of pedestrian crossing
05 In carriageway, crossing elsewhere
06 On footway or verge
07 On refuge, central island or central reservation
08 In centre of carriageway, not on refuge, central island or central reservation
09 In carriageway, not crossing
10 Unknown or other

3.11 Pedestrian Movement [ ]

0 Not a pedestrian
1 Crossing from driver's nearside
2 Crossing from driver's nearside - masked by parked or stationary vehicle
3 Crossing from driver's offside
4 Crossing from driver's offside - masked by parked or stationary vehicle
5 In carriageway, stationary - not crossing (standing or playing)
6 In carriageway, stationary - not crossing (standing or playing), masked by parked or stationary vehicle
7 Walking along in carriageway - facing traffic
8 Walking along in carriageway - back to traffic
9 Unknown or other

3.12 Pedestrian Direction [ ]

Compass point bound

1 N
2 NE
3 E
4 SE
5 S
6 SW
7 W
8 NW
9 Unknown
0 Standing still

3.13 School Pupil Casualty [ ]

1 School pupil on journey to or from school
0 Other

3.15 Car Passenger [ ]

0 Not a car passenger
1 Front seat passenger
2 Rear seat passenger

3.16 Bus or Coach Passenger [ ]

0 Not a bus or coach passenger
1 Boarding
2 Alighting
3 Standing passenger
4 Seated passenger

3.17 DETR Special Projects [ ][ ][ ][ ]

3.18 Casualty Postcode [ ][ ][ ][ ] [ ][ ][ ]

Special codes:
1 Unknown
2 Non-UK resident

Contributory Factor Codes

WHAT WENT WRONG ? (Precipitating Factors)

FAILURES OF DRIVER or RIDER	**MANOEUVRES**
1. Failed to stop (mandatory sign)	9. Swerved to avoid object in carriageway
2. Failed to give way	10. Sudden braking
3. Failed to avoid pedestrian (pedestrian not to blame)	11. Poor turn/manoeuvre
4. Failed to avoid vehicle or object in carriageway	12. Poor overtaking
5. Failure to signal/misleading signal	13. Drove wrong way (eg one way street)
6. Loss of control of vehicle	14. Opening door carelessly
FAILURES OF PEDESTRIAN or PASSENGER	
7. Pedestrian entered carriageway without due care (driver/rider not to blame)	15. OTHER (please supply details)
8. Passenger fell in or near PSV	

WHY ? (Contributory Factors)

PERSONAL DETAILS	**VEHICLE DEFECTS**
1. Impairment alcohol	28. Tyres wrong pressure
2. drugs	29. deflation before impact
3. fatigue	30. worn/insufficient tread
4. illness	31. Defective lights or signals
5. Distraction stress/emotional state of mind	32. Defective brakes
6. physical in/on vehicle	33. OTHER (please supply details)
7. physical outside vehicle	**LOCAL CONDITIONS**
8. Behaviour panic	34. Site details poor road surface
9. careless/thoughtless/reckless	35. poor/no street lighting
10. nervous/uncertain	36. inadequate signing
11. in a hurry	37. steep hill
12. Failure to judge other person's path or speed	38. narrow road
13. Disability	39. bend/winding road
14. Failed to look	40. roadworks
15. Looked but did not see	41. Slippery road
16. Inattention	42. High winds
17. Person hit wore dark or inconspicuous clothing	43. Earlier accident
18. OTHER (please supply details)	44. OTHER (please supply details)
PEDESTRIAN DETAILS	**OBSCURATION**
19. Crossed from behind parked vehicle	45. View windows obscured
20. Ignored lights at crossing	46. glare from sun
DRIVER DETAILS	47. glare from headlights
21. Excessive Speed	48. Surroundings bend/winding road
22. Following too close	49. stationary or parked vehicle
23. Inexperience of driving	50. moving vehicle
24. of vehicle	51. buildings, fences, vegetation, etc
25. Interaction or competition with other road users	52. Weather (eg mist or sleet)
26. Aggressive driving	53. Failed to see pedestrian or vehicle in blindspot
27. Lack of judgement of own path	**ANIMAL INVOLVEMENT**
	54. Animal out of control

PF	V/C	Ref	CF1	CF2	CF3	CF4

Notes: Only enter codes for the person who has a PF, with the Stats 19 Vehicle Ref for a driver or rider
the Stats 19 Casualty Ref for a pedestrian or passenger

PF is the Precipitating Factor, CF1 is the most important Contributory Factor

Show confidence in CF codes by 1=Definite, 2=Probable, 3=Possible