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RESEARCH LABORATORY**

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**THE INCIDENCE OF BURST TYRES PRIOR TO INJURY ACCIDENTS
ON M1 and M4 MOTORWAYS**

by

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THE INCIDENCE OF BURST TYRES PRIOR TO INJURY ACCIDENTS ON M1 AND M4 MOTORWAYS

ABSTRACT

Accidents reported on 152 km of the M1 and M4 motorways during the years 1968, 1969 and 1970 have been investigated with regard to the incidence of burst tyres immediately prior to the accidents.

Of the 1910 personal injury accidents reported in this period 16 per cent were preceded by one of the vehicles involved sustaining a burst tyre.

A similar result was found in an earlier study of accidents on the M1.

Although the numbers of burst tyres were greatest for cars, the relative frequency for any type of vehicle was highest for motor cycles and motor scooters; 36 per cent of all two wheeled vehicles incurring a burst tyre prior to accident involvement. For private motor cars and light goods vehicles combined the figure was 10 per cent and for heavy goods vehicles 3 per cent.

On M1 alone 18 per cent of personal injury accidents were preceded by a burst tyre while for M4 the figure was 13 per cent.

1. INTRODUCTION

The object of this investigation was to try to assess the frequency of burst tyres immediately prior to road accidents on motorways and to observe any trends since an earlier study made in 1960/61.

The information required on whether a burst tyre was experienced immediately prior to the accident was available for certain sections of motorway, in the form of special police reports. This enabled the occurrence of burst tyres for different categories of vehicle and the variability of this factor with different roads to be studied.

2. DATA

The information available covered the years 1968, 1969 and 1970 for 116 km of M1 (southern end to and including the M45 spur) and 36 km of M4 (Chiswick to Maidenhead) motorways; the new regulations governing the condition of tyres came into force on 1 April 1968.¹

The data were collected from special reports of accidents on these roads supplied to the Laboratory by the police and included the severity of the accident (classified by the most severe injury sustained), the types of vehicles involved, and whether tyre failure had occurred. The reports were carefully scrutinised to distinguish between tyres which had burst immediately before the accident involvement and those which failed during or after it. For this purpose a burst tyre denoted a mention in the police accident report of a sudden failure while in motion caused by puncture or rapid deflation.

Although information was available about many damage-only accidents they have been excluded from this investigation because it is known that a very high proportion of such accidents are not reported to the police (there being no legal need to do so) and it was considered quite likely that those reported are not representative of all those which occur.

3. ANALYSIS

3.1 Difference between motorways

Table 1 shows that 311 (16%) of the 1910 personal injury accidents in this sample were reported to have been preceded by at least one of the vehicles experiencing a burst tyre.

The corresponding percentages on M1 and M4 individually were 18 per cent and 13 per cent respectively, a high proportion of the accidents in question. These percentages varied from year to year but overall were significantly* higher on M1 than on M4.

This difference is consistent with journey lengths on M1 being greater than on M4 and journey speeds being higher, but there are no readily available data to support this. It is however true that the maximum journey length on M4 at this time was 36 km. Clearly, as the traffic flow is not uniform along this length of M4 – being greatest closest to London – the mean journey length was somewhat less than 36 km.

For comparison, the corresponding percentage of personal injury accidents preceded by a burst tyre for M6 motorway reported by the Lancashire Constabulary for the year 1969 was 27 per cent.² The results observed in the present study were of the same order of magnitude as those reported in an earlier study made of accidents on M1 alone.^{3, 4}

No data concerning the condition of tyres was available from the police reports. However, in a recent non-motorway survey conducted by the TRRL, 9 per cent of cars in use on the road were found to have at least one tyre with a tread depth of under the legal minimum of 1 mm.⁵ The survey also found large errors in the pressures of tyres on a high proportion of cars, both with respect to the manufacturers advised pressures and to other tyres on the same vehicle.

* "Significant" used in the context of this report means that the statistical chi-squared test has been applied and shown that there is a 1 in 20 probability, or less, of the result being a chance effect.

3.2 Differences year to year

There were no significant differences between the observed percentage of accidents preceded by burst tyres from year to year for M1, but the figure of 7.9 per cent for 1970 on M4 was significantly lower than the corresponding figures for the previous two years.

Two factors which might have affected the 1970 figure for M4 were the presence of road works necessitating closure of parts of some lanes of the motorway and the operation of a 50 mile/h speed limit on some lengths of the motorway, due to road widening, both of which probably reduced the speeds of vehicles. However, data given on the numbers of vehicles stranded due to tyre failure reported on the Metropolitan Police District section of M4, indicated no significant change between 1969 and 1970.⁶ This supports the belief that not all of the change in the incidence of burst tyres was likely to have been due to these factors and it is also believed that there was a certain amount of under-reporting of the conditions of tyres by the police (a detail they are not required to report).

3.3 Vehicle involvement and class of vehicle

Table 2 presents data for the same accidents but in terms of vehicle involvement (ie the numbers of vehicles involved in these accidents). This enabled investigation into the incidence of burst tyres with respect to the type of vehicle and the number of accident involvements of that type of vehicle. Overall, the percentages of vehicles having burst tyres immediately prior to an accident were 9 per cent on M1 and 6 per cent on M4. These percentages are about half the corresponding percentages for accidents: the lower values occur because, while many accidents involved more than one vehicle, few involved more than one vehicle experiencing a burst tyre.

It can be seen from Table 3 that the incidence of burst tyres for different classes of vehicle differed considerably. On both motorways two-wheeled vehicles had significantly the highest rate of burst tyres per vehicle involvement, the figure for the two motorways combined being 36 per cent.

The incidence of burst tyres per vehicle involvement for private motor cars and light goods vehicles combined differ significantly for the two motorways, the rate on M1 being twice that on M4. This difference almost totally accounted for the overall difference between the motorways.

The distribution of all burst tyres by class of vehicle is given in Table 4. It should be noted that, although the incidence of burst tyres prior to a vehicle involvement was highest for two-wheeled vehicles, the majority of burst tyres were experienced by private motor cars. The results of this present survey indicate that a high proportion (75%) of all burst tyres prior to personal injury accidents were experienced by private motor cars.

It can be seen that the distribution of burst tyres by class of vehicle was not the same for M1 and M4, a significantly higher proportion of burst tyres being experienced by two-wheeled vehicles on M4 than on M1. This observed difference cannot be attributed to differing traffic compositions. Timbers, in an unpublished report, gives traffic compositions for M1 and M4; these are reproduced in Table 5 and show that the effect of the differences in composition would be expected to result in M4 experiencing a higher proportion of burst tyres than M1 due to the higher proportion of private motor cars and light vans and the smaller proportion of medium and heavy goods vehicles. Traffic composition does not therefore explain the difference in burst tyre occurrence for the two motorways.

3.4 Other results

Two other results are apparent by further subdivision of the data for M1 and M4 combined. These subdivisions are shown in Tables 6 and 7.

It can be seen from Table 6 that 82 per cent of the accidents preceded by a burst tyre led to a single-vehicle accident while only 31 per cent of all other personal injury accidents were of this type.

About 34 per cent of all single-vehicle injury accidents and 5 per cent of other injury accidents were preceded by a burst tyre.

Furthermore, Table 7 shows that only 3 per cent of the accidents preceded by a burst tyre resulted in a fatality. This second observation may be partly or wholly due to the larger proportion of single-vehicle accidents resulting from burst tyres, and hence the fewer road users at risk in each accident.

4. CONCLUSIONS

The main conclusions to be drawn from the analysis of the data are as follows:

1. Both motorways show the factor of a burst tyre to be present prior to a high proportion of all personal injury accidents. On M1 and M4 combined, the proportion of personal injury accidents preceded by burst tyres was 16 per cent, being 18 per cent on M1 and 13 per cent on M4. This difference may be due to longer journey lengths and higher journey speeds on M1, although this cannot be substantiated. It cannot be explained by the difference in traffic compositions on the two motorways.
2. The overall proportion of 16 per cent of personal injury accidents preceded by burst tyres does not indicate any significant change since the study made nine years earlier.
3. Two-wheeled vehicles had the highest proportion of burst tyre vehicle involvements (36 per cent of all involvements being preceded by a burst tyre) and medium or heavy goods vehicles the lowest proportion (3 per cent of vehicle involvements being preceded by a burst tyre).

The corresponding figure for private motor cars and light goods vehicles combined was 10 per cent and represents the major proportion of the problem (accounting for 82 per cent of all burst tyres prior to accidents and 66 per cent of all resulting vehicle involvements).

4. Eighty two per cent of all burst-tyre injury accidents involved only a single vehicle. This is a higher proportion than that in all other personal injury accidents. Thirty four per cent of all single-vehicle personal injury accidents were preceded by a burst tyre.
5. The proportion of accidents which resulted from burst tyres was lower for fatal accidents than for serious and slight injury accidents.

Although this study is not representative of the road system of Great Britain as a whole the results indicate that, at least on motorways, the problem of burst tyres is serious, 1 in 6 of all personal injury accidents on motorways being preceded by a vehicle sustaining a burst tyre.

Further, 1 in 10 of all private motor cars involved in personal injury accidents had sustained a burst tyre immediately prior to this involvement.

5. ACKNOWLEDGEMENTS

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The report was prepared in the Accident Analysis Division of the Safety Department.

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TABLE 1

Injury accidents preceded by 'burst tyre': M1 and M4, 1968-70

Year	M1			• M4			M1 and M4		
	No with burst tyre	Total accidents	%	No with burst tyre	Total accidents	%	No with burst tyre	Total accidents	%
1968	70	401	17.4	33	225	14.7	103	626	16.4
1969	94	484	19.4	30	214	14.0	124	698	17.8
1970	71	422	16.8	13	164	7.9	84	586	14.3
Totals	235	1307	18.0	76	603	12.6	311	1910	16.3

TABLE 2

Vehicles with 'burst tyre' prior to involvement in injury accidents: M1 and M4, 1968-70

Year	M1			M4			M1 and M4		
	No with burst tyre	Total vehicles	%	No with burst tyre	Total vehicles	%	No with burst tyre	Total vehicles	%
1968	70	804	8.7	33	485	6.8	103	1289	7.8
1969	94	965	9.7	30	491	6.2	124	1456	8.5
1970	71	850	8.4	14	338	3.8	84	1188	7.1
Totals	235	2619	9.0	76	1314	5.8	311	3933	7.9

TABLE 4

The distribution of tyre bursts in injury accidents
by type of vehicle: M1 and M4, 1968-70

Class of vehicle	Number of burst tyres			% of burst tyres		
	M1	M4	M1 and M4	M1	M4	M1 and M4
Motor cycles and scooters	13	15	28	5.5	19.7	9.0
Private motor cars	183	51	234	77.9	67.1	75.2
Light goods	16	4	20	6.8	5.3	6.5
Medium and heavy heavy goods	22	6	28	9.4	7.9	9.0
Others	1	0	1	0.4	0	0.3
Total	235	76	311	100.0	100.0	100.0

TABLE 5

The percentage distribution of traffic on M1 and M4
in 1970

Class of vehicle	M1	M4
Motorcycles and scooters	0.3	0.3
Private motor cars	71.7	83.5
Light goods	4.5	3.3
Medium and heavy goods	22.4	10.9
Others	1.1	2.0
Total	100.0	100.0

TABLE 6

Number of vehicles involved in 'burst tyre' injury
accidents: M1 and M4, 1968-70

Class of accident	No with burst tyre	%	Not preceded by burst tyre	%	Total accidents	%
Single vehicle	254	81.6	494	30.9	748	39.1
Multi-vehicle	57	18.4	1105	69.1	1162	60.9
All personal injury accidents	311	100.0	1599	100.0	1910	100.0

TABLE 7

Severity of 'burst tyre' accidents: M1 and M4,
1968-70

Severity of accident	No with burst tyre	%	Not preceded by burst tyre	%	Total accidents	%
Fatal	10	3.2	122	7.6	132	6.9
Serious	100	32.2	562	35.2	662	34.7
Slight	201	64.6	915	57.2	1116	58.4
All personal injury accidents	311	100.0	1599	100.0	1910	100.0

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