ROAD RESEARCH LABORATORY

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THE COST AND BENEFIT OF ANTI-LOCKING BRAKES ON MOTOR CYCLES

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Ownership of the Transport Research Laboratory was transferred from the Department of Transport to a subsidiary of the Transport Research Foundation on 1st April 1996.

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ANTI-LOCKING BRAKES ON MOTOR CYCLES

ABSTRACT

Detailed records of 140 accidents involving motor cycles were examined, and it was estimated that about 10 per cent of them might not have occurred if motor cycles had been fitted with anti-locking brakes. The cost of motor cycle accidents to the community is estimated on this premise and it is concluded that there would be an economic gain if anti-locking brakes were fitted on motor cycles, provided the cost was below about £30 per machine.

1. INTRODUCTION

It has been shown[1] that if a motor cycle is fitted with an anti-locking braking system, the rider can apply the brakes as hard as he likes on any road surface without the fear of falling off, and also that shorter than usual braking distances can be obtained on slippery surfaces. This note is an attempt to present the economic case for fitting anti-locking brakes to motor cycles. Mopeds (i.e. motor cycles of cylinder capacity less than 50 cc) have been omitted throughout.

2. BENEFIT

2.1 Probable number of accidents prevented

The Laboratory has investigated in detail a small sample (140) of accidents involving motor cycles. From the records of these accidents it is estimated that in about 5 per cent of them it is clear from the data that the rider was thrown off as a result of wheel locking due to brake application. This 5 per cent, which is a conservative figure, would almost certainly not have occurred if the motor cycles had been fitted with anti-locking brakes on both wheels.

A further 50 per cent of the accidents studied would possibly not have occurred if the motor cycle brakes had either been more efficient or had been applied earlier. Now an anti-locking braking system improves the braking efficiency of a motor cycle in the following ways.

1. There is the reduction in stopping distances on *slippery surfaces* which can be obtained with a motor cycle fitted with anti-locking brakes, compared with a standard machine.

2. Many machines are deliberately fitted with front brakes which are not very powerful, because of the risk of locking this wheel, and the application of anti-locking systems would enable more powerful brakes to be fitted.

(3) There is some reason to believe that motor cyclists are very cautious in using their brakes, particularly on slippery surfaces, but if they had confidence that their brakes could be safely applied, they might well use their brakes more freely.

So though in many accidents of this 2nd group anti-locking brakes would have little or no effect it seems reasonable that a small proportion, say 10 per cent, of these particular accidents would have been prevented. This is equivalent to a further saving of 5 per cent of all motor cycle accidents.

It is therefore considered reasonable for estimating purposes to assume that the fitting of anti-locking brakes to both wheels of all motor cycles could save of the order of 10 per cent of motor cycle accidents.

2.2 Cost of motor cycle accidents in 1966

The cost of all accidents in this country involving motor cycles in 1966 has been estimated, and is given below.

There are two types of costs involved in injury accidents. The measurable costs include such items as loss of output, medical costs, damage and administrative costs. Subjective costs are allowances for the suffering and distress which accompany an accident, and can be regarded as costs which the community would usually be prepared to pay in order to avoid the misery involved. The figures used in this report are based on those given in reference 3.

It is assumed that only one motor cycle is involved in each motor cycle accident, and thus the figures which are available for the number of motor cycles involved in accidents[2] can be taken as the number of motor cycle accidents. (This is probably not entirely true but the correction is negligible.)

2.2.1 Injury accidents (measurable costs) The estimated measurable cost of 1966 injury accidents involving motor cycles is given in Table 1. Certain assumptions are made and these are detailed below.

The figures used for costs of accidents in Table 1 are taken or deduced from published work[3,4] but where specific figures for motor cycle accidents were not available or cannot be deduced those for general vehicle accidents were used instead. The following assumptions were made when compiling this table (supporting references are given where possible):-

(a) A fatal accident has on average 1.08 fatal, 0.44 serious and 0.36 slight casualties[3].

(b) A serious accident has 1.17 serious and 0.33 slight casualties[3].

(c) A slight accident has 1.22 slight casualties[3].

(d) The cost of a fatal casualty is taken as £7,600 when the accident does not involve a pedestrian. This figure is assumed, using the published[4] values of £7,625 for a rider and

TABLE I

Measurable cost of injury accident involving motor cycles (including scooters but not mopeds) in 1966

Accident type	Assumed cost per accident (£) (see 2.2.1 for assumptions made)					No. of accidents in 1966	Total Cost (£)
	Casualties	Vehicle damage		Admin	Total		
		m/cycle	others				
Motorcycle and pedestrian							
Fatal	4,440	28	–	38	4,506	202	910,000
Serious	310	28	–	30	368	2,840	1,045,000
Slight	12	28	–	16	56	5,635	316,000
Motor cycle only							
Fatal	8,340	28	–	38	8,406	246	2,068,000
Serious	370	28	–	30	428	4,067	1,741,000
Slight	12	28	–	16	56	7,012	393,000
Motor cycle and one other vehicle							
Fatal	8,340	28	110	38	8,516	651	5,544,000
Serious	370	28	110	30	538	13,678	7,359,000
Slight	12	28	110	16	166	31,104	5,163,000
Motor cycle and two or more other vehicles							
Fatal	8,340	28	275	38	8,681	189	1,641,000
Serious	370	28	275	30	703	1,381	971,000
Slight	12	28	275	16	331	1,974	653,000
					TOTAL	68,979	27,804,000

£7,554 for a pillion passenger. When a pedestrian is injured in the accident, the casualty may be either the motor cyclist or the pedestrian. In this case the cost of a fatality is taken as £4,000, this value being deduced from the published figures for motor cyclists as given above, and that of £3,200 for all fatalities[3].

The economic value of a motor cycle casualty appears much higher than the average cost for all casualties, due to the fact that the age and sex distribution of motor cyclists is different from the average of the population or the average pedestrian. On average the motor cyclist is a young person who would normally have a high economic value to the community. There is no real possibility of differentiating between the economic value of the average motor cyclist of a given age and the average of the whole of the same age group though this could possibly be different.

(e) Using the same principles as in (d), the cost of a serious casualty is taken as £310 when the accident does not involve a pedestrian, and £260 when a pedestrian is involved.

(f) The cost of a slight casualty is £10.

(g) The casualties are all either pedestrians or motor cycle riders and pillion passengers.

(h) The damage to each motor cycle involved is taken as £28[3].

(i) The damage to other vehicles is taken as £110 per vehicle, this figure being assumed from the published[3] values of £127 for cars and £83 for commercial vehicles.

(j) When two or more other vehicles are involved, the average number is taken as 2½.

(k) Administrative costs (police and insurance) are £38 per fatal, £30 per serious and £16 per slight accident[3].

2.2.2 Injury accidents (Subjective costs). It is difficult to express subjective items in monetary terms. Figures have been suggested[3] of £5,000 per fatality and £200 per serious injury; on this basis the total subjective cost of motor cycle accidents in 1966 was about £12,000,000.

2.2.3 Damage accidents The estimated cost of damage only accidents involving motor cycles is given in Table 2.

TABLE 2

Cost of damage accidents involving motor cycles
(including scooters but not mopeds) in 1966

Accident type	Assumed cost per accident (£)			Estimated No. of accidents in 1966	Total cost (£)
	Motor cycle	Other Vehicles	Total		
Motor cycle only	25	–	25	34,000	850,000
Motor cycle and one other vehicle	25	40	65	77,000	5,005,000
Motor cycle and two or more other vehicles	25	100	125	6,000	750,000
			TOTAL	117,000	6,605,000

The following assumptions have been made when compiling this table, again quoting references for the assumption:-

(a) The number of damage accidents is 1.7 times the number of injury accidents[3], this figure being obtained from insurance statistics.

(b) The damage to a motor cycle is £25 per accident[3].

(c) The damage to other vehicles is taken as £40 per vehicle, this figure being assumed from published[3] values of £45 for cars, and £20 for commercial vehicles.

(d) When two or more vehicles are involved, the average number is taken as 2½.

2.3 Total Benefit

Combining the above figures, the estimated cost of all motor cycle accidents in 1966 is about £46,000,000. This figure includes subjective costs in respect of injury accidents.

If 10 per cent of the accidents had been prevented by anti-locking brakes, there would have been a benefit of about £4,600,000.

3. COST

Anti-locking brakes are not yet available for motor cycles, and it is not possible to predict accurately what they will cost. However, using the above figures, we can arrive at the maximum cost which can be economically justified.

The economic benefit per motor cycle is the total benefit in accident costs divided by the total number of motor cycles. In 1966 the total benefit for the year as given in 2.3 above is £4,600,000 and in that year there were about 942,000 motor cycles licensed (excluding mopeds). Thus the benefit per motor cycle in 1966 would have been £5, and this figure can be taken to be the annual benefit.

Using available information[5] it is reasonable to assume the average life of a motor cycle to be of the order of eight years. Using this figure, the benefit to a motor cycle throughout its life will be £40. If we include a discount rate of 8 per cent over the period, then, for the cost to be no greater than the benefit, anti-locking brakes should not cost more than about £30 per machine.

4. CONCLUSIONS

1. If all motor cycles (excluding mopeds) were fitted with anti-locking brakes on both wheels, and these brakes were maintained in working order, it is roughly estimated that about 10 per cent of motor cycle accidents might be prevented.

2. This would result in an estimated saving to the country of about £5 million per annum taking into account both measurable and subjective costs. (Estimates were made of the possible effect on the 1966 accidents when the benefit was estimated as £4,700,000.)

3. In order that the cost should not exceed the benefit, anti-locking brakes should not cost more than about £30 per machine.

5. REFERENCES

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