Fire Research Note No. 618

VEHICLE FIRES ON THE M. 1 MOTORWAY, 1964

by

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SUMMARY

In 1964 fire brigades attended 96 fires on the M. 1 motorway and its associated roads, the M. 10 and M. 45. Not counting incidents in service areas or on slip roads, this represents an annual rate of incidence of 0.7 fires per Km (or 1.1 fires per mile) which compares unfavourably with fire incidence rates on other roads. Fires were more likely on predominantly downhill sections of the road and on the middle section of the road, notably in Buckinghamshire: they were not so frequent in Hertfordshire, the section with the greatest traffic density.

Sixty-two of the fires were in lorries and tankers, 25 of these being attributed to tyre friction. Cars accounted for twenty-five incidents, of which 13 were due to electrical faults. Since cars and light vans were more numerous on the motorway than lorries, the figures show clearly that the fire risk on the motorway is greater with lorries than with ordinary motor cars.

Firefighting could not always be carried out immediately, for often the appliances had a long journey from the fire station to the scene of the fire. In 24 incidents the fire had been extinguished before the arrival of the brigade. Of the remaining 72 incidents, 52 needed the use of hose reel jets, while power pumps and hydrants were utilised on 18 occasions.

Rescues, escapes or casualties were a feature of 6 incidents. Three 'buses were evacuated. In the year there were one fatal and seven non-fatal fire casualties.

MINISTRY OF TECHNOLOGY AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

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Introduction

The annual frequency of fire brigade attendances at fires involving road vehicles in Great Britain has been increasing since 1952 and is now of the order of 12,000[1,2] : these fires occur on about 322,000 Km (about 200,000 miles) of all roads[3], classified and unclassified.

The extension of the network of motorways in Great Britain has continued since the opening of the Preston By-Pass in December 1958 and the first section of the London to Birmingham Motorway (M. 1), with its associated roads, the M. 10 and the M. 45, from Watford (Herts) to Crick (Northants) in 1959 (See Fig. 1). These two sections comprised some 130 Km (about 80 miles) of motorway; by the end of 1964 there were just over 500 Km (about 310 miles) of motorway in use in Great Britain. Firefighting on these roads presents a number of problems. Motorways generally traverse rural areas, interchange points are sometimes as much as 16 Km (about 10 miles) apart and emergency telephones are spaced at 1.6 Km (one mile) intervals. It is therefore of interest to examine the records of vehicle fires on the motorways.

This investigation is based on an analysis of all reports received from fire brigades on fires involving road vehicles on the M. 1 and its associated roads in 1964.

Location of fires

Table 1 shows the location of fires in relation to the brigade area and the length of motorway open in the area at the beginning of 1964. The lengths shown in brackets are those of the Crick (Northants) - Lutterworth (Leicestershire) extension, opened on 1st October 1964. The sections of the road are also shown diagrammatically in Fig. 1.

Table 1: Brigade area and location of fire

Brigade	Location				Total	Length of motorway		Annual fire frequency*	
	Northbound carriageway	Southbound carriageway	Service areas, slip roads	Not stated unknown		Km	miles	per Km	per mile
Hertfordshire	4	9	2	-	15	24	15	0.54	0.87
Bedfordshire	14	5	3	-	22	31	19	0.61	1.00
Buckinghamshire	8	5	4	3	20	16	10	1.00	1.60
Northamptonshire	4	24	4	3	35	39 (2)	24 (1)	0.78	1.26
Leicestershire and Warwickshire	-	-	1	3	4	6 (9)	4 (6)	0.36	0.59
TOTAL	30	43	14	9	96	116 (11)	72 (7)	0.69	1.11

*Calculated on the assumption that the new section (lengths shown in brackets) was open for three months of the year, and neglecting fires in service areas and on slip roads.

Gradients are generally not steeper than about 1 in 25 on motorways, but it is interesting to notice that in Bedfordshire, fires occur more often on the northbound carriageway, which is predominantly downhill, whereas in Northants, fires are more liable to happen on the southbound carriageway, also mainly downhill. It appears from this that fires are more frequent on downhill sections, where speeds are likely to be highest. Table 1 also shows that fires are more likely to occur on the middle section, through Buckinghamshire, than on other parts of the motorway. It has, however, been shown[4] that the average daily traffic flow at the Friars Wash Interchange, Hertfordshire (M1/A5) is greater than that near the Newport Pagnell Service Area, Buckinghamshire. It is possible that the more dense traffic in Hertfordshire results in lower average speeds.

If it is assumed that the M. 1 is representative of all motorways open in 1964 there would be an annual expectation of about 390 fires involving road vehicles on motorways, or about 340 if fires in service areas or on slip roads were excluded. There are about 322,000 km (45,300 miles) of road classified "A" or "B" by the Ministry of Transport.[3] There were 11,528 fires involving road vehicles (internal combustion engine) in Great Britain in 1964.[2] On the assumption that they all occur on class "A" or "B" roads, the fire incidence rate per annum per kilometre of road would be 0.16 (or 0.26 per mile), which is less than one quarter of that on the M. 1 motorway. Hence fire frequency for a given length of road is higher on motorways than on other roads.

Types of vehicle involved in fires

Fire brigades attended 96 vehicle fires on the M. 1 in 1964 of which 62 (nearly 65 per cent) involved lorries, and 25 (or 26 per cent) involved cars and light vans; the remaining 9 per cent were in buses, mini-buses (6 per cent) and other vehicles (3 per cent). From Table 2 it can be seen that lorries and tankers constitute about 37 per cent of the vehicles using the motorway, and cars and light vans about 61 per cent, so that a lorry is roughly 4 times as likely to have a fire as a car.

Table 2: Types of vehicle using the motorways at different times of year

(R.R.L. figures based on study at Newport Pagnell)

Month	Type of vehicle as percentage of total vehicles			
	Car, light van	Lorry, tanker	Bus, minibus	Other
January	54.2	45.1	0.5	0.2
April	62.3	35.7	1.3	0.7
July	65.6	31.2	2.1	1.1
October	63.4	34.8	1.1	0.7

In 1964 there were about 12.3 million vehicle for licenses in existence[5] of which about 67 per cent were for cars and 17 per cent for goods vehicles.

Relating these figures to the frequencies of fires in vehicles on all roads (cars, etc. 50 per cent and lorries, etc. 28 per cent) shows that the likelihood of a fire in a lorry is about twice that of a fire in a car. It appears, therefore, that the relative fire hazard of lorries is considerably greater on the motorway than on roads in general.

Times of occurrence

Fires tend to be least frequent in the summer months. Of the 96 fires in 1964, only 10 occurred in July and August.

Only 5 of the fires occurred on Sundays. Sixty-two of the incidents (nearly 65 per cent) involved lorries; these are generally less used at weekends, but, according to the Road Research Laboratory[4], their usage does not vary greatly with time of year (Table 2). Traffic density at weekends is more variable according to time of year - hence driving at weekends can be expected to be slower in summer than in spring and autumn. Several weather factors, such as fog and snow are liable to affect speeds of driving in the winter.

The daily frequencies of fires in different types of vehicle are shown in Table 3, and the frequencies at different times of day (all vehicles) in Table 4.

Table 3: Day of Week and type of vehicle

Day of week	Type of vehicle				TOTAL
	Car, light van	Lorry, tanker	Bus, minibus	Other	
Sunday	2	1	1	1	5
Monday	-	15	-	-	15
Tuesday	4	9	-	1	14
Wednesday	3	8	-	-	11
Thursday	3	13	-	-	16
Friday	2	14	-	-	16
Saturday	11	2	5	1	19
TOTAL	25	62	6	3	96
Percentages	26.0	64.6	6.3	3.1	100.0
All fires in road vehicles in Great Britain, 1964. TOTAL	5 776	3 238	188	2 326	11 528
Percentages	50.1	28.1	1.6	20.2	100.0

Table 4: Time of day of call in relation to traffic density

Time of day of call	No. of fires	Percentage of traffic*
00.00 - 02.59 hours	10	3.9
03.00 - 05.59 hours	10	3.1
06.00 - 08.59 hours	14	11.8
09.00 - 11.59 hours	16	19.5
12.00 - 14.59 hours	10	16.6
15.00 - 17.59 hours	10	19.2
18.00 - 20.59 hours	15	16.2
21.00 - 23.59 hours	11	9.7
TOTAL	96	100.0

*Based on R.R.L. study of usage at Newport Pagnell (ref. 4)

It can be seen from Table 3 that lorry fires are fairly evenly distributed from Monday to Friday, but about half of the incidents involving cars and buses occur on Saturdays.

Table 4 offers slight evidence that fires are more frequent between 06.00 and 11.59 hours, but this is not conclusive. It is possible that this is one of the periods of the day when commercial vehicles, which have a higher fire risk than private cars, do a substantial portion of their mileage.

Types of vehicle involved and causes of fires

The type of vehicle involved is related to the cause of fire in Table 5.

Table 5: Cause of fire and type of vehicle

Cause of fire	Type of vehicle involved				TOTAL
	Car, light van	Lorry, tanker	Bus, minibus	Other	
Collision	2	1	1	-	4
Electrical faults	13	4	1	1	19
Friction:					
(i) due to braking	1	5	-	-	6
(ii) due to flat tyres, etc.	2	25	-	-	27
Oil leak (not due to collision)	1	2	1	2	6
Overheating (no further information given)	3	14	-	-	17
Smoking materials	-	6	-	-	6
Other	3	2	-	-	5
Unknown	-	3	3	-	6
TOTAL	25	62	6	3	96

It is noticeable that friction due to braking, flat or under-inflated tyres (or foreign matter caught between tyres) is the largest single known cause of fires on the M.1; it is also an important cause in all fires involving road vehicles[1]. Electrical faults account for over 50 per cent of the fires in cars and light vans: these fires are generally small. Smoking materials dropped onto lorry tarpaulins, sometimes by motorists, accounted for six fires.

There is no discernable seasonal variation in the causes of fire other than tyre friction, the principal cause, (accounting for 28 per cent of the fires) which occurred mainly in the early and late periods of the year (see Table 6).

Table 6: Cause of fire and time of year

Cause of fire	Two-month periods						TOTAL
	January, February	March, April	May, June	July, August	September, October	November, December	
Collision	1	-	-	-	1	2	4
Electrical faults	1	3	5	3	6	1	19
Friction							
(i) due to braking	1	1	-	-	2	2	6
(ii) due to flat tyres, etc.	10	6	3	-	3	5	27
Oil leak (not due to collision)	-	2	2	1	1	-	6
Overheating (no further information given)	3	2	2	4	4	2	17
Smoking materials	-	1	1	1	2	1	6
Other	2	1	1	-	1	-	5
Unknown	1	1	-	1	2	1	6
TOTAL	19	17	14	10	22	14	96

Fire brigade attendance times

It is not always easy for a fire brigade to get quickly to a motorway incident. Interchange points can be as much as 16 km (about 10 miles) apart (see Fig. 1); emergency telephones are spaced at intervals of 1.6 km (one mile) and fire stations tend to be widely spaced in the areas through which the M. 1 motorway passes. The attendance time (i.e. period between call and arrival) at fires is shown in Fig. 2, from which it can be seen that, despite the difficulties, the bulk of the fires were attended in periods between 6 and 15 minutes: the mean time was about 12 minutes. There were, however, several times greater than 15 minutes and, in one incident, difficulty in locating the vehicle resulted in an attendance time of 35 minutes.

Table 7: Cause of fire in relation to method of extinction

Cause of fire	Method of extinction by fire brigade								Total
	No firefighting	Tackled and extinguished before arrival of brigade	Tackled before arrival of brigade			Not tackled before arrival of brigade			
			Small means	Hose reel jets	Power pumps, hydrants	Small means	Hose reel jets	Power pumps, hydrants	
Collision	-	1	-	-	-	-	1	2	4
Electrical faults	3	9	-	2	-	1	3	1	19
Friction:									
(i) due to braking	-	1	-	2	-	-	2	1	6
(ii) due to flat tyres etc	-	1	-	5	-	-	15	6	27
Oil leak (not due to collision)	1	1	-	1	-	-	2	1	6
Overheating (no further information given)	2	4	1	2	1	-	6	1	17
Smoking materials	-	-	-	2	1	-	2	1	6
Other	-	1	-	-	-	-	4	-	5
Unknown	-	-	-	2	1	-	1	2	6
TOTAL	6	18	1	16	3	1	36	15	96

Method of extinction

The methods used to extinguish the fires are shown in relation to the causes in Table 7.

The Table shows that 24 fires were extinguished or burnt out before the fire brigade arrived. Another 20 were tackled before the brigade arrived, of which only 3 (15 per cent) needed the use of power pumps and hydrants. Of the remaining 52 incidents, fifteen (i.e. 29 per cent) required the use of power pumps and hydrants, which is indicative of the value of an early attack on the fires and the advisability of carrying portable extinguishers.

The nineteen electrical fires, which were mostly in cars, were generally small and twelve of these were extinguished before the arrival of the fire brigade. In contrast, only one of the fires due to tyre friction did not need the attention of the brigade.

Table 8, which shows the type of vehicle in relation to the method of extinction, indicates that, not only were the lorry fires more numerous than fires in other vehicles, but that they tended to be larger.

Table 8: Type of vehicle in relation to the method of extinction

Type of vehicle	Method of extinction by fire brigade								TOTAL
	No firefighting	Tackled and extinguished before arrival of brigade	Tackled before arrival of brigade			Not tackled before arrival of brigade			
			Small means	Hose reel jets	Power pumps, hydrants	Small means	Hose reel jets	Power pumps, hydrants	
Car, light van	5	9	–	3	–	1	6	1	25
Lorry	1	8	1	11	2	–	27	12	62
Bus, minibus	–	–	–	1	1	–	2	2	6
Other	–	1	–	1	–	–	1	–	3
TOTAL	6	18	1	16	3	1	36	15	96

Damage to vehicles

To assess damage involved a certain amount of subjective analysis of the reports. In 53 incidents, the damage was fairly small and in a further 18 incidents it was moderate. The remaining 25 incidents resulted in serious damage or complete destruction of the vehicle. In one of these incidents a car and a lorry were in collision, hence two vehicles became involved in the fire. In another four of the more serious incidents, the fire spread to the road surface or the grass verge.

Casualties, Rescues and Evacuations

Six incidents involved fire casualties, rescues or evacuation. Three buses had to be evacuated when they became on fire; in one of these, three people suffered slight burns; all of these three incidents occurred in July. In a fourth incident a person was rescued from a crashed minibus having suffered minor injuries. In the fifth incident three people sustained severe burns when their van caught fire and were detained in hospital.

The sixth incident, when a car was in collision with a lorry, was, perhaps, the most serious. The car was severely damaged and its occupant died from asphyxiation and severe burns.

Information published by the Road Research Laboratory[6] shows that there were 42 fatal and 579 non-fatal casualties in 1964 on the M. 1 and its associated roads. Fire casualties in 1964 were one fatal and seven non-fatal.

Discussion

The average annual frequency per mile compares very unfavourably with other roads and there is a suggestion that with greater speed there is a greater risk of fire. This was particularly noticeable with lorries which travel appreciably faster than on other roads. The large number of fires attributed to tyre friction on lorries stresses the importance of keeping tyres at their correct pressure and free of grit, particularly in winter. The extent to which tyre friction is associated with the twin tyres fitted to many heavy vehicles is not known, but there is certainly a possibility of friction when tyres of this type are under-inflated. The increase in pressure which occurs in hot weather is a possible explanation of the difference between the summer and winter frequencies of fires due to tyre friction.

The rural nature of the M. 1, and the consequent high brigade attendance times, suggests that it might be a good idea to construct some emergency slip roads solely for the use of the fire brigade and other emergency services. The carrying of portable extinguishers by vehicles would facilitate the early extinction of fires and the possibility of providing road-side hydrants might be considered.

Conclusions

There were 96 fires on the M. 1 motorway and its associated roads M. 10 and M. 45 in 1964; of these 14 occurred in service areas or slip roads. This represents an average annual frequency of 0.69 fires per km (1.11 fires per mile) of road if fires in service areas or slip roads are excluded. Fires occur more often on downhill sections of the motorway and the highest frequency per mile is in Buckinghamshire. Fires are not so frequent on the sections with the greatest traffic density, i.e. in Hertfordshire.

Tyre friction accounted for 27 incidents, 25 of which involved lorries. Electrical faults accounted for 19 incidents, 13 of which involved cars.

On account of the rural nature of the districts traversed and the distances between interchanges on the M. 1, the average attendance time of the fire brigades was about 12 minutes. Twenty-four of the incidents did not require brigade attention; of the remaining incidents, two were put out by small means, 52 were extinguished by hose reel jets, the remaining 18 necessitated the use of power pumps and hydrants.

Six incidents involved fire casualties, rescues or evacuation of vehicles; three of these involved buses. There were one fatal and seven non-fatal fire casualties in 1964.

References

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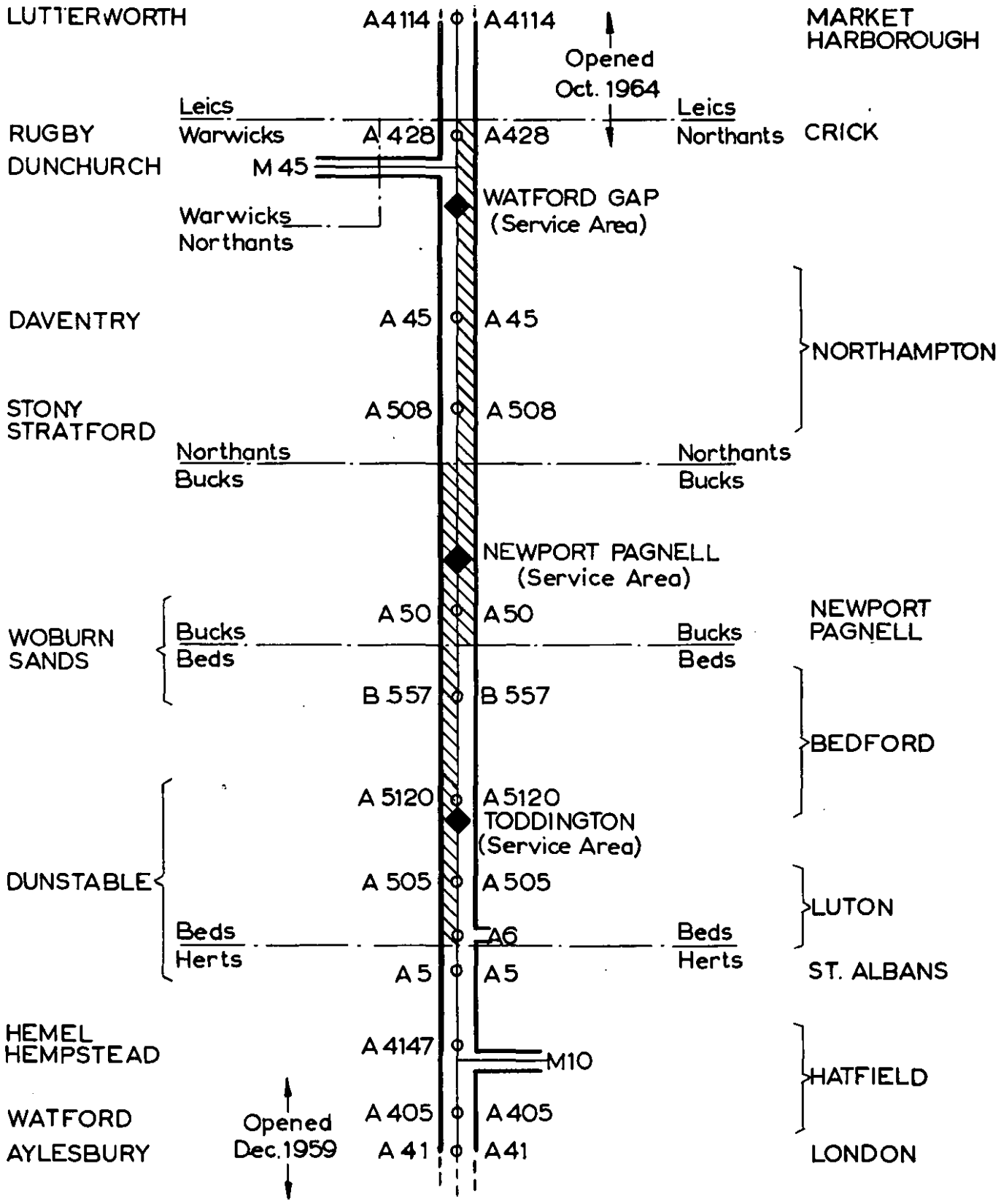
6. Road Research 1964. Ministry of Transport Road Research Laboratory, H.M.S.O., London, 1965.



The M.1. has now been extended as far north as Castle Donnington - near Derby

(Opened November 1959 unless shown otherwise)

FIG. 1. DIAGRAMMATIC MAP OF THE M.1. AND ASSOCIATED ROADS

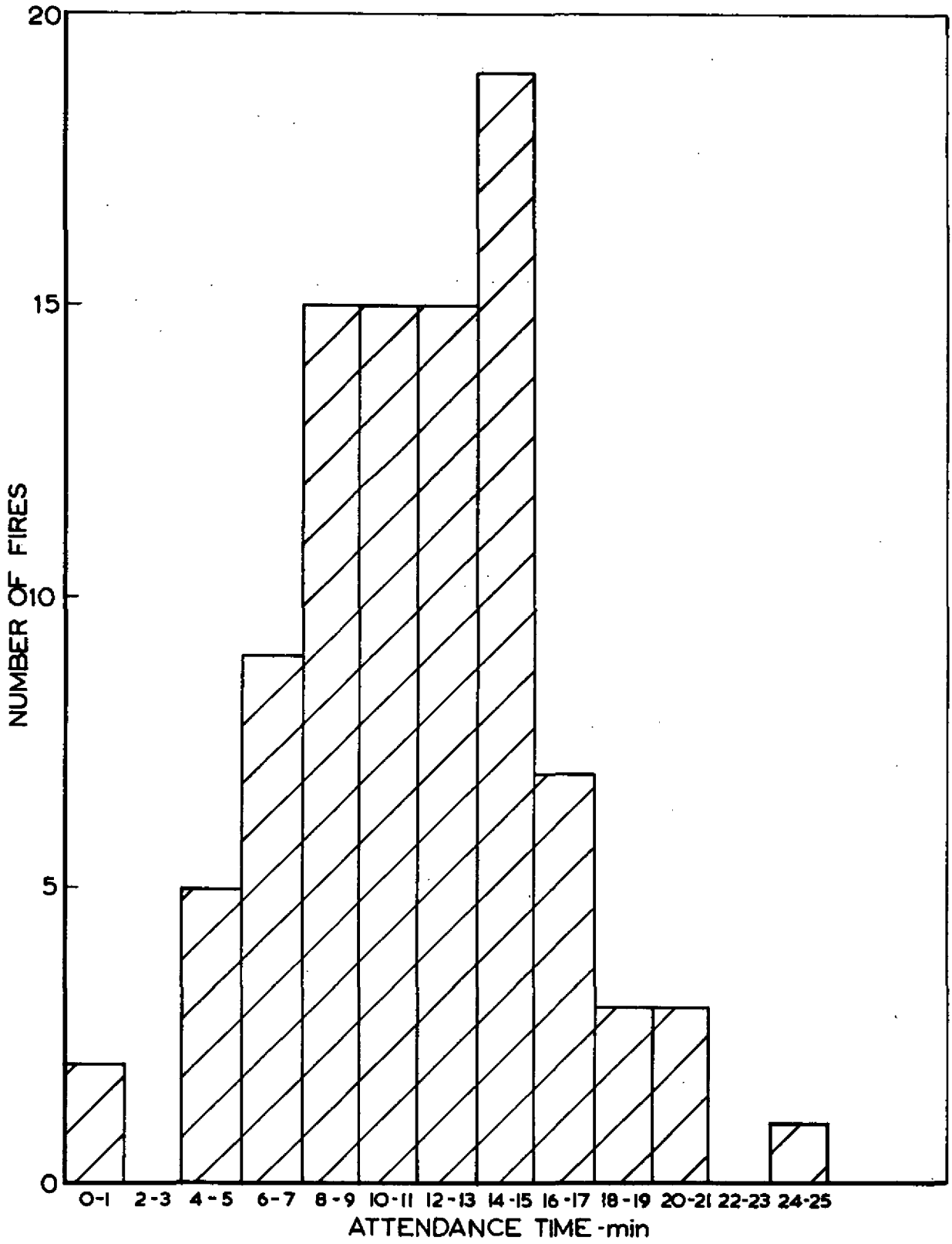


FIG. 2. ATTENDANCE TIMES AT FIRES ON THE M.1. MOTORWAY, 1964