REAR-END COLLISIONS AND CLOSE FOLLOWING

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1. INTRODUCTION

Although, the consequences of the rear-end collisions are usually not so serious, this type of accidents presents a big problem on Croatian roads, due to its frequency; Almost one-fifth on the whole and one-third in urban areas, of all traffic accidents are just rear-ends.

The majority of them occur between 10a.m. and 6p.m., accordingly to the traffic flow frequency, and (by the way) in quite oposition to the presence of alcohol in drivers' blood; (Figure 1).

(Figure 1)

The majority of rear-end collisions in urban areas occur at crossroads - about two thirds. Almost half of them take place at signalised crossroads, which could be related to our findings previously found at the same kind of crossroads; (Gledec, 1996), i.e.

- the far most frequent type of accidents are rear-end collisions,
- amber light is very often too short (3 seconds on crossroads with speed of 60 km/h),
- accident risk is generally higher at the crossroads witout blinking green, than at those with blinking green.

In accordance with the above mentioned, it can be stated that the rear-end collisions are not quite "untied to area". But obviously, certain technical inconveniences are neither exclusive nor the main cause of their happening.

The origin of each accident is of course wrong behaviour. It is very logical to assume that the short time headway - as a wrong behaviour too - is playing an important role in causing rear-end accidents.

A recent Finish investigation by Rajalin and others (Rajalin, Hassel, Summala, 1997) found the relationship between the tailgating and increased number of traffic violations and also guessed "tailgating drivers" as more risky.

In our former preliminary investigation it has been found that the share of drivers following the predecessors on urban roads at time headway less than a second is between 10 and 39 %; (Gledec, 1997).

2. PROBLEM

To investigate and to state, at least at the level of indication, if the tailgating objectively indicates an increased accident risk; if there is any relationship between the time headway and accident risk and (serious) traffic violations.

3. WORKING METHOD

3.1. Data collection method

1. Field observation - recording of time headway

Field observation of vehicles' time headway have been performed on three different roads of urban road network, in all other similar conditions. All roads were dual carriageways, with speed limits 70 or 80 km/h.

The time headway of some vehicle was determined by using the stop watch in-built in "minispeed" equipment and its recording has been saved together with the video picture on the video tape, for further connecting of that time with the register plate of the vehicle. All that equipment is called "Travimo" and is installed in a civil car, almost quite unrecognisible to the drivers. So the recorded headways were the real ones in traffic flows.

As the stopping of the vehicles on the spot has not been done, the identity of driver was not established. Instead of that, the assumption that the vehicle's owner is the driver is established this way. Of course it could be rather doubtful asumption, but inevitable in given circumstances. Obviously, such assumption has certain influence on the validity of the results, which has to be kept in mind interpreting the final results.

Of interest here were the time headways less or equal of two seconds. Otherwise, it has not been regarded as a following. So, only such time headways, related with the corresponding registration number, have been included in the sample for further analysis. This way total sample of 297 time headways was collected. Stratified by the certain critical levels it was the following :

- < .8 seconds ..... 43 %,
- > .8 and <=1 second ..... 21 %,
- > 1 second ..... 36 %.

Such sample is the consequence of greater interest for shorter headways than for the longer ones, therefore it does not reflect the real distribution of time headways in traffic flow.

For the further analysis it was necessary to determine the identity of the driver. As the stopping of the vehicles on the spot was not carried out, drivers identification had to be done in some other way. Due to that certain part of sample is lacking for those vehicles

whose owners were not private persons. Because of that sample was further reduced; (to 210 cases with the very similar proportion concerning mentioned critical levels.)

2. Penalties data collection

The national data base of penalties and demerit points in traffic contains relevant data only for the last year - from the july of 1996. (Demerit system point was established here by the new Road Traffic Safety Act, stated on the beginning of July, 1996.) Unfortunatelly, there is no complete information in data base of all road traffic violations made by a certain driver and about the fines paid for them. Due to that, the idea of collection the data on the penalties has been abandoned. The mentioned data base contains only the total number of demerit points - representing of course only those more serious, as prescribed by the Act, (By the way, about 60 road traffic violations are followed by the demerit points).

Fortunatelly, during this investigation, re-checking of the driver - on the repeated driver exam - with at least 7 demerit points in a period of 24 months, has not started yet. Naimely, demerit points are deleted after successfully passed driver exam.

The key for data base retreiving was the " personal identification number" of an (assumed) driver, that has been read from the national vehicles' data base.

There were 25 drivers (12%) with the demerit points, in the span from 1 to 4.

3. Accidents data collection

The national data base of traffic accidents and their participants, established in the present form, covers the time period of only the last two and half years - beginning with 1995. This data base retrieved by the unique personal number of the driver. For the reasons of simplicity, only the data on the role of participant in accident is consulted. All other data (type of accident, consequences, ...) were omitted. This way it was found out how many accidents each driver have had in the last two and half years.

There were 40 drivers (19%) with accidents; one or two.

3.2. Data processing method

Statistical analysis of all collected data has been performed by using the STATGRAPH package. For making the graphs of final results the same programme has been used, as well as the programme of HG.

4. RESULTS

As stated earlier, the identity of the driver in the vehicle owned by a non-private person had not been stated so that these data had been omitted from the sample in further

processing. But it could have had possible influence on the sample pattern if, for instance, the drivers of the non-private vehicles had operated the vehicles in a different way.

The comparison of these two groups of drivers did not show significant differences in time headways. Therefore, we can come to the conclusion that the drivers are similar to each other; (T-value was 1,308). In other words, the sample reduced this way did not changed its pattern.

The distribution of all headways is shown in Figure 2. It has to be stressed that it is not the real distribution of time headway in traffic flow, because the shorter headways were of primary interest.

(Figure 2)

Figure 3 shows the distribution of the shortest headway - up to 1 second. As it can be seen, the most frequent ones are the headways of 0.6 seconds. There are even those of only 0.2, as it can also be seen.

The possible relationship between the headways and traffic accidents on one hand, and number of demerit points on the other was sought by the regression analysis. The results did not indicate any relationship between the headways and the indicators of danger, which was not surprising because of the small values and demerit points, and especially the accidents.

But it does not mean that some particular tendencies are quite impossible (that might be relevant if the sample would be greater). In that sense the distributions of the headways for particular levels of the dependent variables have been compared. Namely, it was of interest to see whether the headway distributions for the drivers

- without accidents,
- with one accident, and
- with two accidents,

were similar or different in certain elements. If the headway distribution for drivers without accidents is similar to those with accidents, the time headway could hardly be indicator of the real danger, and vice versa.

The concordance of headway distributions for different levels of demerit points - from 0 to 4 - was also analysed.

Figure 3 shows the shortest headway distributions for different number of accidents. Although all of them are rather similar, it seems that certain differences do exist. In the group of drivers without accidents there are quite a lot of them with the headway of one second. In the group of drivers with one accident, the same headway is much less present, and in the group of two accidents there is almost none.

(Figure 3)

Drivers with very short headway of 0.3 seconds are exclusively those with (one) accident. The drivers with two accidents, though rare (only 2 % of all and 13 % in group of "accidental" drivers) are exclusively those with the headways from 0.5 to 0.7 seconds).

When all the headways are being observed simultaneously, the picture is not changed, except for the fact that in the group of drivers with one accident the most frequent are those with the headway of 1.3 seconds that is surprising; (figure 4).

(Figure 4)

Figure 5 presents the headway distributions for the different levels of demerit points - from 0 to 4.

(Figure 5)

The drivers with headway of 1.6 seconds are present in the groups with demerit points with much less proportion. It has to be noted that in the groups of drivers with 3 and 4 demerit points are only the drivers with the shortest headways - 0.3 - 0.6 seconds.

It seems that the biggest discordance exists in the shortest headways - less than a second; (figure 6). The drivers without demerit points quite differ from those with points. In the group without points there are plenty of very short headways, but also those with the proper headways - of 0.9 and 1 second. In the group of drivers with one point there is the dominance of shorter headways; in the groups of drivers with 3 or 4 points that is even more present. In the group of 2 points more present are those with proper headways.

(Figure 6)

The possible relationship between the number of demerit points and traffic accidents was sought by regression analysis. None relevant relationship has not been found. In accordance with those results, it could hardly be said that the number of demerit points is valuable indicator of driver's danger. Of course, all the previously mentioned limitations must be kept in mind here.

5. DISCUSSION

Several important things must be taken into account when discussing the results shown before. First, data sample was rather small and limited and uneven relating to the different levels of the variable of primary concern. Further, it was assumed that the driver and vehicle's owner are the same person, which is of course false assumption in a certain way.

Also, the short period of time of accidents happening that was taken into consideration was of certain influence. Primary dependent variable had to be the accident risk - the number of accidents related to the driver's exposure to risk. Since the data on the exposure are doubtful in general - and especially here, where identity of the driver was

not exactly determined - it was further assumed that all the drivers - or at least the drivers at the same level of time headway - had the similar exposure to risk.

Also, all of the accidents for the certain driver were analysed, and not only the rear-end collisions, despite the fact that rear-ends are of primary interest. Otherwise, the sample of data would have been diminished additionally, and so quite improper for any analysis.

With regard to all of the mentioned limitations and assumptions, the reached results can only be the indication of and orientation for the considered issue. That investigation should accordingly be regarded as the preliminary one.

Having all this mind, it is even surprising that the previous results are as they are - rather consistent and balanced. For the time being they are showing mostly that tailgating does not indicate greater inclusion in traffic accidents or increased accident risk. It seems that tailgating indicates in a way a greater proneness to more serious traffic violations. If so, the question arises on the nature of relationship between the serious traffic violations and accident risk.

Anyway, there are more questions than answers, showing at least that the further investigations in this field have to be done, more comprehensive and more precise.

6. CONCLUSION

On the basis of the results of this preliminary analysis on time headways and its indicativeness for accident risk it could hardly be said that short time headway is relevant for happening of traffic accidents and increased accident risk. Anyway, much more investigations in that field is needed for more resolute conclusions.

7. REFERENCES

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2. Rajalin, S., Hassel, S.O. and H. Summala : Close-following Drivers on Two-lane Highways, Accident Analysis and Prevention, (will be published in 1997).

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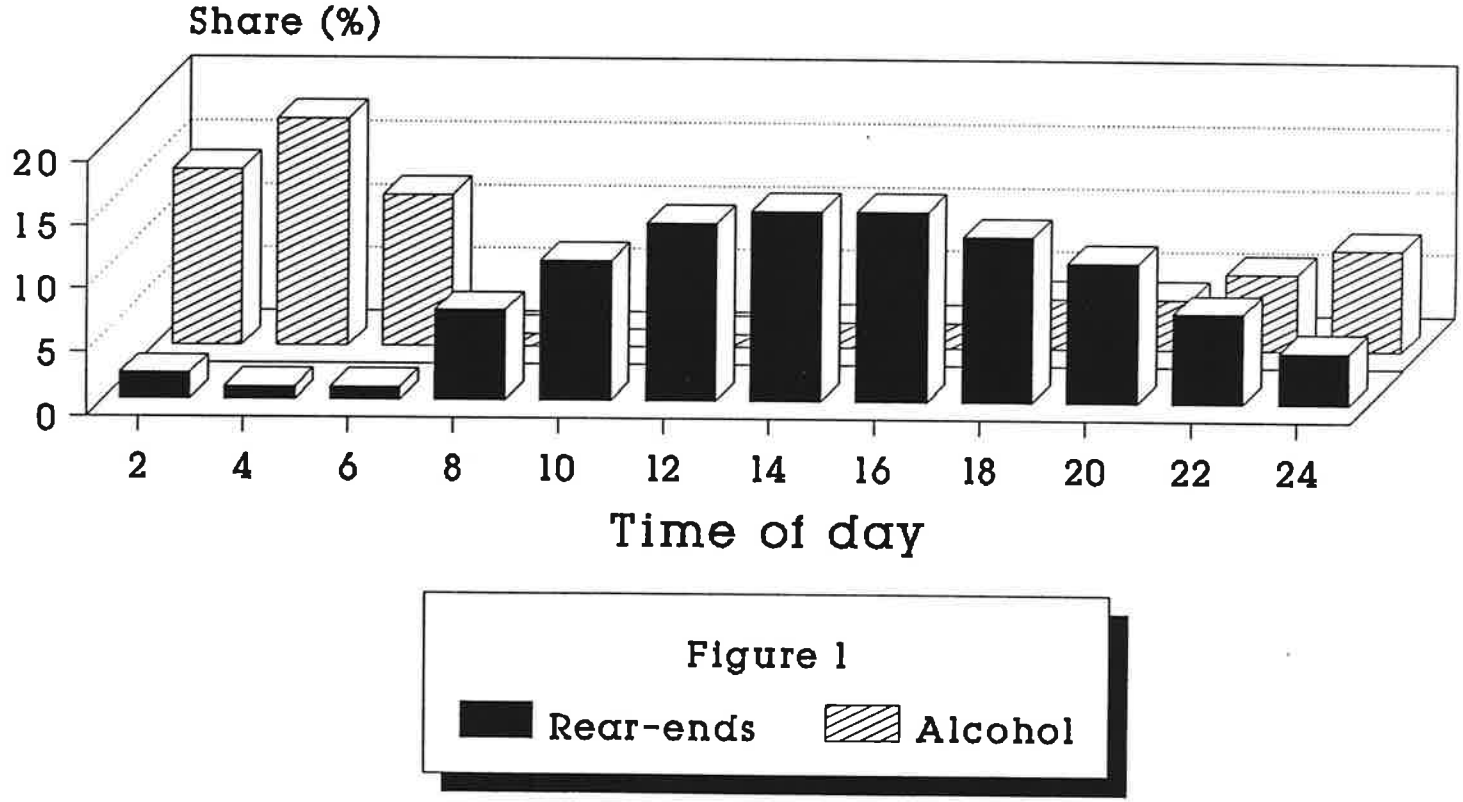
REAR-END COLLISIONS
AND PRESENCE OF ALCOHOL IN THEM
(TIME DISTRIBUTION)



CROATIA, 1996.

Figure 2 HEADWAYS DISTRIBUTION
(HEADWAYS <= 2 SECONDS)

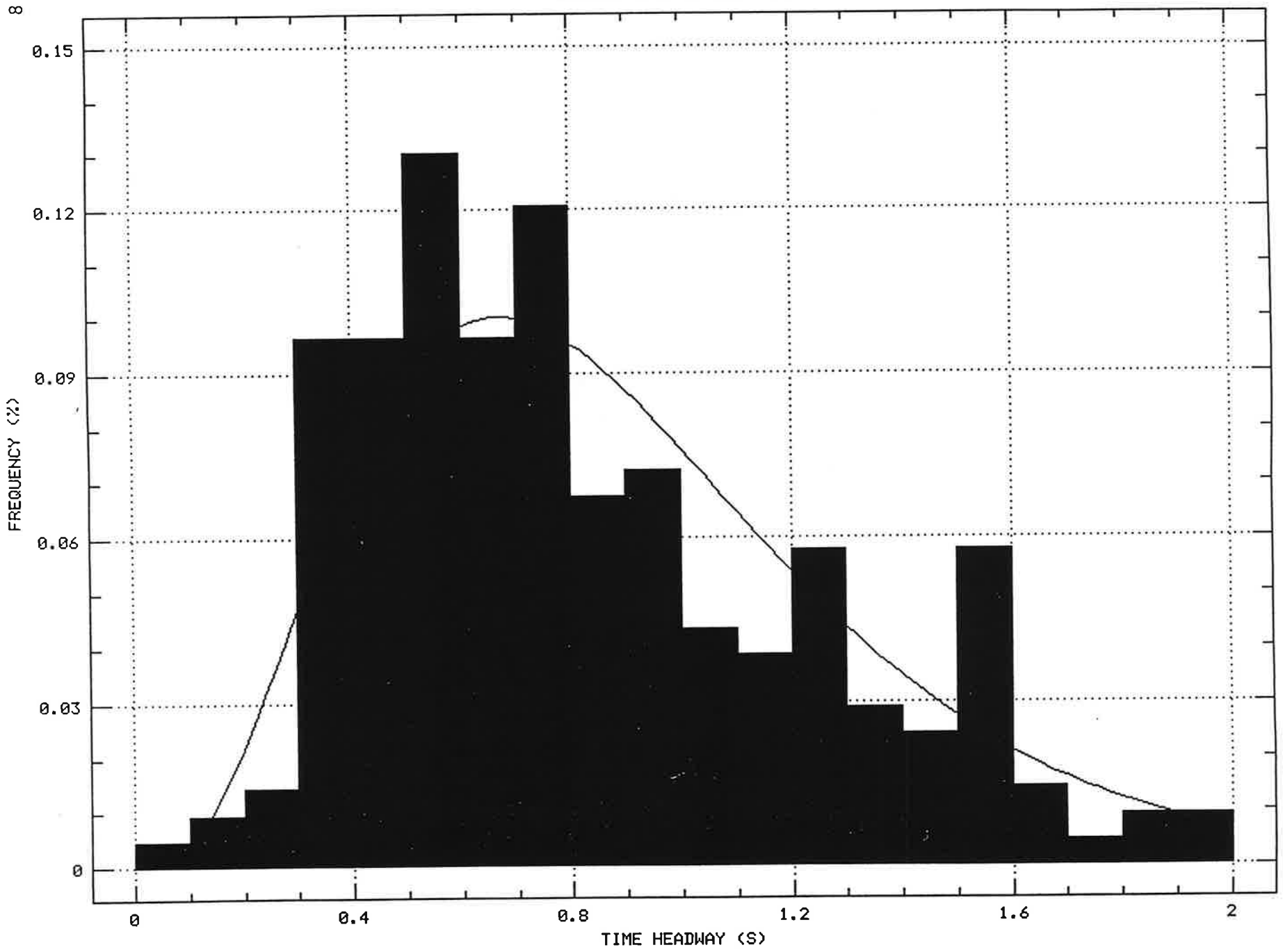


Figure 3 HEADWAYS AND ACCIDENTS
(TIME HEADWAYS <= 1 SECOND)

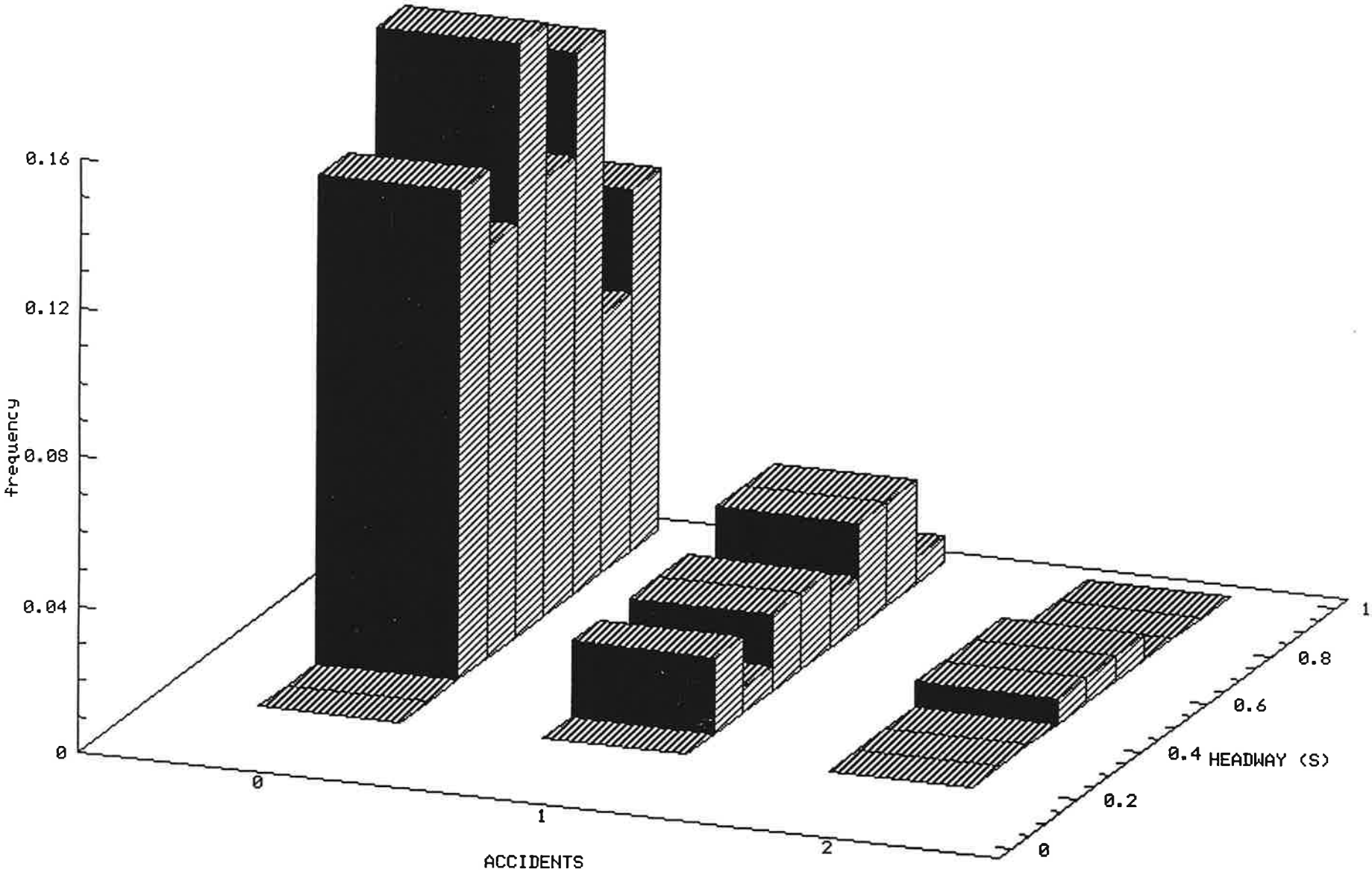


Figure 4 HEADWAYS AND ACCIDENTS
(TIME HEADWAYS <= 2 SECONDS)

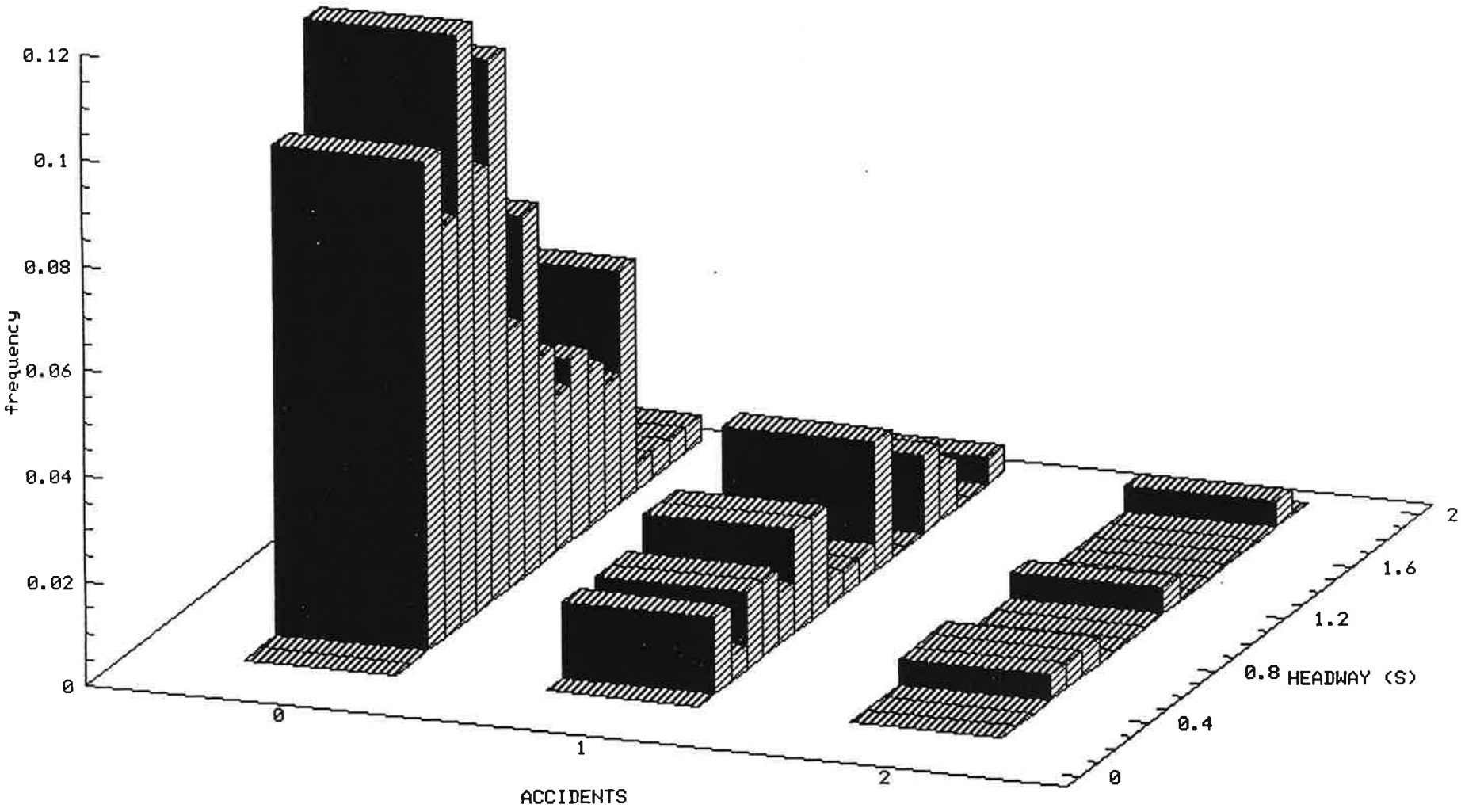


Figure 5 HEADWAYS AND DEMERIT POINTS
(TIME HEADWAYS <= 2 SECONDS)

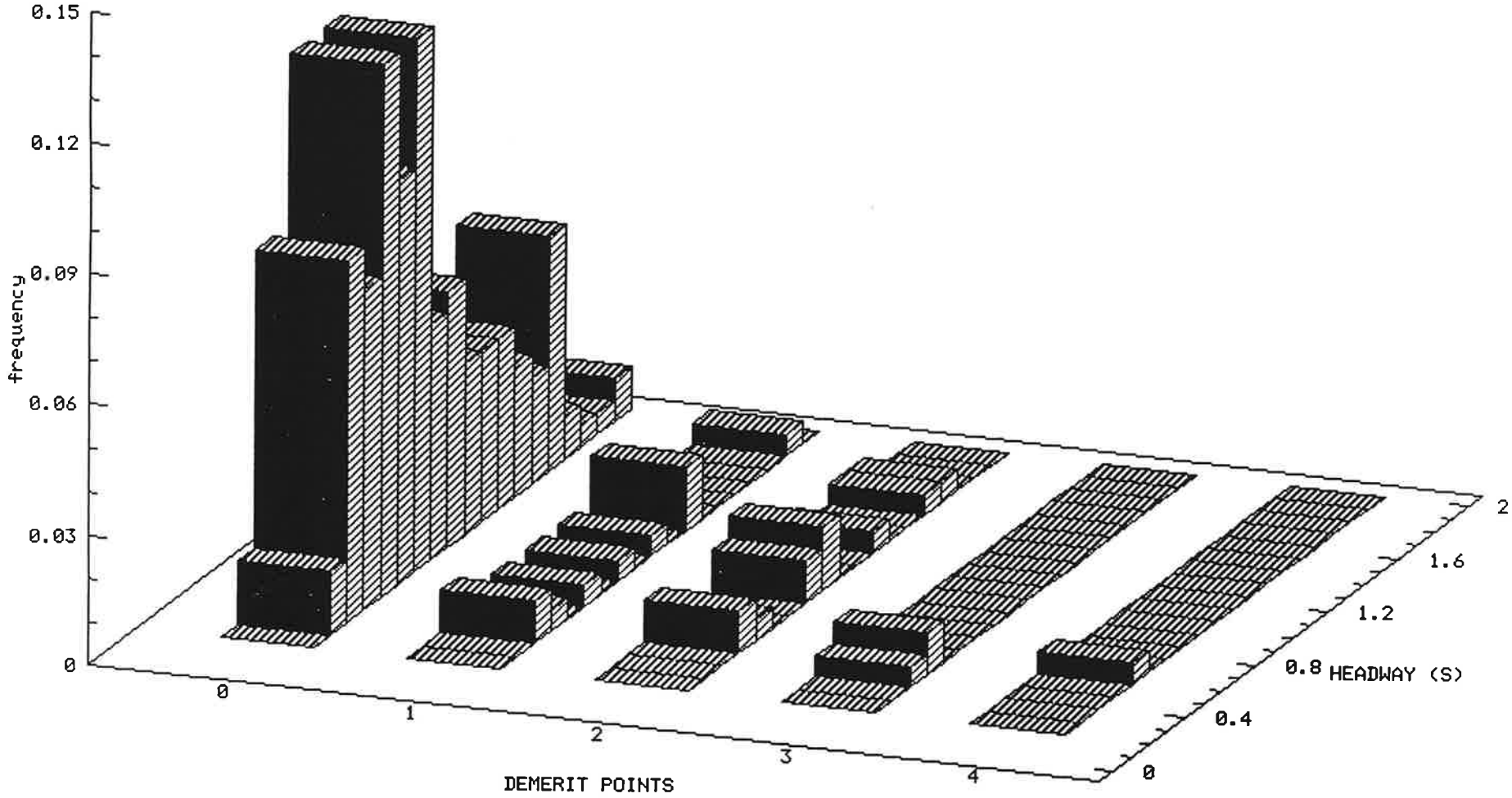


Figure 6 HEADWAYS AND DEMERIT POINTS
(TIME HEADWAYS <= 1 SECOND)