RÅDET FOR TRAFIKSIKKERHEDSFORSKNING

AKADEMIVEJ BYGNING 371 2800 LYNGBY TLF. (02) 88 53 00 GIRO 6548644

Case No. 4.1.2 (Choice of lighting)
Working paper No. 2

Effect of motor cyclists' use of running lights based on accident data during the period of 1st May, 1977 - 30th June, 1978.

Worked out for use in the NTR working group dealing with running lights.

29th January, 1979
Hans V. Lund, Civil Engineer

/IB 11.12.1980

Introduction

In the revision of the Road Traffic Act coming into force on the 1st of May, 1977, a special rule for motor cycles is stated in § 52 subsection 3:

> "Use of dipped lights are compulsory for motor cycles during daytime."

This provision is based on the conclusion of NTR report No. 12: Varselljus för motorcyklar (Running Lights for Motor Cycles) stating,

> "Motor cyclists' risk of being involved in accidents - with or without own fault - may be expected to be reduced in case use of running lights is made compulsory for motor cyclists during daytime."

Thus it appears directly from the reasons for the law amendment that a reduction of the accident risk is to be expected, it may be reasonable to examine whether these expectations are fulfilled.

The reasons for investigating the accident development exactly now is the result of the NTR working group about running lights, in which, among other things, it is also contemplated to make running lights compulsory also for other motor vehicles during daytime.

Traffic counts of motor cyclists' lighting.

A precondition for the effect of a road safety countermeasure is that it is used according to the intention. Conversely, it is of fundamental importance when judging the effect of a countermeasure to investigate to which extent it is used.

In this instance working paper No. 1 describes how motor cyclists' lighting has been influenced by the law amendment based on a few traffic counts in Copenhagen and Ålborg about one month before and one month

after the coming into force of the law.

It appears from the working paper that the vast majority of the motor cyclists obey the new regulation, 99% and 81% against 75% and 27% before the coming into force of the law, but it is also mentioned that different weather conditions have influenced the use of lighting before the law amendment came into effect.

As no systematic counts of motor cyclists' use of running lights have been made, it cannot be determined whether the use of running lights has been changing gradually over a longer period of time, just as it cannot be determined whether the above-mentioned figures are typical of the whole country.

Accident development.

Accidents involving motor cycles constituted both in 1968 and 1977 9% of the total number of casualties. Among the traffic-killed persons motor cyclists amounted in 1968 to 4% and in 1977 to 8%.

The development in the motor cycle accidents has shown a declining tendency from 1968 to 1974 (from 1818 to 1062), but from 1974 to 1977 there has been an increase so that the number of casualties in 1977 was 1489.

As mentioned above, the number of casualties was in 1977 1489, and the extent of injuries among the involved motor cyclists (and their passengers) was 69 killed, 975 seriously injured and 577 slightly injured.

The seasonal variation in the motor cycle accidents has increased during the years 1968-1977 with a decline in the number of winter accidents and an increase in the summer accidents.

In 1977 almost half (49%) of the motor cycle accidents ocurred during the week-end (Friday - Saturday - Sunday) The corresponding number was in 1968 44%.

Thus these figures confirm the supposition made in RfT Publication No. 89 that the motor cycle is a leisure time vehicle, and that this has become still more characteristic during recent years.

Analysis of motor cycle accidents in relation to the law amendment about running lights.

In NTR Report No. 12 about running lights it is recommended not to limit an obligation to use running lights, neither locally nor temporally.

For that reason it seems reasonable to make a comparison of accidents covering a period of time as long as possible after the coming into force of the law. Due to the seasonal variations stated, the "after-period" has been chosen to be one year from 1st of May, 1977 to 30th April, and comparisons are drawn with the 4 previous years in the same period, e.g. from 1st of May, 1973 to 30th of April, 1977.

The compared accidents include casualties in which the motor cycle is involved as first or second unit according to the unit classfication applied in connection with the report to the Danish Bureau of Statistics, compare supplement 1, from which the accident situations and unit classification appear.

By means of the classification of the accident situations it has, prior to the analysis been estimated, how running lights might influence the accidents. This estimate has resulted in the following grouping:

Group 1: Accident situations 0 + 7 + 9:
One-vehicle accidents, accidents involving parked vehicles, obstacles, etc. on the road. Data basis according to "Road Traffic Accidents 1977" from the Danish Bureau of Statistics comprising about 25% + 3% + 2% ~ 29% of all casualties involving motor cycles in 1977.

In this group running lights are not supposed to be of any importance for the accident.

Group 2: Accident situations 1 + 3:

Accidents involving vehicles on the same road going in the same direction and without turning and accidents involving vehicles on the same road going in the same direction and with turning off the road.
Data basis about 10% + 13% = 23% of all casualties with motor cycles in 1977.
In this group running lights are supposed to be of importance due to the overtaken motor cyclist's red rear lamp or the overtaking motor cyclist's front running light.

Group 3: Accident situations 5 + 6 + 8:

Accidents involving vehicles going in the same direction in intersections, accidents involving vehicles on different roads and turning off the road, and accidents involving pedestrian and vehicle.
Data basis about 7% + 14% + 6% = 27% of all casualties involving motor cycles in 1977.
In this group it is supposed that running lights might be of importance, as a switched on front lamp might make a motor cycle more visible.

Group 4: Accident situations 2 + 4:

Accidents involving vehicles on the same road going in opposite directions and without turning and accidents involving vehicles on the same road going in opposite directions and with turning.
Data basis 9% + 11% ˜ 21% of all casualties involving motor cycles in 1977.
In this group running lights are supposed to give maximum effect, as the vehicles in the

traffic situation just before the accident are in a frontal position.

As to be seen, the accidents are fairly regularly distributed between the 4 groups, and group 4, in which running lights are supposed to give maximum effect, is covering 21% or 310 casualties in 1977.

To illustrate the development in accidents during the five years, figure 1 in the supplement shows how casualties involving motor cycles as first or second unit are distributed in the police report according to daylight situation at the place of accident. The number of accidents distributed on daylight, darkness, twilight are approx. 4:2:1, and accidents in darkness as well as twilight show a steadily increasing tendency during the 5-year period. On the other hand, the daylight accidents are characterized by a sudden decline (of 18%) from the period 73/74 to 74/75 after which a steady rise can be seen up to 77/78.

Whether the daylight accidents in 73/74 are a statistic "outlier" cannot be determined in this analysis, but it may be mentioned that the increase in percentages from 74/75 to 77/78 in the daylight accidents amount to 42% and to 40% for the night accidents.

In daylight, situation group 3 is the most frequent followed by group 2, group 1, and group 4. The characteristic fall from 73/74 to 74/75 can be seen in all four situation groups, and it may be noted that in 76/77 group 4 does apparently not behave as expected; a matter which will be discussed later. Apart from this point, the other points are apparently characterized by the same trend of development, viz. a steady increase from 74/75 to 77/78.

In darkness, group 1 is the most frequent with increasing number of accidents during the years. Between the other groups there is almost similarity in

accident numbers, and with a somewhat smaller increase.

The twilight accidents are equally divided between the four groups and with a slight increase for all groups. Due to the relatively small number of twilight accidents, these are omitted in the following analyses.

A statistic test of the daylight accidents distributed according to periods and situation groups shows that the distribution on the single situation groups does not follow the same pattern. The test shows that especially group 4 is outlying by having a smaller number of accidents in 75/76 and by having a greater number of accidents in 76/77 than estimated.

In 73/74 group 3 has a higher value than expected. In case these few points are considered as statistic contingencies and leaved out of the test, it may be proved that the distributions on the remaining groups do not differ. On this background the fall in the number of accidents - from 192 to 173 accidents - in group 4 from 76/77 to 77/78 is to be considered.

The conslusion of these contemplations is that in none of the four accident groups is it possible to demonstrate significant decreases in 77/78 compared with the preceding years, but it would be interesting to see how the declining tendency from group 4 will develop over a longer period of time than the one analyzed here.

In darkness the above-mentioned distribution test shows that group 3 differs in 74/75 and 77/78 from the other distributions by having too many or too small accident numbers, respectively, during these periods in comparison with the estimate. But as in the case of the daylight distributions it may be demonstrated, after omission of these two points, that the distributions in the remaining groups do not differ.
As regards the night accidents it may, therefore, be concluded that in 77/78 no change in any of the four groups can be demonstrated.

In case these conslusions are combined it does not seem as if motor cyclists' use of running lights has influenced the number of casualties involving motor cycles.

Using an analysis method, which has been specially developed for accident analyses in connection with an investigation of running lights in Finland (described in detail in VTI Report No. 102, 1976) the following δ-value may be calculated:

$$\delta = \frac{\text{No. of daylight accidents involving more than one veh.}}{\text{No. of night accidents involving more than one vehicle}} \Big/ \frac{\text{No. of one-vehicle daylight accidents}}{\text{No. of one-vehicle night accidents}}$$

A falling δ-value may be caused by a decrease in the number of one-vehicle night accidents or by a decrease in the number of daylight accidents involving more than one vehicle, or by an increase in the number of daylight one-vehicle accidents or by an increase in the number of night accidents involving more than one vehicle.

The variation of the δ-value during the chosen periods is shown in the table stated below. It appears from this that in 77/78 the δ-value is not lower than the preceding years.

	73/74	74/75	75/76	76/77	77/78	ialt
FD	620	497	536	658	678	2989
FM	191	207	225	236	249	1108
$\frac{FD}{FM}$	3.25	2.40	2.38	2.79	2.72	2.70
SD	145	129	175	186	212	847
SM	141	139	187	193	235	895
$\frac{SD}{SM}$	1.03	0.93	0.94	0.96	0.90	0.95
δ	3.16	2.59	2.55	2.89	3.02	2.85

FD = Group 2 + 3 + 4 in daylight
FM = Group 2 + 3 + 4 in darkness
SD = Group l in daylight
SM = Group 1 in darkness

Conclusion

An analysis of traffic accidents with personal injury involving motor cycles as primary accident parties shows no effect of using running lights.

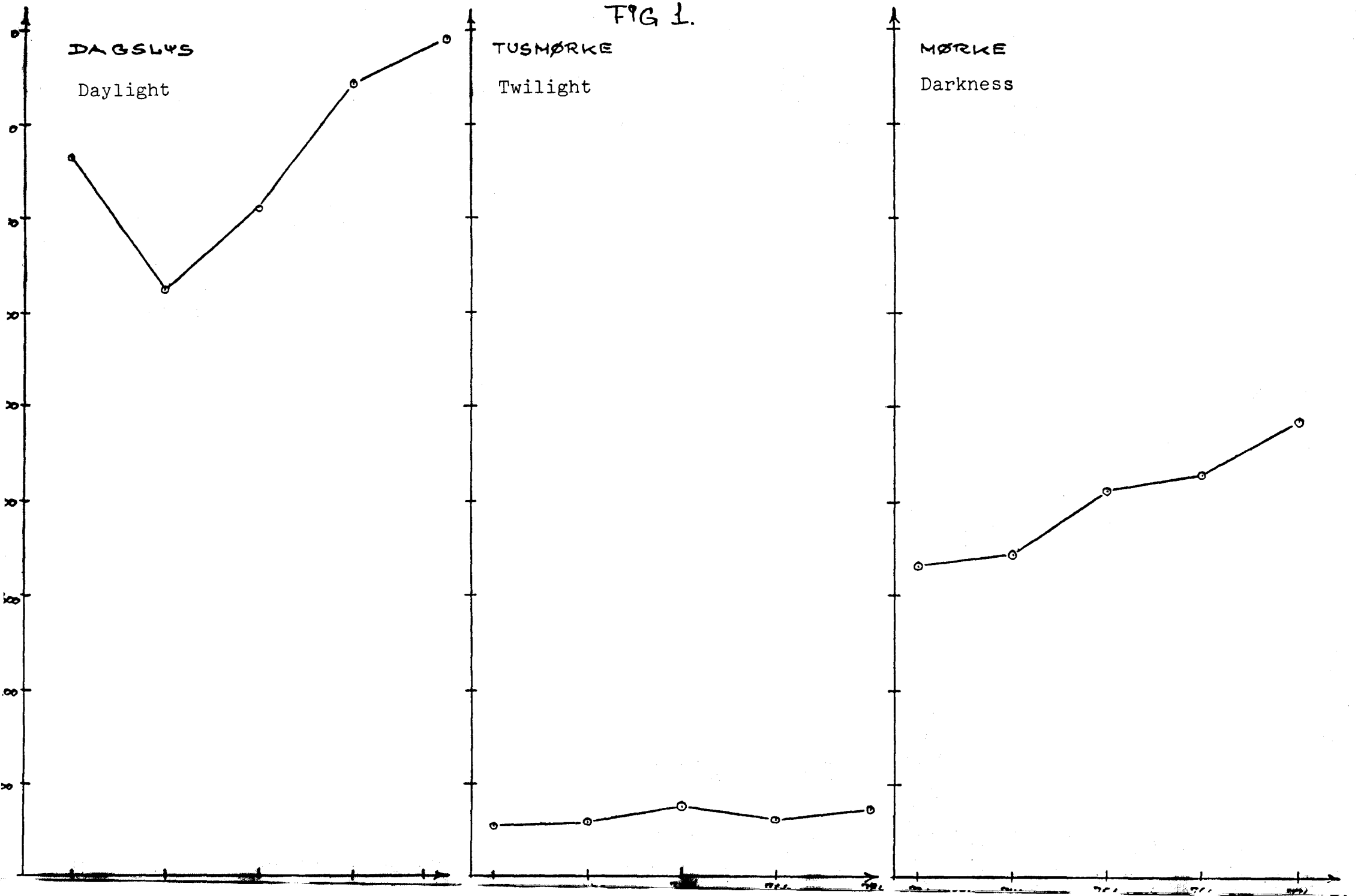
Due to the fortuitous variations ascertained for exactly that group of accidents, in which running lights should be of maximum effect, it is recommended to repeat the analysis when bigger accident numbers are available. However, a more profound investigation should also include more traffic counts of motor cyclists' use of lighting. The counts might possibly be carried out together with RfT's other helmet/belt counts, as this will only require very little extra efforts.

Survey of supplements

Figure 1:	Casualties involving motor cycles as first or second unit distributed according to year of accident and daylight situation at scene of accident.
Figure 2:	Casualties involving motor cycles as first or second unit distributed according to year of accident, daylight situation at scene of accident, and situation groups.
Supplement 1:	List of accident situations and unit classification from the Danish Bureau of Statistics.
Supplement 2:	Distribution test of situation groups in daylight and darkness.

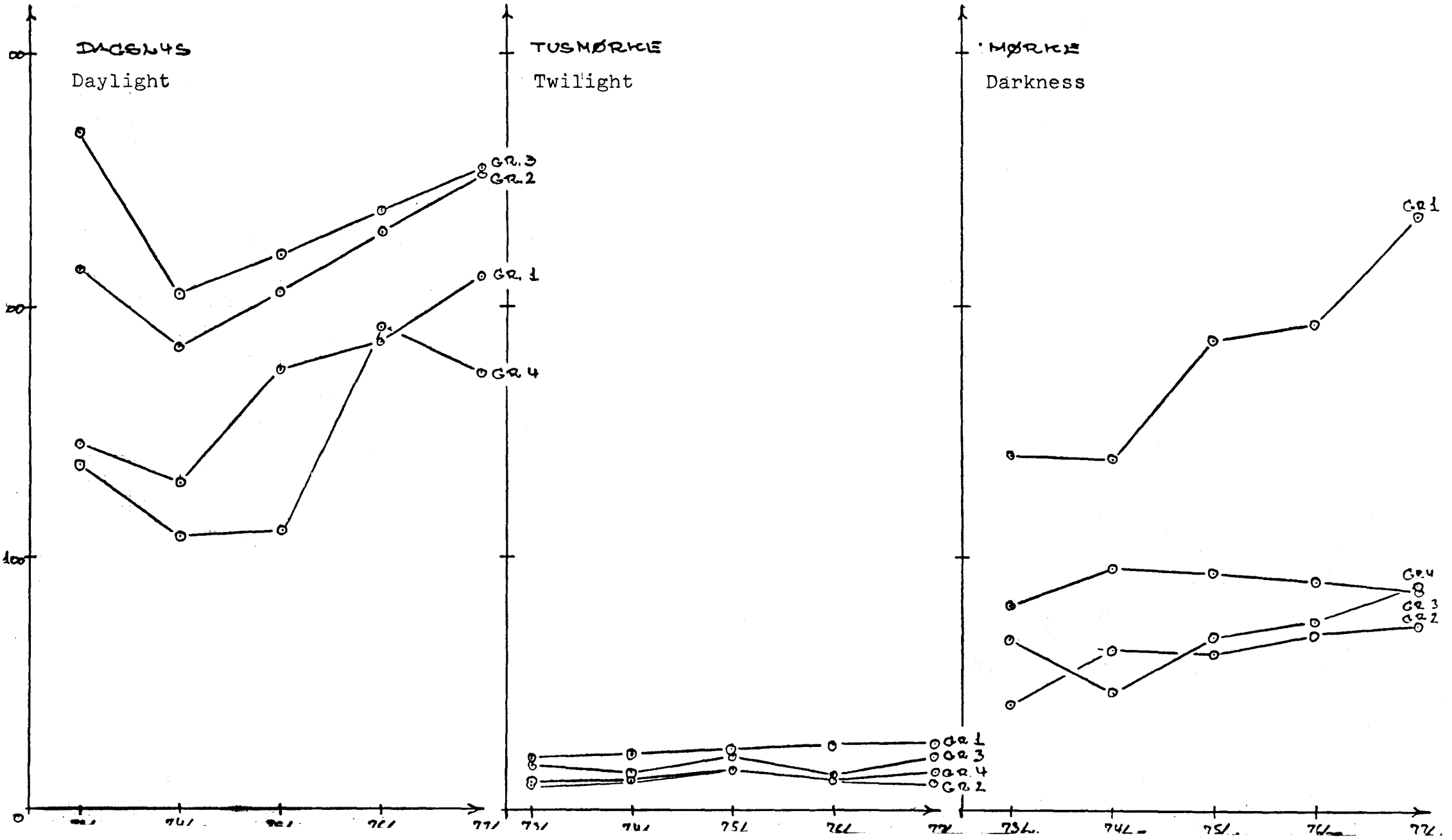
Casualties involving motor cycles distributed on daylight situation.

FIG 1.



Casualties involving motor cycles distributed on daylight situation and situation groups.

FIG 2.

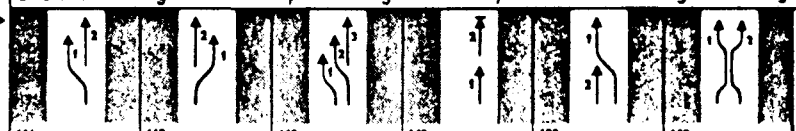


Uheldssituationer

Singleuheld

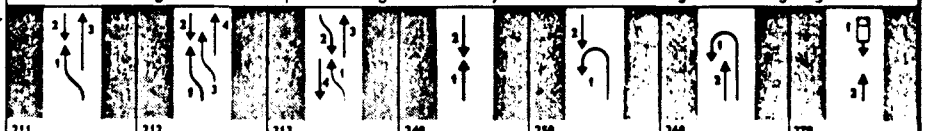
011 Uheld på lige vej til højre for kørselsretning
012 Uheld på lige vej til venstre for kørselsretning
021 Uheld i eller efter højresvingende kurve til venstre for kørselsretning
022 Uheld i eller efter venstresvingende kurve til højre for kørselsretning
023 Uheld i eller efter højresvingende kurve til højre for kørselsretning
024 Uheld i eller efter venstresvingende kurve til venstre for kørselsretning
030 Uheld ved svingning i kryds, vendevej o.l.

Uheld mellem ligeud kørende på samme gade eller vej med samme kurs og uden svingning



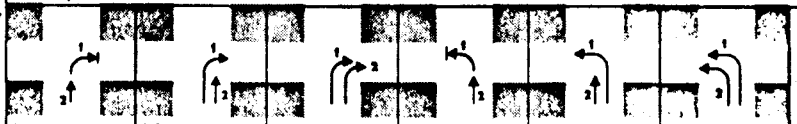
111 Uheld ved overhaling venstre om
112 Uheld ved overhaling højre om
113 Uheld ved dobbeltoverhaling
140 Uheld ved påkørsel bagfra
150 Uheld med køretøj, som starter fra kørebanekant
160 Uheld ved trængning

Uheld mellem ligeud kørende på samme gade eller vej med modsat kurs og uden svingning



211 Uheld ved overhaling i anden position
212 Uheld ved overhaling i tredie eller højere position
213 Uheld mellem modsat overhalende køretøjer
240 Modeuheld
250 Uheld ved vending over for modkørende
260 Uheld ved vending foran modkørende
270 Uheld ved bakning

Uheld mellem kørende på samme gade eller vej med samme kurs og med svingning i T-kryds, Y-kryds, korsvej, indkørsel m.v.

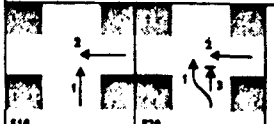


311 Uheld med køretøj placeret for højresving
312 Uheld ved højresving ind foran modkørende
313 Uheld mellem samtidigt højresvingende
321 Uheld med køretøj placeret for venstresving
322 Uheld ved venstresving ind foran modkørende
323 Uheld mellem samtidige venstresvingende

Uheld mellem kørende på samme gade eller vej med modsat kurs og med svingning i T-kryds, Y-kryds, korsvej, indkørsel m.v.

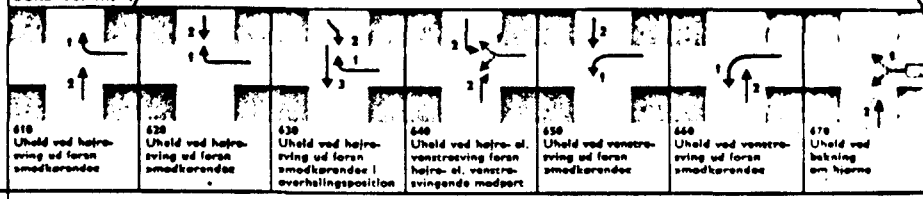
410 Uheld ved venstresving ind foran modkørende
420 Uheld mellem højre- og venstresvingende modkørende
430 Uheld mellem samtidigt venstresvingende modkørende

Uheld mellem ligeud kørende i korsvej uden svingning



510 Uheld i kryds
520 Uheld ved overhaling i kryds

6 Uheld mellem kørende på hver sin gade eller vej med svingning. (T-kryds, Y-kryds, korsvej, ind- og/eller udkørsel m.v.)

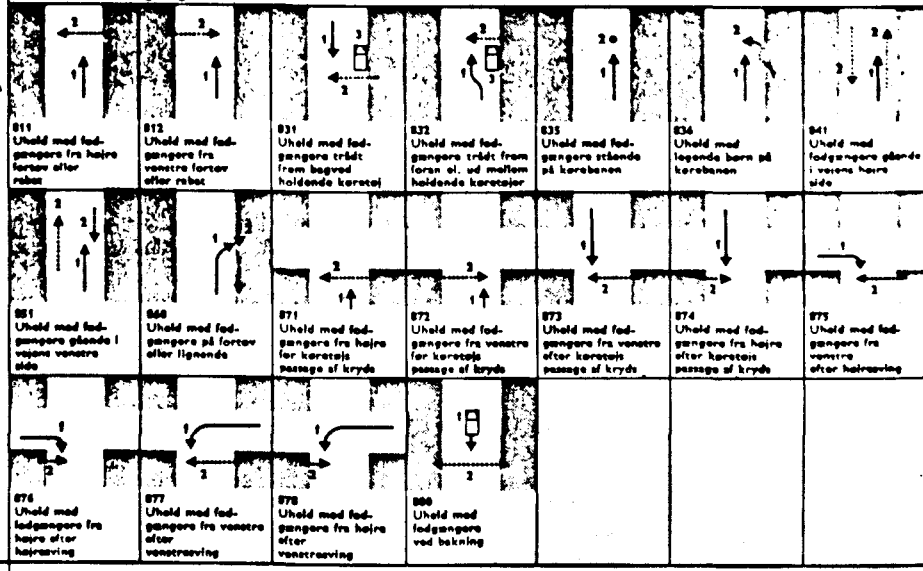


610 Uheld ved højresving ud foran modkørendes
620 Uheld ved højresving ud foran modkørendes
630 Uheld ved højresving ud foran modkørendes i overhalingsposition
640 Uheld ved højre- el. venstresving foran højre- el. venstresvingende medkørt
650 Uheld ved venstresving ud foran modkørendes
660 Uheld ved venstresving ud foran modkørendes
670 Uheld ved bakning om hjørne

7 Uheld med parkeret køretøj m.v.

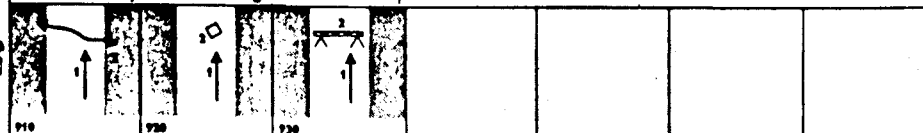
710 Uheld med køretøj parkeret i højre gade- eller vejside
720 Uheld med køretøj parkeret i venstre gade- eller vejside
730 Uheld med køretøj parkeret i venstre gade- eller vejside ved overhaling
741 Uheld ved åbning af vogndør med kørebanen el. holdende eller parkeret køretøj
742 Uheld ved åbning af vogndør med cyklesti el. holdende el. parkeret køretøj

8 Uheld med fodgængere



811 Uheld med fodgængere fra højre forfra eller rabat
812 Uheld med fodgængere fra venstre forfra eller rabat
831 Uheld med fodgængere trådt frem bagved holdende køretøj
832 Uheld med fodgængere trådt frem foran el. ud mellem holdende køretøjer
835 Uheld med fodgængere stående på kørebanen
836 Uheld med legende børn på kørebanen
841 Uheld med fodgængere gående i vejens højre side
851 Uheld med fodgængere gående i vejens venstre side
860 Uheld med fodgængere på fortov eller liggende
871 Uheld med fodgængere fra højre for køretøjs passage af kryds
872 Uheld med fodgængere fra venstre for køretøjs passage af kryds
873 Uheld med fodgængere fra venstre efter køretøjs passage af kryds
874 Uheld med fodgængere fra højre efter køretøjs passage af kryds
875 Uheld med fodgængere fra venstre efter højresving
876 Uheld med fodgængere fra højre efter højresving
877 Uheld med fodgængere fra venstre efter venstresving
878 Uheld med fodgængere fra højre efter venstresving
880 Uheld med fodgængere ved bakning

9 Uheld med dyr eller faste genstande m.v. på kørebanen



910 Uheld med dyr på kørebanen
920 Uheld med faste genstande m.v. på kørebanen
930 Uheld med afspærringsmateriel på kørebanen

Supplement 2: Distribution Test. Daylight and darkness.

Dagslys	73/74	74/75	75/76	76/77	77/78	Sum
Gr. 1	145	129	175	186	212	847
=	169	138	157	186	197	
0+7+9	3.41	0.59	2.06	0.00	1.14	7.20
Gr. 2	215	184	206	229	251	1085
=	216	177	201	239	252	
1+3	~ 0	0.28	0.12	0.42	~0	0.82
Gr. 4	137	108	110	192	173	720
=	144	118	134	158	166	
2+4	0.34	0.85	4.30	7.32	0.30	13.11
Gr. 3	268	205	220	237	254	1184
=	236	193	219	261	275	
5+6+8	4.34	0.75	0	2.21	1.60	8.90
Sum	765	626	711	844	890	3836
	8.09	2.46	6.49	9.94	3.04	30.03

$x^2(12)=28.30$
99.5

Mørke	73/74	74/75	75/76	76/77	77/78	Sum
Gr. 1	141	139	187	193	235	895
=	148	154	184	191	218	
0+7+9	0.33	1.46	0.05	0.02	1.33	3.19
Gr. 2	42	64	62	70	73	311
=	52	54	64	67	74	
1+3	1.92	1.85	0.06	0.13	0.01	3.97
Gr. 4	68	47	69	75	89	348
=	58	60	72	75	83	
2+4	1.72	2.82	0.13	0	0.43	5.10
Gr. 3	81	96	94	91	87	449
=	74	78	92	96	109	
5+6+8	0.66	4.15	0.04	0.26	4.44	9.55
Sum	332	346	412	429	484	2003
	4.64	10.28	0.28	0.42	6.21	21.83

$X^2(12)=21.0$
95
$x^2(12)=23.3$
97.5

The numbers in each cell indicate observed values, estimated values as well as X^2-contribution of the cell.