3.10 Traffic conflicts experience in Denmark
(H. S. Ludvigsen)

As will have appeared from the first seminar on traffic conflicts in September, 1977, in Oslo, no appreciable research had been instituted into traffic conflicts in Denmark. However, great interest has been taken in the development in other countries in the hope that some of the techniques being advanced would turn out sufficiently operational to be applied in practice.

The Secretariat for Safety Road Improvements wishes primarily to use the conflicts technique for establishing the effects of different road safety installations quickly with a view to advising the local highway authorities and to enable these authorities to utilize the restricted road investment resources to their maximum benefit for road safety purposes.

At the seminar in Oslo, the conflicts technique, advanced by Christer Hydén of the University of Lund, Sweden, seemed to yield promising results. It was decided that this technique should be tried out in Denmark. Today 2 analyses have primarily been carried out.

1. An intersection analysis made by Swedish observers in Denmark.
2. Analysis of a number of intersections made by Danes, trained in the Swedish observation technique.

The traffic conflicts technique is based on the following principles: (cf Christer Hydén: "A traffic conflicts technique for examining urban intersection problems" - presented in Oslo 1977).

A conflict is defined as a situation which would have led to an accident if none of the road users involved had taken any evasive action. The degree of severity of conflicts is determined by focusing on the moment when one of the road users, involved in the conflict situation, starts taking evasive action. The degree of severity is defined as the remaining time to an accident (in the following TO) if both road users involved had continued with unchanged speeds and directions.
A serious conflict occurs when the time to accident (TO) is below 1.5 seconds. The following numerical values should be applied when converting conflicts and accidents, the table values indicating the ratios between accident per time unit and conflicts per time unit.

<table>
<thead>
<tr>
<th></th>
<th>Car-car</th>
<th>Car-bicycle</th>
<th>Car-pedestrian</th>
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<tbody>
<tr>
<td><strong>Low speed</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$3.2 \times 10^{-5}$</td>
<td>$14.5 \times 10^{-5}$</td>
<td></td>
</tr>
<tr>
<td><strong>High speed</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>$13.2 \times 10^{-5}$</td>
<td>$77.2 \times 10^{-5}$</td>
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</table>

1) All situations in low speed intersections and situations with only turning vehicles involved in high speed intersections and situations with only turning vehicles involved in signalized intersections.

2) Situations with at least one vehicle involved, continuing on the same road, in high speed intersections and situations with at least one vehicle involved, continuing on the same road, in signalized intersections.

1. Intersection analysis with Swedish observers

The purpose of this survey was to study the possibilities of applying the Swedish conflicts technique in Denmark.

A comparison should be made between the risk of accidents ascertained over a number of years and the risk measured by conflicts. Modification of the layout of the intersection should be made, followed by an evaluation of the safety effect of this modification.

The analysis was carried through in a signalized intersection between 2 primary roads. The intersection is located in a small town. Average daily traffic is 6000 for one of the roads and 4700 for the other. Correspondingly, the speed limits are 70 km/h for the major road and 60 km/h for the minor one.
Personal injury accidents in the before period of 4.7 years are shown in fig. 1. Fig. 2 shows the conflicts registered in the before period. The material does not show significant similarities. The estimated risk when applying the Swedish conversion multipliers does not agree particularly well with the risk ascertained in connection with accidents.

Fig. 3 shows the conflicts registered in the intersection after modification of the layout. There have been material changes in the conflicts from the before period to the after period. The total number has been reduced from 37 to 27 which is significant on 5% level. Car-car conflicts have been reduced from 21 to 13. The decrease in car-car conflicts between cars turning left and cars continuing on the same road is significant on 5% level. Car-bicycle/moped conflicts have been reduced from 13 to 8. This change is significant on 5% level. The before period saw 3 registered conflicts between car-pedestrian and 6 in the after period.

The survey questions whether it is justifiable uncritically to apply the Swedish risk calculations to Danish road conditions. The survey indicates that a positive effect may be expected as the result of modification of the layout of the intersection in question. The distribution of the various types of conflict compared with real accidents could indicate the necessity of refinement of the conflicts technique so that the relation can be found between specific types of accident and the corresponding types of conflict.

2. Intersection analysis made by Danish observers

The project was carried out by The Technical University of Denmark. The aim of the project was: "To make a survey and evaluation of the conflicts technique as a means of judging the risk of accidents in unsignalized intersections." The Swedish traffic conflicts technique was applied, but the observers were Danes trained in observation techniques by Christer Hydén. 13 unsignalized intersections in the Copenhagen area were examined. The conflict observations were compared with accident data covering 7.6 years.
The analysis produced the following conversion values between conflicts and personal injury accidents.

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<tr>
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<th>Car-bicycle</th>
<th>Car-pedestrian</th>
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<tbody>
<tr>
<td>Low speed</td>
<td>1.1 x 10^{-5}</td>
<td>14.5 x 10^{-5}</td>
<td></td>
</tr>
<tr>
<td>High speed</td>
<td>14.3 x 10^{-5}</td>
<td>53.3 x 10^{-5}</td>
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The numerical value 1.1 x 10^{-5} is based on a very slender basis. The values 14.3 x 10^{-5} and 14.5 x 10^{-5} fall within the 90% limits for the Swedish values. The 2 values may therefore be presumed to be the same for Danish and Swedish road conditions. But the conversion multiplier for high speed and car-bicycle/pedestrian may be presumed to differ from the Swedish value on the present basis.

At first the analysis was based on personal injury accidents. However, the police knows of quite a number of damage only accidents. Attempts were made at drawing up a model in which the risk measured by conflicts registration was compared with the risk measured by a weighted sum of accidents involving personal injury and damage only.

As subreports bear close relation to the degree of seriousness of the accidents it was decided that personal injury accidents should have multiplier 1, damage only accidents between cars 0.25, and damage only accidents between car-bicycle 0.80.

Given these conditions the following conversion multipliers were found:

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<th>Car-pedestrian</th>
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<tbody>
<tr>
<td>Low speed</td>
<td>2.2 x 10^{-5}</td>
<td>15.4 x 10^{-5}</td>
<td></td>
</tr>
<tr>
<td>High speed</td>
<td>24.2 x 10^{-5}</td>
<td>55.1 x 10^{-5}</td>
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</table>
This model showed much better adaptation to the risk of accidents than did the original model.

For the same model fig. 4 shows a comparison between expected and actual levels of risk in 10 intersections. An analogous comparison for various accident situations shows considerable larger differences.

Today the method of measurement is thus not applicable in general for an analysis of a specific accident situation. Such applicability will require calculation of specific conversion multipliers between conflicts and accidents for the individual accident situation.

With a view to the general applicability of the technique it must on the basis of the modest Danish analyses be considered expedient to carry on research into the reliability and applicability of the technique. However, the conflicts technique is expected to be able to reflect the level of risk in an intersection.

Experience from analyses also demonstrates the advantage of the application of the technique as a supplement to accident data. In this connection it is desirable to be able to supplement these data with registration of road user behaviour. Frequently incorrect use of the road system is observed. In these situations only mere chance decides whether the misapplication is without consequences, results in a conflict situation or leads to an accident.
Personal injury accidents - before

Conflicts - before

Fig. 1

Fig. 2
Conflicts - after

Copenhagen

Sore

Fig. 3
Calculated risk

Actual risk

Fig. 4