TRAFFIC ACCIDENTS AND THE ROAD NETWORK

by

Denzil D. Senanayake

Introduction

A safe road is what the normal road user and particularly the driver always aspires for. This should necessarily be so with the Sri Lankan situation as, in this country, over the years, the roads have gradually drifted towards a condition that could be called "highly hazardous". Accidents have become a common occurrence.

In road accidents the effect on the country is twofold. One, the direct economic effect, due to loss of life, injury to persons and damage to property. The other, which may be called the indirect effect, is due to suffering and bereavement resulting from accidents. It is the latter that makes it really difficult to assess the total cost of accidents. Nevertheless, the cost to the country as a result of road accidents can be called enormous.

All over the World there is an ever increasing concern for the effects of road accidents and efforts are being made continuously to make the roads safer.

The Japanese National Police Agency has this to say in their 1984 Traffic Police Administration Report:

"Today, vehicular traffic displays a big role in our life and the increase of traffic accidents as derived from traffic is one of the most important social problems in Japan. Thus, the problem of traffic accidents must be urgently and energetically tackled by the Central and the Local Government as well as individuals".

This statement is quite applicable to the conditions in our country too, as road traffic had been growing at an extremely fast rate in recent times and there had been a correspondingly high increase of accidents. Statistics show that from 1976 to 1984, the vehicle population has increased from a mere 160,000 to over 400,000 and the total number of accidents have gone up, between the years 1967 and 1981, from about 6000 to over 24,000 at which level it had virtually remained constant in 1982 and 1983.

In considering road accidents, no doubt, one has to concede that it is not only the condition of the road that matters. The driver and the vehicle respectively also play an important part. However, it is not intended to go into the details of these aspects in this paper. This paper intends only look at the road and the roadway environment in relation to accident statistics and in relation to what can be identified as obvious defects and shortcomings of the road network, that lead to accident situations.

Accident Statistics and Analysis

Accident statistics that had been collected and documented by the Police Department for the period 1974 to 1983 were analysed with a view of observing the accident patterns or trends on our roads. Incidentally this period was significant in that there were changes of policy regarding importation of vehicles into the country. Also, several of the country's development programmes which had an effect on road transport were initiated, executed and some of them completed during this period.

In the years from 1974 to 1977 there was only a restricted growth of vehicles in the country. But, with the liberalization of importation of vehicles in 1977, a fast and steady growth


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of vehicles resulted. This is indicated in Table I and Diagram 1. Also as seen from Table I there was an increase in all categories of vehicles and the rate of increase of some types such as motor-cycles, lorries, private buses had been far in excess of the others.

Table 2 and Diagrams 2, 3 and 4 show that after 1976 and with the increase in numbers of vehicles there had been a corresponding increase in the number of accidents, number of fatalities and in the number of those injured in accidents. However, some degree of levelling off in all these effects is observed in the years 1982 and 1983 in spite of the continued increase in importation of vehicles.

Diagram 5 (Accidents Vs Vehicles) clearly shows a characteristically saturation type of graph or curve suggesting that the number of accidents have reached a peak in spite of the increase in vehicles. This probably indicates that either the driver has begun to accept some of the accident causing situations as normal and is able to react normally or that there is an improvement in accident causing factors. However, this may need more careful analysis.

**TABLE 1**

**VEHICLE STATISTICS**

<table>
<thead>
<tr>
<th>Year</th>
<th>Motor Cycles</th>
<th>Motor Lorries</th>
<th>Motor Buses (Private)</th>
<th>Motor Buses (S.L.T.B.)</th>
<th>Total*</th>
</tr>
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<tr>
<td>1974</td>
<td>86871</td>
<td>22501</td>
<td>34434</td>
<td>1057</td>
<td>156425</td>
</tr>
<tr>
<td>1975</td>
<td>87840</td>
<td>22773</td>
<td>34438</td>
<td>1117</td>
<td>157866</td>
</tr>
<tr>
<td>1976</td>
<td>89795</td>
<td>23384</td>
<td>34689</td>
<td>1186</td>
<td>161010</td>
</tr>
<tr>
<td>1977</td>
<td>92910</td>
<td>24435</td>
<td>35512</td>
<td>1264</td>
<td>166980</td>
</tr>
<tr>
<td>1978</td>
<td>99523</td>
<td>29642</td>
<td>40315</td>
<td>1529</td>
<td>184474</td>
</tr>
<tr>
<td>1979</td>
<td>109273</td>
<td>45087</td>
<td>46649</td>
<td>3105</td>
<td>218326</td>
</tr>
<tr>
<td>1980</td>
<td>114443</td>
<td>79803</td>
<td>55838</td>
<td>5752</td>
<td>270836</td>
</tr>
<tr>
<td>1981</td>
<td>119826</td>
<td>96851</td>
<td>63479</td>
<td>8068</td>
<td>303248</td>
</tr>
<tr>
<td>1982</td>
<td>131657</td>
<td>107547</td>
<td>69705</td>
<td>10497</td>
<td>334983</td>
</tr>
<tr>
<td>1983</td>
<td>136853</td>
<td>121840</td>
<td>77714</td>
<td>14143</td>
<td>366650</td>
</tr>
<tr>
<td>1984</td>
<td>141730</td>
<td>138632</td>
<td>85701</td>
<td>17999</td>
<td>400487</td>
</tr>
</tbody>
</table>

* Agricultural and other special vehicles not considered.

Source: Registrar of Motor Vehicles,
Diagram 1

Diagram 2
### TABLE 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Total No. of Accidents</th>
<th>Total No. of Fatalities</th>
<th>Total No. of injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>14497</td>
<td>746</td>
<td>9215</td>
</tr>
<tr>
<td>1975</td>
<td>14059</td>
<td>753</td>
<td>9048</td>
</tr>
<tr>
<td>1976</td>
<td>14650</td>
<td>745</td>
<td>9055</td>
</tr>
<tr>
<td>1977</td>
<td>15297</td>
<td>892</td>
<td>9416</td>
</tr>
<tr>
<td>1978</td>
<td>18282</td>
<td>864</td>
<td>10289</td>
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<td>1979</td>
<td>19395</td>
<td>939</td>
<td>11050</td>
</tr>
<tr>
<td>1980</td>
<td>23711</td>
<td>1105</td>
<td>13551</td>
</tr>
<tr>
<td>1981</td>
<td>24656</td>
<td>1247</td>
<td>13507</td>
</tr>
<tr>
<td>1982</td>
<td>24002</td>
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<td>12565</td>
</tr>
<tr>
<td>1983</td>
<td>24341</td>
<td>1372</td>
<td>12153</td>
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</table>

Source: Police Department

### TABLE 3

<table>
<thead>
<tr>
<th>Year</th>
<th>Total population Millions</th>
<th>No. of accidents per million population</th>
<th>No. of Fatalities per million population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>13.28</td>
<td>1091</td>
<td>56</td>
</tr>
<tr>
<td>1975</td>
<td>13.50</td>
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<td>56</td>
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<tr>
<td>1976</td>
<td>13.72</td>
<td>1067</td>
<td>54</td>
</tr>
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<td>1977</td>
<td>13.94</td>
<td>1097</td>
<td>64</td>
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<td>1978</td>
<td>14.19</td>
<td>1288</td>
<td>61</td>
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<td>1979</td>
<td>14.47</td>
<td>1340</td>
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<td>1980</td>
<td>14.75</td>
<td>1608</td>
<td>75</td>
</tr>
<tr>
<td>1981</td>
<td>14.99</td>
<td>1645</td>
<td>83</td>
</tr>
<tr>
<td>1982</td>
<td>15.20</td>
<td>1579</td>
<td>85</td>
</tr>
<tr>
<td>1983</td>
<td>15.42</td>
<td>1580</td>
<td>89</td>
</tr>
</tbody>
</table>

Source: Police Department & Department of Statistics

![Diagram 3](image-url)
The information given in Table 3 is very significant in that, after 1967 there is a steady increase in the number of accidents as well as in the fatalities per unit of population (i.e., per million people).

From Table 4 it is seen that each year, of the people killed in road accidents, the pedestrians account for about 50% or more and that the percentage of motor-cycle riders meeting with death has increased from about 3% to more than 10% after 1977.

Table 5 clearly indicates that of the vehicles the involvement of the motor-cycles in accidents had been on the increase and that the pedal cyclist is also a substantial contributor.

As depicted in table 6, on the average, 25 percent of the accidents occur on A class roads (Trunk Roads) and 22 percent on roads in Colombo. Together they account for 50 percent of all the accidents that take place on our roads. These figures become quite significant when viewed in terms of the total network of roads in the country as A class roads and Colombo roads together constitute only about 7 percent of the total length of roads.
**TABLE 4**

NUMBERS AND PERCENTAGES OF CLASS OF ROAD USER KILLED IN ROAD ACCIDENTS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class of Road User</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>395</td>
<td>53.0</td>
<td>370</td>
<td>49.7</td>
<td>348</td>
<td>47.3</td>
<td>480</td>
<td>53.8</td>
<td>488</td>
<td>56.5</td>
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<tr>
<td>Pedal Cyclist</td>
<td>90</td>
<td>12.1</td>
<td>129</td>
<td>17.3</td>
<td>112</td>
<td>15.2</td>
<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rider</td>
<td>22</td>
<td>3.0</td>
<td>15</td>
<td>2.0</td>
<td>27</td>
<td>3.7</td>
<td>91</td>
<td>10.2</td>
<td>80</td>
<td>9.3</td>
</tr>
<tr>
<td>Driver</td>
<td>55</td>
<td>7.4</td>
<td>72</td>
<td>9.7</td>
<td>67</td>
<td>9.1</td>
<td>60</td>
<td>6.7</td>
<td>60</td>
<td>6.9</td>
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<tr>
<td>Passenger</td>
<td>171</td>
<td>23.0</td>
<td>155</td>
<td>20.8</td>
<td>172</td>
<td>23.4</td>
<td>261</td>
<td>29.3</td>
<td>236</td>
<td>27.3</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
<td>1.5</td>
<td>03</td>
<td>0.5</td>
<td>09</td>
<td>1.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>745</td>
<td>100</td>
<td>744</td>
<td>100</td>
<td>735</td>
<td>100</td>
<td>892</td>
<td>100</td>
<td>864</td>
<td>100 939</td>
</tr>
</tbody>
</table>

Source: Police Department

**TABLE 5**

Numbers and Percentages of Type of Vehicles Involved in Road Accidents

1977 to 1983

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of vehicles</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1929</td>
<td>9</td>
<td>2095</td>
<td>8</td>
<td>2386</td>
<td>8</td>
</tr>
<tr>
<td>Motor Cycle</td>
<td>912</td>
<td>4</td>
<td>1104</td>
<td>4</td>
<td>2166</td>
<td>7</td>
</tr>
<tr>
<td>Private Car</td>
<td>7773</td>
<td>34</td>
<td>9632</td>
<td>35</td>
<td>9010</td>
<td>31</td>
</tr>
<tr>
<td>Taxi</td>
<td>871</td>
<td>4</td>
<td>1042</td>
<td>4</td>
<td>1053</td>
<td>4</td>
</tr>
<tr>
<td>Light Goods vehicle</td>
<td>1511</td>
<td>7</td>
<td>1799</td>
<td>7</td>
<td>2290</td>
<td>8</td>
</tr>
<tr>
<td>Heavy Goods vehicle</td>
<td>4409</td>
<td>19</td>
<td>5449</td>
<td>20</td>
<td>5863</td>
<td>20</td>
</tr>
<tr>
<td>Bus</td>
<td>4473</td>
<td>20</td>
<td>5614</td>
<td>20</td>
<td>5807</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Police Department
**TOTAL NO. OF MOTOR VEHICLES (10,000)**

**DIAGRAM 6**

**TABLE 6**

ACCIDENTS BY ROAD TYPE

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>'A' Roads</th>
<th>No.</th>
<th>%</th>
<th>'B' Roads</th>
<th>No.</th>
<th>%</th>
<th>Colombo Roads</th>
<th>No.</th>
<th>%</th>
<th>Other Roads</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>15297</td>
<td>5094</td>
<td>33</td>
<td></td>
<td>1948</td>
<td>13</td>
<td></td>
<td>2789</td>
<td>18</td>
<td></td>
<td>5468</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>16257</td>
<td>5469</td>
<td>30</td>
<td></td>
<td>1115</td>
<td>06</td>
<td></td>
<td>3821</td>
<td>21</td>
<td></td>
<td>7882</td>
<td>43</td>
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</tr>
<tr>
<td>1979</td>
<td>19395</td>
<td>4311</td>
<td>22</td>
<td></td>
<td>841</td>
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<td></td>
<td>4448</td>
<td>23</td>
<td></td>
<td>9795</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>23711</td>
<td>6733</td>
<td>28</td>
<td></td>
<td>1094</td>
<td>05</td>
<td></td>
<td>5137</td>
<td>22</td>
<td></td>
<td>10749</td>
<td>45</td>
<td></td>
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<tr>
<td>1981</td>
<td>24655</td>
<td>7195</td>
<td>29</td>
<td></td>
<td>969</td>
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<td></td>
<td>5349</td>
<td>22</td>
<td></td>
<td>11143</td>
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<td>5746</td>
<td>24</td>
<td></td>
<td>10945</td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>

Source: Police Department
Roads and Roadway Environment

The problem with our roads and the roadway environment is as historical as it is economic.

Almost all our roads have evolved over a period of time, prior to the 'advent' of the modern day high speed vehicle, and were kept improved and maintained only nominally over the years. They were never constructed, and few only/were improved later, to cater to the increase of traffic experienced in recent times. Worst was that their alignments were hardly corrected in keeping with speed levels that the present day vehicles are expected to travel at, leave alone what they are capable of. Most drivers today would desire to, and in many instances are forced to, travel at speeds around 60 Kmph (40 Mph) or above. But, our roads are unable to cater to such desires or demands. In actual fact most of our roads are unsafe at speeds above 60 Kmph (40 Mph).

The present day roadway environment consisting of the fast moving traffic, the pedestrians, cyclists, carts, the poor road edges, way side boutiques, the congested intersections etc., all put together, too has a historical background.

Over the years, people were allowed to establish themselves along the road side without much control, and they started carrying out activities on the road edge and even on the road itself, such as selling things, stacking logs, repairing vehicles and even sitting down and chatting, which the roadway was never meant for. Even on our main trunk roads there are still places where a house or boutique would abut the carriageway edge and from which the people would stop out right infront of the path of vehicles. Very few pedestrians in general believe that they should cross the road as quickly as possible using the shortest possible path and leave the roadway for the traffic to move. Under these circumstances it is no wonder the statistics indicate that each year nearly 50% or more of the people who die as a result of road accidents are pedestrians.

Till 1977 the pressure was never really felt as the vehicles were less in number and their rate of growth was slow. But, since 1977, as the statistics indicate, there was a rapid growth of vehicles and also a rapid growth of accidents on our roads. It could now be argued that the condition of the road and the roadway environment was greatly responsible for such increase of accidents.

Since of late, however, the authorities have fully realised the need to improve the roads and the roadway environment. One important step that was taken, although late, was the revision of the thoroughfares ordinance. The Original Ordinance provided for a general building limit of only 7.5"m (25 ft.) from the centre of the road, for any road irrespective of its importance. The revised version (still to become law) will provide for 15 m. (50 ft.) 12 m. (40 ft.) and 7.5 m. (25 ft.) from the centre of the road as building limit for trunk roads (A class) main roads (B Class) and other roads (C,D & E Class and unclassified roads) respectively. This should certainly improve the situation with time as the bulk of the traffic is carried by A & B class roads.

Some of the township roads also carry heavy traffic and not all of them belong to the classified roads. For these roads, depending on their importance, the local authorities were expected over the years to street line them and prevent road side development. Some of the improvements already carried out and are being carried out in the Colombo City were based on such street lines. However, there is an ever increasing need to look into urban roads more carefully and in this regard the recently established Urban Development Authority (UDA) in consultation with the Highways Department and the Local Authorities have already taken several useful steps.

Presently, the Highways Department has launched a 5 year improvement programme, starting from 1985, with World Bank and Asian Development Bank assistance, whereby several of the A & B Class roads will be generally improved. This although is not intended to fully answer the call, will nevertheless help in the faster than normal improvements to the road network. In addition the Highways Department and other organisations such as the UDA, GCEC, Maharass Development Authority, in the recent past had embarked on a series of new additions to the existing network. Several of the existing trunk roads also had been looked into for the provision of by pass facilities at congested townships and also for total replacement. In this regard, however,
finances are a very big constraint.

In the short term, however, with less expenditure there are several small scale improvements that could be made to the existing road network, particularly A & B roads and Urban Streets, in order to reduce their vulnerability to accidents. But, there should exist a systematic approach, in this regard, based on an overall plan.

Road Improvements and Road Safety Aspects

The five year road rehabilitation programme launched by the Department of Highways, no doubt, is the most broad based of all road improvement programmes ever undertaken in the country. However, this programme too suffers from certain drawbacks or shortcomings when looked at from the point of view of road safety.

The improvements so far proposed, in the programme, for very good reasons, have been looked at from an economic standpoint of optimizing on the available funds. Greater stress is laid on reducing vehicle operating costs by improving on the riding quality of road surface and the stress laid on aspects of road safety is only incidental.

As such there appears to be a need to incorporate in, or superimpose on, the planning of these improvements and other similar improvements that would be carried out to the network of roads in the country in the future, certain aspects of safety.

An essential general feature that helps to maintain and promote road safety is consistency in layout. This would mean, in particular, consistency in alignment and consistency in roadway widths, looked at from the point of view of required roadway capacity and required roadway speed. It would also mean consistency in incidental improvements such as sign posting, carriageway-markings, channelization at intersections, street lighting and other similar improvements.

Such consistency in road layout will fit in well with driver expectations and driver desires, which form the basis for the "Driving Task".

It could be said that all road safety revolves round the Driving Task, which in turn consists of the component sub tasks of Control, Guidance and Navigation that the driver is expected to perform[2]

In the control sub task the driver has to deal with the vehicle essentially and as such the vehicle condition predominates. But, in the guidance sub task, where the driver guides the vehicle through the traffic stream, and in the navigation sub task, where the driver plans and executes a journey within the constraints of time etc., he has to depend on the condition of the road and the roadway environment and also on the amount of information that he receives from the road. In this regard, a road that is consistent in every aspect will provide the ideal conditions for the driver.

Road Layout Considerations

The roads in the country could be considered to consist of a primary network and a secondary network - The trunk roads (A Class) and main roads (B Class) along with the more important urban roads forming the primary network - the C, D & E class roads along with urban secondary roads; unclassified rural roads, estate roads etc., forming the secondary network.

Of the nearly 60,000 Km. of total roadway in the country only about 10,000 to 11,000 Km. fall within the primary network as defined above and the rest totalling about a 50,000 Km. are in the secondary network.

The roads in the primary network carry traffic volumes ranging from 500 vehicles per day (V.P.D.) to about 35,000 V.P.D. where as the roads in the secondary network carry volumes less than 300 V.P.D. and in most cases less than 100 V.P.D. As such, from the point of view of road safety and layout improvements it is the primary network that needs special treatment.

To establish consistency in layout, it will be necessary, in the first instance to figure out the corrections that are necessary to the alignment of each road that is taken up for improvement and on the basis of such corrections to alignment to reserve or acquire the required right of way.
The corrections to alignment have to be based on a suitable design speed taking into consideration the importance of the road and terrain. A suitable range of design speeds for the alignment correction of primary network of roads, in general, will be between 40 and 80 km/hour. In the process of such corrections, curves less than 100 m. radius and gradients more than 6 percent should be treated with special care. Sight distances across horizontal curves and at crests and troughs of vertical curves, also will have to be looked into and suitably corrected.

The right of way (ROW) requirements along with the requirements of platform width (PW) and carriageway width (CW) depend on the traffic levels. For the two lane roads in the primary network the following widths are suggested.

<table>
<thead>
<tr>
<th>Traffic/v.p.d.</th>
<th>ROW m</th>
<th>PW m</th>
<th>CW m</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-1000</td>
<td>9.0-12.0</td>
<td>7.5-10.0</td>
<td>5.5-6.0</td>
</tr>
<tr>
<td>1000-3000</td>
<td>10.5-13.0</td>
<td>9.0-11.0</td>
<td>6.0-7.0</td>
</tr>
<tr>
<td>3000-5000</td>
<td>11.5-15.0</td>
<td>10.0-13.0</td>
<td>7.0-9.0</td>
</tr>
</tbody>
</table>

Concluding Remarks

The intention of this paper was to look at roads particularly from the accident point of view and to suggest remedial measures, very generally, in the long-term.

Stress was laid on establishing consistency in the layout of roads as an essential feature in promoting road safety. However, it has to be stated that establishing consistency in layout particularly with the road network in Sri Lanka, which had come into being over the years rather haphazardly, could only be achieved through a concerted effort on the part of policy makers and all those authorities who have to plan and execute work in this regard. Other interested organisations and the general road user also have a part to play. Most important of all is to create an awareness among all about the need for safer roads.

References
