Traffic performance evaluation of road networks by the α-relationship

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Part 2

Traffic performance indices. One of the most interesting problems in traffic engineering is that of defining the quality of the traffic flow by an objective yardstick. The present definition of Level of Service refers only to road sections and is therefore unsuited to the situation as to how to apply them to complete road networks. Moreover, the six Levels of Service are partially dependent on qualitative measures and subjective interpretations of the situation. It is suggested that the parameter α, used in Part I of this paper, may be used as a possible measure of Traffic Performance which could be extended to define the present standard of the Levels of Service.

In the first part of this paper, it was found that the traffic intensity on a road network of a specific category can be related to the sum of the space-mean speed v and the road density k, as expressed in the formula

$$\alpha = k - v$$

(1)

where α is approximately 1 for most of the cases examined. For α = -1, this formula may be written as

$$k = v + \alpha$$

(2)

Dividing both I and R by the respective parameters of each traffic area results in the traffic flow ω per unit length of the road network that

$$\omega = \frac{v}{k}$$

(3)

for the range of values found in the cases studied.

Table I. The basic parameters (in absolute metric values)

<table>
<thead>
<tr>
<th>Town</th>
<th>L (km)</th>
<th>v (km/h)</th>
<th>k (v/k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wroclaw</td>
<td>100</td>
<td>80</td>
<td>1.25</td>
</tr>
<tr>
<td>London</td>
<td>25</td>
<td>50</td>
<td>0.20</td>
</tr>
<tr>
<td>Paris</td>
<td>30</td>
<td>70</td>
<td>0.28</td>
</tr>
</tbody>
</table>

The α-map

It is asserted that the α-values may interpret the Traffic Performance in the centre, since it can be possible to interpose equal-α-values between the maps and the one that will represent the spatial distribution of the α-values in the area. Such an example has been computed for London and is presented in Fig. 1, whereas the distribution of equal-α-values for the London α-map is shown. (See Appendix 1 in this paper.)

Although this map is based on only 10 α-values, it does portray well some of the known characteristics of the traffic performance of the various areas of the city. For instance, there is a prominent ridge of high traffic performance along the central axis, while the traffic performance reduces as the distance from this center increases.

Further analysis

As has been mentioned already in Part I of this paper, the present Level of Service can be considered as the "Kinetic Energy" of the traffic. The effect of the traffic performance on the network, representing the traffic flow of many tens of thousands of vehicles, is a measure of the traffic conditions on a network.

Table I shows the relevant parameters of the α-network that have been used in this paper, p = the additional traffic. As can be seen, two measures may be used: either the average α-value for a town, or the "nearly Kinetic Energy" of the network can be carried on, 100 first is more applicable for comparison purposes between towns, while the second is more important for an evaluation of the traffic flow conditions on the complete road network for the town studied.

(2) Those sectors that are considered as belonging to the "central group" were found again to be the same as those of the α-values, with the relative value of α = 0.2, thus proving again that this measure can be used for defining the Centre of a town.

(3) Figure 1 presents the α-map for the 10 sectors of the town. Although this map has less detail due to the number of sectors, it shows a detailed pattern of the value of the α-values, since it is based on 10 α-values. In this case also a more complete picture was obtained between the ridges of the α-values and the major changes in the area.

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