V. TRAFFIC LANES AND CARRIAGEWAY

V.1. Comparison of guidelines

Table 5.1 gives a list of the width of traffic lanes and carriageways as applied in a number of countries. Sometimes these widths are dependent on the design speed or the reference speed.

Table 5-1: International comparison of widths of Traffic Lanes and Carriageways

Country and name of guidelines or other source	Design Speed or Reference Speed [km/h]	Width of Traffic Lane [m]	Width of Traffic Lane Marking [m]	Width of Carriageway [m]
Austria RVS 9.232 [10]	80 - 100	3.50	0.15	7.00
Denmark (practice)	90 - 120	3.60	0.10	7.20
France CETU [11]	80 - 100	3.50	?	7.00
Germany RAS-Q 1996 [12]/ RABT 94 [13]	100(26T,26Tr) 70 (26t) 110 (29.5T)	3.50 3.50 3.75	0.15 0.15 0.15	7.00 7.00 7.50
Japan Road Structure Ordnance [14]	80 - 120 60	3.50 3.25		7.00 6.50
the Netherlands ROA [15]	120 90	3.50 3.25	0.15 0.15	7.00 6.50
Norway Design Guide Road Tunnels [16]	80 - 100	3.45	0.10	6.90
Spain Instrucción 3.1 [17]	90 - 120	3.50	0.10	7.00
Sweden Tunnel 99 [18]	70 90 110	3.50 3.75 3.75	0.10 or 0.15 0.15 0.15	7.00 7.50 7.50
Switzerland (rectangular tunnels)	80 - 120	3.50 - 3.75	0.20	7.75
Switzerland (SN 640201) [19]	80 - 120	3.50 - 3.75	0.20	- 7.75
UK TD27(DMRB 6.1.2) [20]	110	3.65	0.10	7.30
USA AASHTO [21]		3.60	n.s.	7.20

V.2. Functional aspects

V.2.1. Design speed

For reasons of economy it is not always possible to maintain the same design speed in tunnels as on the adjoining open roads. Generally the design speed in tunnels is 10 - 20 km/h lower. This allows a reduction of the width of the off-carriageway. Reducing design speed and speed limits promotes traffic safety by reducing speed differences.

Sweden does not use the term design speed, but the term reference speed which is the planned speed limit.

The design speed is also dependent on the radius of curves that are possible and the distance between interchanges.

V.2.2. Traffic lane width

Traffic lanes must accommodate the vehicle width plus an allowance for normal driving wander plus a distance to allow comfortable overtaking clearance.

It was pointed out in chapter IV that according to the American Highway Capacity Manual [6] lane widths of 3.60 m provide optimal conditions for traffic capacity.

Swedish experiments however, with traffic lane widths varying from 3.25 m to 3.75 m, did not show measurable differences in road capacity, provided that fixed objects were at a minimum distance of 1.00 m from the inner side of the edge lane marking. There were no indications that lane widths above 3.50 m improve safety.

In the last revision of the German guidelines on road design the width of the traffic lanes on dual carriageway roads with two lanes per carriageway in the open as well as in tunnels (design speeds between 70 and 120 km/h) is 3.50 m (RQ26 and RQ26T). In tunnels where for reasons of traffic management during works in the other tube, traffic has to flow over 4 narrowed lanes in one tube the width of traffic lanes is 3.75 m (RQ29,5T).

In the Dutch guidelines the design width of passenger cars is 1.75 m. Studies indicate that when the overwidth (i.e. the width of the traffic lane minus the width of passenger cars) is 1.60 m (lane width 3.35 m) 85% of the drivers do not drive faster than 120 km/h; when the overwidth is 1.10 (lane width 2.85) 85% of the drivers do not drive faster than 90 km/h. Thus the width of the traffic lanes is a means to influence the average driving velocity.

So for the theoretical minimum lane width in the Netherlands the following matrix is used:

Table 5-2: Theoretical minimum width of traffic lanes in the Netherlands

Type of car	Vd = 120 km/h	Vd = 90 km/h
Passenger Car	3.35 m	2.85 m
Heavy Goods Vehicle		3.20 m

Drivers desire to keep a safety margin to other moving vehicles which they overtake and also to fixed objects that they pass. This safety margin is called the **object distance** and its magnitude is dependent on the design velocity and on the type of fixed object.

Table 5-3: Object Distances according to Dutch guidelines

Type of object	Vd = 120 km/h	Vd = 90 km/h
fixed object	1.50 m	1.00 m
moving object (lorry)	1.75 - 1.85 m	1.00 m

The values 1.75 - 1.85 m follow from a German investigation (passenger cars overtaking heavy vehicles).

Therefore if motorists drive along the inner edge of the lane marking and are overtaken there should be a distance between the cars of 1.80 m which leads to a width of the driving lane of 3.50 - 3.60 m.

When a passenger car driving on the overtaking lane, “touching” the edge lane marking, overtakes a heavy vehicle driving on the driving lane close to the traffic lane marking, the required width of the overtaking lane should be 3.50 till 3.60 m as well.

Thus the width 3.50 for traffic lanes is somewhat smaller than ideal for comfortable. On the other hand this width is more than the theoretical minimum to maintain an average velocity of 120 km/h (table 5-2).

In case of lower design velocities, however, a restriction of the width of traffic lanes is acceptable (if the reduction of the capacity is acceptable).

On Japanese urban motorways the design speed often is 60 km/h or less. If roads belong to class 2 traffic lanes are reduced to 3.25 m.

V.3. Conclusions

- From table 5.1 it appears that there is broad agreement on the width of traffic lanes 3.60 m in Anglo-Saxon countries and 3.50 m in Europe and Japan. With such lane widths motorists feel comfortable regarding traffic speed and distance to overtaking vehicles. An increase of the width of traffic lanes does not increase the capacity or improve safety.

- In most countries the driving speed in tunnels is limited to 100 km/h or less.

- Only Sweden prefers a lane width of 3.75 m at reference speeds of 90 and 110 km/h.

- Some countries (the Netherlands, Japan) use traffic lanes of 3.25 m width for motorways in urban areas combined with a lower design speed.

- Traffic speed depends on more elements than geometry (sight distance, travel distance, speed limits and enforcement).

- Traffic management during works in one of the tubes may require wider normal traffic lanes to allow four narrow lanes in one tube.

- The widths of the traffic lane markings vary from 0.10 m to 0.15 m.

V.4. Recommendations

- It is recommended that the width of traffic lanes in tunnels with design velocities of 100 km/h be not less than 3.50 m.

- When it is acceptable/necessary to impose restricted speed limits (80 or even 60 km/h) in road tunnels (i.e. when sharp curves are unavoidable, noise reduction in built-up areas, limited capacity necessary, cost reduction) a restriction of the width of traffic lanes (to for instance 3.25 m) may help drivers to reduce speed and thus act as a psychological support of the speed limit. This generally has to be enforced with frequent controls and high fines.

- In the design stage of twin tunnels consideration should be given to traffic management during maintenance and repair works requiring the replacement of normal width lanes by temporary narrower width traffic lanes.

- It is recommended wherever possible to maintain the same width of traffic lanes and off-carriageways in road tunnels as on the adjoining carriageways in the open air.

- If the width of traffic lanes in tunnels is restricted by comparison with the adjoining carriageways in the open air and a restricted design speed is applied, this restriction should commence at least 150 m from the entrance of the tunnel.