

### **Vehicles turning right into side-roads or frontage assesses**

On a two-way road, a vehicle turning right into a side-road must wait for a suitable gap in oncoming traffic. If no turning pocket is provided, this blocks a lane to straight-ahead traffic until the turning manoeuvre is completed. If the space between the turning vehicle and the kerb is, for example, a designated bus lane or occupied by a parked car, then no straight-ahead traffic can move until the turning vehicle clears.

### **Vehicles turning right out of side-roads or frontage accesses**

Especially at busy times, vehicles turning right out of side-roads, may, rather than wait for simultaneous gaps in both directions of flow, leave the side road and wait, sideways-on to opposing traffic, while they attempt to force their way into their desired traffic stream. Opposing traffic is then blocked until the manoeuvre is completed.

Where carriageway width permits, it may be possible to provide carriageway markings or kerbed islands which will allow such turning vehicles to wait in the centre of the road without blocking other traffic (see Chapter 37).

### **Bus stops**

A stopped bus obstructs other vehicles from using the nearside traffic lane. If parked vehicles prevent the bus from getting close to the kerb, the adjacent lane will also be obstructed while passengers, including less mobile people, step down from the kerb and up again from the carriageway to board the bus. One-person operation of buses has extended dwell times at stops, though more widespread use of season tickets and travelcards has, to some extent, off-set this effect. Bus bays, often constructed to prevent this obstructive effect, can also delay a bus as it waits to join a stream of overtaking cars (see Chapter 24).

### **Pedestrian crossings**

Zebra crossings can severely restrict traffic flow, especially where they are well-used, such as outside a busy railway station or college. In some locations, this may reflect an appropriate priority for pedestrians over traffic. Elsewhere Pelican, and other light-controlled, crossings reduce this obstructive effect by interrupting the pedestrian flow so that they cross in groups. Pedestrian crossings incorporated within a signalised urban traffic control (UTC) system give 'green man' signals, at times when the least disruption is caused to traffic, but, nevertheless, limit traffic flow to below the capacity of the link.

### **The resulting limitation on the throughput of an urban link**

From the examples referred to in Section 32.1 above, it can be seen that, in ideal circumstances, a traffic lane can have a vehicular capacity of the order of 2,000 pcus per hour per lane which is equivalent to the maximum saturation flow rate on the approach to a traffic signal junction. In practice, few urban links have upstream and downstream junctions which can accommodate a flow of this magnitude. Furthermore, on most urban links, the practical constraints described above limit the traffic flow that could otherwise be accommodated from the geometry of the link. The resulting maximum traffic flow on a link is, therefore, directly dependent on the nature and the severity of the constraints which operate, especially at junctions.

## **32.4 Environmental Capacities of Links and Areas**

The concept of environmental capacity was advanced by Colin Buchanan in the 'Traffic in Towns' report (Buchanan *et al*, 1963), where it was defined as:

'The capacity of a street or area to accommodate moving and stationary vehicles, having regard to the need to maintain the (chosen) environmental standards.'

In other words, environmental considerations could be used to determine the upper limit of traffic flow and the proportion of heavy vehicles, consistent with a maximum acceptable level of, say, pedestrian delay and noise nuisance previously established as the minimum environmental standards for a particular street. The minimum standard and the most significant environmental factor (eg noise, risk of accident, etc.) might vary from street to street and at different times of day, according to the type of activities taking place and their sensitivity to intrusion by vehicular traffic. Thus, a street with wide footways and predominantly commercial frontages might have a higher figure for environmental capacity (ie a lower environmental standard) than a street with narrow footways fronted by terraced housing. Likewise, the environmental capacity for a residential street, based upon noise nuisance, would be higher during the day than during the night. Also, the degree of priority to be accorded to pedestrians and cyclists will have a bearing on the acceptable maximum level of vehicular traffic. The starting point for such decisions would normally lie in designating a hierarchy of the road network (see Chapter 11) but local factors, such as frontage activity, conservation area designation and the location of schools and hospitals, would also play a part.

Buchanan suggested that the environmental capacity for an access road or local distributor lies, typically, in the range 300–600 vehicles per hour, demonstrating that the maximum traffic flow compatible with a good environment will be substantially lower than the traffic capacity determined merely by the width and alignment of the carriageway or the intersections and other constraints along its length. Thus, to ensure that the environmental capacity of a street or network is not exceeded, design features or traffic management measures are often required to restrict traffic flow and to control the type and speed of vehicles permitted to use certain streets. There are many ways in which this can be achieved and a variety of techniques is explained in Chapter 20.

Deterioration of air quality has received increasing attention as an environmental concern. Under the Environment Act (HMG, 1995), local authorities are required to assess air quality and to identify areas where air pollution exceeds, or is forecast to exceed, thresholds specified in the national air quality strategy. Authorities must design Air Quality Management Areas and must draw up plans to reduce the levels of pollution to below specified thresholds. Such plans may include the management or control of traffic and thus could be fed into the consideration of the environmental capacity of links in the road network.

### 32.5 Balance of Capacities in a Hierarchical Network

Little purpose is served in providing link capacities on a route which are much greater than the capacities through junctions, although providing space to store queueing traffic may be a consideration. At peak times, some short links may be filled with vehicles queueing to pass through downstream junctions. Generally, though, there will be opportunities to use some of the roadspace between junctions to provide bus or cycle lanes, to widen footways in areas busy with pedestrians or to designate loading or parking spaces at frontages, provided that sufficient roadspace remains to balance the traffic flow with the capacity of the junctions, after allowing for the practical constraints described in Section 32.2. If the overall capacity offered is less than the traffic demand, drivers will tend to seek other routes. This may be acceptable, even beneficial, on an access road or local distributor whose environmental capacity is being exceeded and where less harmful alternative routes are available. On a district or primary distributor route, an excess of traffic demand over capacity will create a potential for the undesirable use of local residential roads by through traffic, ie 'rat-running'.

### 32.6 Assessing the Impact of Changes in Link Capacity

Whatever criteria are used to define link capacity, any proposed change to the capacity of a link should, like any other investment proposal, be appraised using appropriate methods which encompass all relevant effects. Details of economic and environmental appraisal methods are set out in Chapter 9.

When a road link or junction is subjected to traffic demand above its capacity, congestion ensues, speeds drop, delays are caused to vehicles, journey times become unpredictable, fuel is wasted by queueing traffic and vehicle exhausts pollute the air to a greater extent than would be the case with the same volume of smoothly-flowing traffic.

In respect of accidents, it is not always the case that increasing the capacity of a congested link will improve its safety record. Certainly, the severity of accidents tends to worsen with increased traffic speed and accidents can 'migrate', when traffic patterns are altered. Safety audits of individual schemes are needed to predict the consequences on accident levels (see Chapter 16). Likewise, it is not automatic that an increase in the capacity of an urban link provides overall benefits. When the capacity of a congested link is increased, there may be an immediate reduction in fuel consumption and pollution from vehicle exhausts if traffic flow is smoother. However, if traffic demand has been suppressed by congestion, the extra capacity may lead to traffic growth with consequent increases in fuel usage and pollution. If, on the other hand, the extra capacity is provided as part of an area-wide plan to strengthen the road hierarchy, then the benefits of diverting traffic away from residential environments onto the improved link may be realised without encouraging overall traffic growth.

### 32.7 References

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| Buchanan, C<br><i>et al</i> (1963) | The Buchanan Report<br>'Traffic in Towns', Stationery<br>Office.                   |
| Buchanan, M and<br>Coombe D (1976) | 'A note on traffic speeds in<br>London', Traffic Engineering +<br>Control, (June). |
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