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BICYCLE RESEARCH REPORT NO. 3

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AUSTRALIAN NATIONAL CAPITAL DEVELOPMENT COMMISSION: CYCLEWAYS

35 kph Limit on Cycle Routes in Canberra, Australia

The Key Facts

In Canberra, the Australian capital, where cyclists are also allowed on pavements - except within 10 metres of shops when open - planners are to design cycle routes with long and fairly gently gradients, and major cycleways on the flat will be designed for speeds of at least 35 kph (22 mph).

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Cycle routes in Canberra, will be so convenient and direct that cyclists will use them voluntarily. This is mainly a result of applying cyclists-oriented planning principles to traffic management.

The ruling factor for the speeds suggested on the cycleways is the limit which 85% of cyclists should not exceed without their journey being interrupted. On flat routes carrying regular traffic this is to be 35 kph, on leisure routes 27 kph (17 mph) (figure 1).

The verges will be kept clear so as to enable cyclists to brake in time before hitting any obstacles. This will also apply at junctions, where sightlines are often obstructed by hedges, fences or other obstacles, so for example a 5% gradient has to be kept clear for as much as 60 metres (fig 2).

To help cyclists accept gradients on these routes, length and incline are designed to cause the least possible exertion. It is just as tiring for a cyclist to climb a 10% incline of barely 30 metres as it is to climb a 3% incline of 300 metres. In fact more than three times as much height can be gained on a low gradient for the same exertion (fig 3).

Other specifications include a width of 2.5 metres and foundations considerably stronger than for pavements; road signs and other potential obstacles are to be set back one metre from the sides. Construction costs per kilometre will be about DM 100.000 or Aus$ 45,000, based on figures for 1982. There will also be running costs for maintenance to keep the cycleways in long-term use.

Title

Publication: "Cycleways" (in English), published by National Capital Development Commission, Technical Paper 37, Canberra 1983.

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1. Cycleway Design Speeds

The safe operating speed of cycles is a function of numerous factors including air resistance, weather conditions (wind, temperature, rain, etc.), type of bicycle (gearing, weight), roadway conditions and the cyclist himself (physical condition and motivation). All these factors must be considered but the designer can effectively control the conditions of thhe roadway only and, hence, design speed becomes a critical element in cycleway design.

The operating speed of cyclepaths will be influenced by the width of the path, its intensity of usage, the horizontal and vertical alignment, the surface material, and the basic function of the path.

Design characteristics for cycleways must keep in mind the average speeds of cyclists. Although cyclists have been recorded at speeds greater than 48 km/h, most people ride at half this speed, with a probable average of 16-18 km/h.

The Department of Housing and Construction, in a report prepared for the N.C.D.C. on a "Cycle Path System for Canberra", recommended that the mean speed for design purposes for cyclepaths should be 35 km/h for trunk paths and 27 km/h for recreational paths. These mean speeds have been adopted for the design of cycleways in Canberra. Figure 1 shows increased speeds expected at various downhill gradients and, conversely, reduced uphill speeds.

Where cyclists are required to share pathways with pedestrians, as in Canberra, the conflict produced by their relative differences in speed, requires that a compensating reduction in design speed be considered during design.

The cycleway network is made up of components with different design speeds and this fact needs to be considered in designing a section of cycleway, with primary importance being given to the predominant function.

2. Stopping Sight Distances

The most common incidence of sight distance problems is at underpasses, where approach paths are commonly curved, and where the walls of the structure restrict vision. Each case must be considered individually during design and the best possible curve radius adopted.

In cases where cycleways join or intersect with roadways, an adequate stopping sight distance must be provided. Where a cycleway is between the kerb and the property line in the road reservation, the cyclist's view of cross traffic is frequently obscured by hedges, fences, bushes and shrubs.

At the intersection of cycleways with a main road or access roads, the cyclist's speed and direction of approach must be controlled so that he can see and respond to any vehicle which poses a risk at the crossing.

The relationship between stopping sight distance and the gradient is shown in Figure 9. Techniques, similar to these, are used for the calculation of sight clearances needed on horizontal curves and other geometric design requirements.

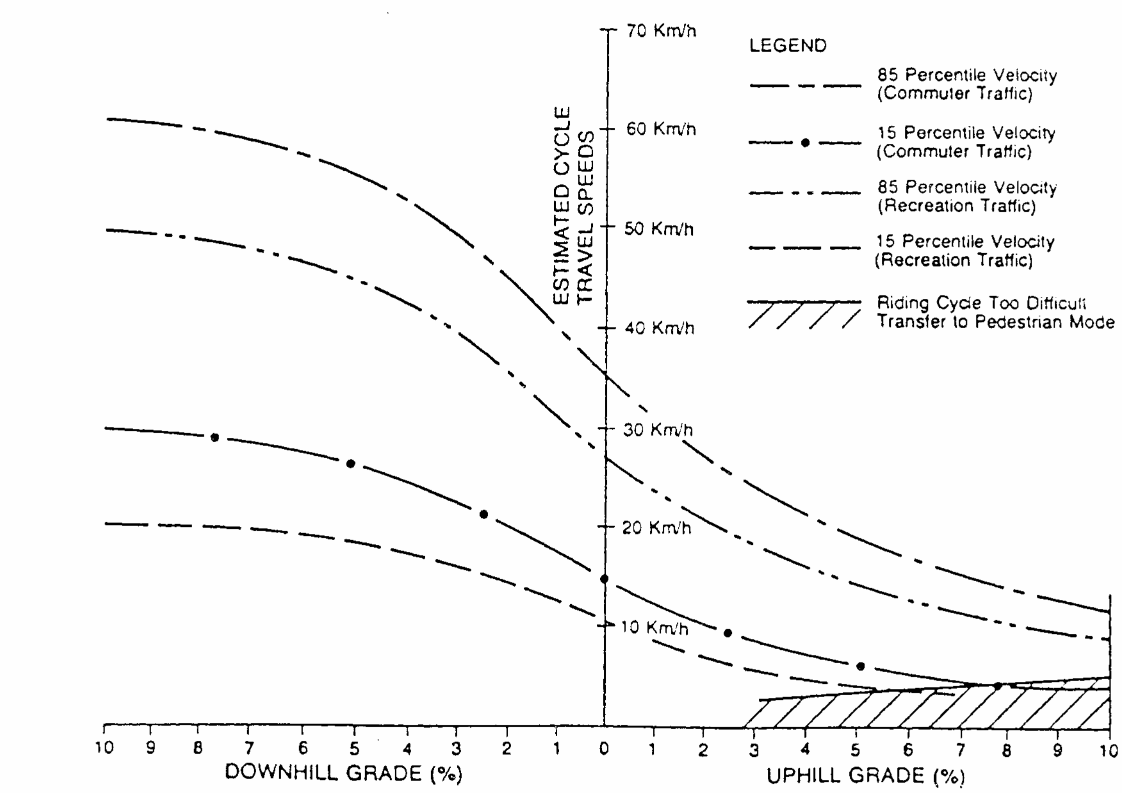


Figure 1 Design Velocity Calculation

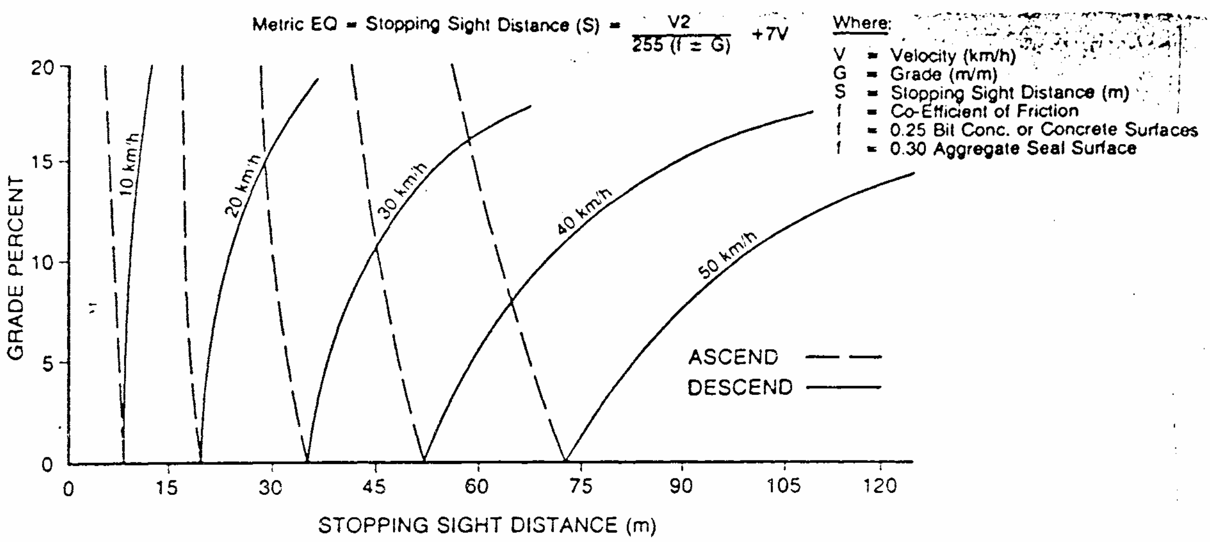
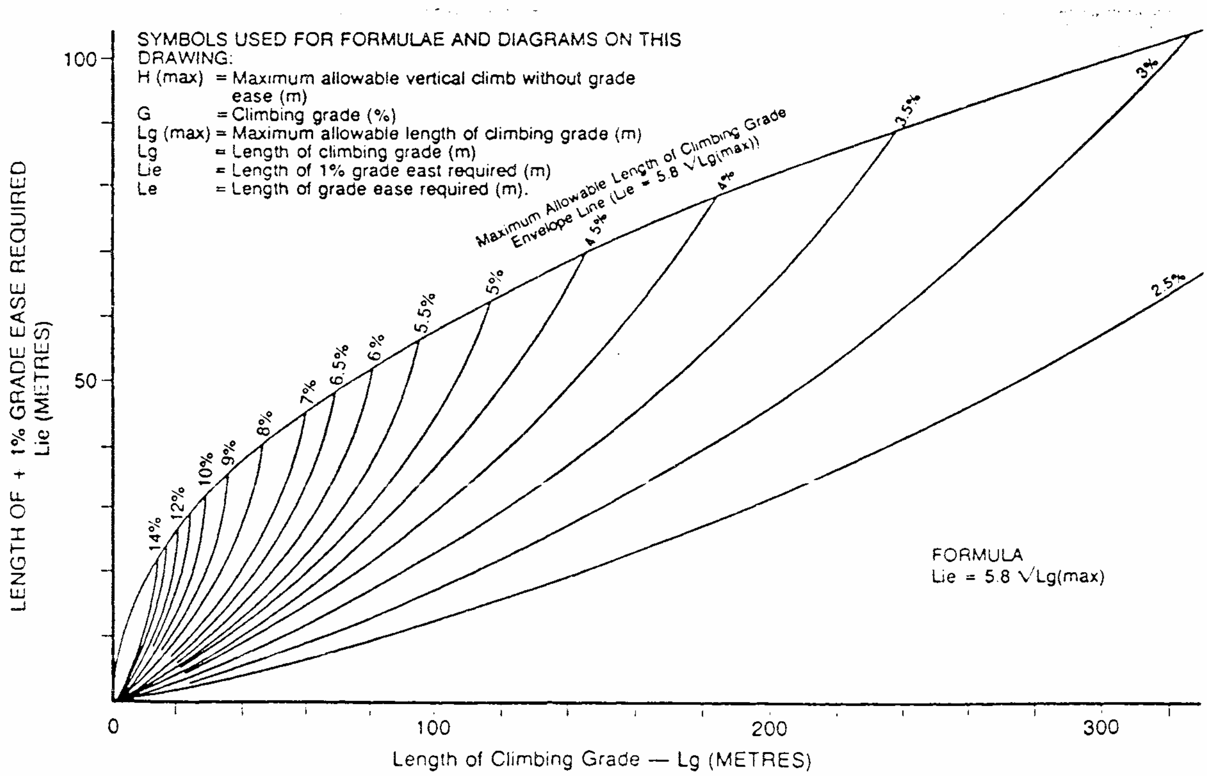


Figure 2 Stopping Sight Distance Calculation

3. Gradients

Path gradients should be no more than 5 per cent. Except where adherence to this maximum will incur significantly increased costs, a greater gradient may be adopted over short lengths.

Generally, the amount of energy required to use a cycleway will affect the usage of the route. It is apparent that once the grade exceeds 5 per cent, there is a sharp drop in length of the climb which most cyclists will tolerate. The Department of Housing and Construction's recommendations on this aspect of cyclepath design are contained in Figure 10 (a) and (b) 'Maximum Grade and Grade Ease Calculations'. This shows how the length of grade ease required may be calculated from the actual length of various uphill grades experienced by cyclists and has been adopted for the design of cycleways in Canberra.



Note: Figure 10a shows the minimum length of +1% grade ease, Lie, required for each particular length of climbing grade, Lg, at various different climbing grades, G. Where the climbing grade is not constant, a series of lengths, Li, of different climbing grades Gi, may be used provided that:

$$\Sigma \left(\frac{Gi^2 \times Li}{2916}\right) = \left(\frac{Gi^2 \times Li}{2916} + \frac{G2^2 \times L2}{2916} + \dots\right) = < 1.0$$

In such a case, the equivalent grade Geq, may be calculated by

$$Geq = \left(\frac{\Sigma Gi \times Li}{\Sigma Li}\right) = \left(\frac{Gi \times Li + G2 \times L2 + \dots}{L1 + L2 + \dots}\right)$$

and the equivalent length, Leq, may be calculated by:

$$Leq = (\Sigma Li) = (L1 + L2 + \dots)$$

and the minimum length of +1% grade ease Lie, required may be calculated from Figure 10a using Geq and Leq.

Figure 3 Grade Ease Calculation for Grade Ease of +1%