CLIMBING AND AUXILIARY LANE ANALYSIS WITH SPEED PROFILING

Auxiliary lane types include passing lanes and climbing lanes on highways and lanes for the priority passage of certain vehicles on mixed-use and urban roads.

On highways, passing lanes and climbing lanes both serve to laterally separate slower vehicles that are unable to maintain the prevailing traffic speed. This reduces congestion and mitigates vehicle ‘platooning’ where traffic flow is throttled. Climbing lanes have also been shown to improve roadway safety. The installation of a passing lane on a two-lane highway significantly can reduce the occurrence of rear-end accident rates [D. Harwood et al, 1985].

Passing Lanes
Passing lanes serve to disperse platoons and improve traffic operations by creating or enhancing passing opportunities along a roadway corridor. Where passing lanes are required, the civil engineer will seek a corridor with adequate sight distance at the lane addition and at the lane tapers. The engineer will also consider the presence of intersections and high-volume driveways in order to avoid turning movements on a road section where passing is encouraged. Passing lanes on a two-lane roadway are often more cost effective for providing passing opportunities than continuous four-lane sections because locations with high construction costs can be avoided.

Climbing Lanes
Highways with significant changes in grade, and particularly rising grades, contribute to vehicle speed variance and the possible need for climbing lanes. Climbing lanes also provide another optional element to the treatment of vertical alignments, allowing steeper and shorter gradients to be considered. The reduced earthworks can offset the cost of the road widening.

Speed Profiling
When considering the location of climbing lanes the civil engineer will combine an analysis of the size and length of the grade change with the speed profile of heavier vehicles that make use of the road. Algorithms for vehicle speed profiling at a given highway grade may incorporate vehicle weight to power ratio, average speed at the onset of change in highway grade, gearshift delays and even aerodynamic drag factors.

The result of the speed profile calculation can then be compared with the given road service level. In South Africa speed reductions of 20 km/h or more for certain vehicle profiles may warrant the provision of a climbing lane [CSIR, 2005]. In the United States, an additional lane is suggested where the speed difference of heavy vehicles and
passenger cars is above 15 km/h and, in a number of European countries including Germany, the starting point of an auxiliary lane is located where the average speed of heavy vehicles is lower than 70 km/h [S Choi et al, 2016].

Climbing Lane Analysis with Speed Profiling using Civil Designer Software

By taking a design vehicle specification and vertical alignment as an input, CIVIL DESIGNER will generate a speed profile for the design vehicle and suggest climbing lanes based on the Speed Profile analysis of the vertical alignment and according to the user defined allowable speed reduction. This functionality uses an SAE (Society of Automotive Engineers) Truck Performance Equation, which has been adapted to incorporate gearshift delays.

The software proposes climbing lane chainages and allows the engineer to apply the selected climbing lanes to the edge levels. Complex super-elevation transitions between the normal profile and the climbing lane profile can be created and auxiliary lane widths can be adjusted where necessary.

The Edge Control dialog in Civil Designer

Auxiliary lanes are created by specifying the lane width, start and end position, the taper lead-in and lead-out length and the layer works template relevant to the design. The suggested lanes can be added and edited as required.

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View a video demonstrating CIVIL DESIGNER’s Climbing Lane Analysis with Speed Profiling functionality on YouTube.

References:


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