Speed is a substantial factor contributing to road safety. Currently, speed reduction is mainly achieved through law enforcement and the implementation of traffic calming measures. An alternative speed reducing approach is to encourage drivers to voluntarily choose an appropriate driving speed. Improving road infrastructure safety can be achieved by making roads forgiving and self-explaning. This could be done by clarifying the road design characteristics for each road category. The effect on driver behavior by varying road-shoulders and presence of roadside trees was tested by means of a fixed-driving simulator experiment. Speed and lateral position were used as performance indicators. The results indicated that shoulders might not be applied to decrease the speed on the experimental road stretch, but their presence cause drivers to drive closer to the road edge, hence eliminating the probability of head-on collisions. Roadside trees did not cause drivers to adjust their driving speed; possibly due to trees not being perceived as a threat to safety by the drivers. Due to a relatively small sample size the findings of this study should be considered provisional and as pilot results for further simulator experiments using larger sample sizes to visualize the impact of different road designs on the driving behavior prior to costly deployment. However, the results are highly relevant for the understanding of the influence of road design features on driver behavior as well as for the understanding of the use of the simulator in this field of road safety research.