

# Geometric Design of Suburban Roundabouts

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A modern roundabout is an intersection with a circulatory roadway at which the vehicle speed is low, and the traffic is continuous and circulating in one direction around the central island towards the exits at the approach legs. Modern roundabout design is an iterative process that is composed of the following steps: (1) the identification of the roundabout as the optimal traffic solution; (2) the definition of the number of lanes at the intersection based on the required capacity and the level of service; (3) the initial design of the roundabout geometry; (4) design vehicle swept path, the fastest path analysis, and visibility performance checks; and (5) detailed roundabout design if the results of the performance checks are in line with the design recommendations. Initial roundabout geometry design elements are not independent of each other; therefore, care must be taken to provide compatibility between them. An overview and a comparative analysis of the initial geometric design elements for suburban single-lane roundabouts defined in roundabout design guidelines and norms used in Croatia, Austria, France, the Netherlands, Germany, Serbia, and Switzerland is given in this entry.

Keywords: approach alignment ; outer radius ; circulatory roadway ; apron ; splitter island ; roundabout entry ; roundabout exit ; longitudinal slope

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The development of modern roundabouts began in the 1960s in the United Kingdom with the adoption of the yield-at-entry rule, which gave the circulating traffic priority over entering traffic <sup>[1]</sup>. Modern roundabouts spread to other parts of Europe in the 1980s <sup>[2]</sup>. Intensive construction of roundabouts has begun in Europe in the last 30 years. European countries that stand out in the total number of roundabouts are France (63,212), Spain (36,762), and Italy (30,917) <sup>[3]</sup>, and states like the Netherlands, Sweden, Switzerland, Denmark, Finland, Germany, and Austria are also pursuing policies of mass roundabout construction.

Modern roundabout design is an iterative process, and it begins with the identification of the roundabout as the optimal traffic solution in the given conditions. The initial roundabout design refers to (1) defining the size of the intersection by selecting the outer radius, (2) laying the approach leg axes, and (3) defining the geometry of the design elements on roundabout entry and exit lanes, circulatory roadway, and central island. The initial design of the roundabout is usually followed by three performance checks: the examination of the design vehicle swept path, the fastest path analysis, and the visibility checks. If the results of these checks are not in line with the design recommendations, the geometry of the elements applied in the initial design phase is modified.

In this entry, guidelines for the initial design of individual geometric elements at a suburban single-lane roundabout, given in design guidelines and norms that are used in Croatia <sup>[4]</sup>, Austria <sup>[5]</sup>, France <sup>[6]</sup>, the Netherlands <sup>[7][8]</sup>, Germany <sup>[9]</sup>, Serbia <sup>[10][11]</sup>, and Switzerland <sup>[12][13][14][15]</sup>, are presented. These documents are selected for the following reasons. Firstly, they all define the following geometric elements of suburban roundabouts: the outer radius, the circulatory roadway, the apron, the splitter islands, entry and exit design, and the longitudinal slopes of the approaches and/or the intersection plane. Secondly, the geography and the terrain in the countries these documents originate from are different, which affects the intersection design elements' dimensions and shapes. For instance, predominantly flat terrain can be found in the Netherlands, whereas predominantly mountainous terrain is found in Switzerland and Austria. At the same time, all terrain types are represented in France, Germany, Croatia, and Serbia. The third reason for the selection of the documents is the year in which they were issued, ranging from 1991, when Swiss guidelines were published, to the year 2014, when the newest edition of Croatian guidelines for suburban roundabouts was issued. Namely, this 23-year range was marked by the mass construction of roundabouts in all the above-mentioned countries, so we believe it would be interesting to observe whether and how roundabout design approaches changed in that period. The Federal Highway Administration (FHWA) guidelines are not included in this entry because the American design vehicles used in the swept path analysis (and, consequently, the dimensions of roundabout design elements) are larger than the vehicles that can be found on European roads. The reason the United Kingdom and Australian guidelines are omitted from this entry is the fact that the UK and Australian traffic drives on the left.

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