

Synchro Snippets

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By now, you probably are aware that the 2010 Highway Capacity Manual (HCM) includes a method for analyzing roundabouts. Unlike the roundabout method within the HCM 2000, the HCM 2010 includes a robust procedure for analyzing both one and two lane roundabouts with or without slip ramps. The method was largely developed using field data collected at 31 locations within the United States. NCHRP Report 572 provides an overview of the roundabouts and the data collected.

As engineers or planners, many of us often wonder how a particular parameter can influence the results of a particular analysis scenario. Many of us rely on the default parameters and tend not to change them unless there is good reason.

Two of the key parameters of the HCM 2010 methodology, follow-up and critical headway, play an important role in determining the capacity and delay of roundabouts. Within Chapter 33 of the HCM 2010, users are encouraged to calibrate headways to those observed in the field. These parameters have significant effect on the calculations of both capacity and delay.

To shed some light on the significance of these factors, this edition of *Synchro Snippets* provides a comparison of the default headway values to those collected within the field. During one of our Synchro Studio Training Courses, one of the attendees from Reid-Middleton, a well known consultant specializing in roundabout design, was in attendance. He was kind enough to share characteristics from a few recently constructed roundabouts located in the northwest.

The HCM 2010 roundabout method automatically assigns a follow-up and critical headway based upon the geometric configuration of the roundabout. The default headway values are considered somewhat high for locations that have drivers familiar with roundabouts. Generally speaking, the more familiar drivers are, the lower the headway values.

This was true at each of the six roundabout locations provided by Reid-Middleton. Based upon field observations, lower headway values were required to reflect typical queuing at the roundabouts. Table 1 includes a summary of the default headway values based on the HCM 2010 and selected values as discussed in Chapter 33 of the HCM 2010. These headways provided realistic results at each of these six roundabouts.

Circulating Lanes	Default vs. Field Measure	Follow-Up Headway (sec.)	Critical Headway (sec.)
Single Lane	Default HCM 2010	3.186	5.193
	Field Measured	2.5	4.8
Multi-Lane	Default HCM 2010 - Left Lane	3.186	4.113
	Default HCM - Right Lane	3.186	4.293
	Field Measured - Left Lane	2.2	4.7
	Field Measured - Right Lane	2.2	4.4



An operational analysis was then conducted using both the default and field-measured headway values at each of the six roundabouts. Table 2 depicts the turning volumes at each intersection, while Table 3 depicts the average delay by approach and the overall intersection. Although the headway values have differences of less than **one** second, the differences in delay range between six to over 50 seconds.

Table 2 - Existing PM Peak Hour Volumes															
Roundabout Location	City/State	Circulating Lanes	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Total
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
I-5 Off Ramp & Thornton St/Portal Way	Ferndale, WA	1	1	1	1	379	1	340	1	261	399	14	123	1	1523
SR20 Spur & Commercial Ave	Anacortes, WA	1	-	-	-	153	-	399	-	112	65	577	172	-	1418
SR92 & G.F.A.R. (Quarry Road)	West of Granite Falls, WA	1	433	670	-	-	391	41	-	-	-	30	-	297	1862
Lundeen Pkwy & Callow Rd	Lake Stevens, WA	1	2	395	8	73	7	3	73	7	3	8	7	38	1602
Lundeen Pkwy & Vernon Rd	Lake Stevens, WA	2	57	702	21	193	352	60	11	23	421	39	10	36	1924
Point Brown Ave & Chance a LA Mer	Ocean Shores, WA	2	328	278	176	91	130	304	133	452	163	443	528	365	3393

Table 3 - Average Delay						
Roundabout Location	Roundabout Location	Eastbound Approach	Westbound Approach	Northbound Approach	Southbound Approach	Total
1-5 Off Ramp & Thornton St/Portal Way	Default Headway	5.7	41.6	12.8	7.3	25.9
	Field Measured	4.5	16.0	7.9	5.4	11.5
SR20 Spur & Commercial Ave	Default Headway	-	10.7	10.8	27.7	19.7
	Field Measured	-	7.1	7.7	12.6	10.1
SR92 & G.F.A.R. (Quarry Road)	Default Headway	114.9	24.7	-	19.6	77.2
	Field Measured	30.7	13.5	-	12.0	23.4
Lundeen Pkwy & Callow Rd	Default Headway	13.0	64.9	6.4	12.8	47.1
	Field Measured	8.5	18.1	4.9	9.3	14.8
Lundeen Pkwy & Vernon Rd	Default Headway	9.7	13.4	95.8	7.9	31.2
	Field Measured	6.1	8.3	34.1	5.9	13.4
Point Brown Ave & Chance a LA Mer	Default Headway	53.9	228.8	45.2	32.1	70.4
	Field Measured	35.1	96.3	30.2	12.7	34.7

As you begin to analyze roundabouts based on the HCM 2010, be sure to consider the importance of calibrating the headway factors. One of the benefits of Synchro is the ease of analyzing different types of intersections within the same file without having to recode the intersection.