

Approved Corrections and Changes for the Highway Capacity Manual 2000

TRB Committee AHB40, Highway Capacity and Quality of Service

Unless stated otherwise, corrections apply to both the U.S. Customary and Metric versions.

NEW	PAGE	ITEM	CORRECTION	APPROVAL DATE
		Chapter 6	Update variable symbol and definition according to changes made in Equation 20-16.	10/13/2004
	7-3	Last sentence on page	Change the last sentence to read "The space mean speed is 38.3 mi/h, calculated as $(60)[3 \div (2.0 + 1.5 + 1.2)]$."	1/13/2003
	7-6	4 th paragraph	Change first sentence to read "The slope of any ray line drawn from the origin of the speed-flow curve represents the inverse of density , based ..."	6/29/2002
	8-2	Pedestrian Characteristics	Change the third sentence to read "An average walking speed of 4.0-ft/s is appropriate...".	1/13/2003
	8-12	Exhibit 8-12	Change Facility descriptions for Detroit, MI to be "I-96 Jeffries Freeway at Warren" and "Lodge at W. Grand Blvd. "	1/13/2003
	10-10	Exhibit 10-7	Correct service volumes (see attached tables).	6/29/2002
	10-11	Exhibit 10-8	Delete middle yellow interval and associated dotted line to reflect a standard green-yellow-red phasing sequence (see attached revised exhibit)	7/26/2003
	10-24	Correct chapter reference	Change the third sentence following Exhibit 10-19 to read: "Chapter 16 provides..."	1/12/2004
	10-36	Reference 6	Add at the end, "...1982, specifically citing Mekky, A., On Estimating Turning Flows at Road Junctions, Traffic Engineering and Control Journal, Vol. 20:10, October 1979, pp. 486-487.	1/13/2003
	10-45, 10-46	Equations A10-1 and A10-3, Exhibit A10-9	Correct equations A10-1 and A10-3 and associated text and Exhibit A10-9 for the Quick Estimation Method for Signalized Intersections in Appendix A (see attached material)	1/13/2003
	12-15	Replace Exhibit 12-7b	Replace with Figure 7, NCHRP Project 20-7 (160). (See attached material.)	10/13/2004
	13-18	1 st paragraph	Revise first sentence to read "Procedures in Chapter 24 generally apply to weaving segments between 500 to 2,500 ft long." For the metric version, "...segments between 150 to 750 m long."	6/29/2002
	14	Revisions throughout the chapter	Revisions are made throughout the chapter to maintain consistency between the HCM and the Transit Capacity Manual. (See separate file.)	1/23/2006
	15-2	Exhibit 15-1	Revise first item in Input box to read " Define segments "	6/29/2002
	15-8	Equation 15-6	Replace with Equations 15-6a and 15-6b and redefine terms (see attached material). For the U.S. Customary version of the manual, substitute English units for the metric units shown.	6/29/2002

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	15-16	Example Prob. 1	In the table under Step 1, column two, change PF = 0.0 to PF = 1.0 .	6/29/2002
	15-19	Example Prob. 2, Worksheet	Revise worksheet numbers, metric version (see revised material)	6/29/2002
	15-20	Correct appendix reference	Change the fourth checked sentence under The Facts to read: "Segment lengths...described in Appendix B,"	1/12/2004
	15-22, 15-23	Example Prob. 4, solution steps and worksheet	Revise value in Step 4 for k = 0.4 . Revise calculated values based on this change in other steps and worksheet on next page (see revised material).	6/29/2002
	15-24, 15-25	Example Prob. 5, solution steps	Revise formula in Step 3 for <i>d</i> . Revise value in Step 4 for k = 0.4 . Revise subsequent values in other steps based on these changes (see revised material).	6/29/2002
	15-25	Appendix A	Revise step 3 under LOS analysis to be: 3. Convert the hourly directional volumes to through-movement 15-min flow rates by subtracting the turn movement volumes served by exclusive turn-lane lane groups and then divide this difference by the PHF.	6/29/2002
	15-25, 15-26	Appendix A	Revise the second set of seven steps under the planning analysis procedures (see revised material)	6/29/2002
	15-27	Appendix B	Redefine steps 2, 4, and 5: 2. Determine the appropriate FFS for each street segment . 4. Make test-car travel time runs over each street segment during the... 5. Total travel speed for the entire urban street section should also...	6/29/2002
	16-19, 16-152	Equation 16-10, Equation G16-8	Apply the following constraints for the delay and queuing progression factor formulas: (i) $PF \geq 1.0$ and $PF_2 \geq 1.0$ for Arrival Types 1 and 2 (ii) $PF \leq 1.0$ and $PF_2 \leq 1.0$ for Arrival Types 4 to 6 (iii) $P \leq 0.95$ ($R_p \leq 0.95/u$) for both PF and PF_2 (iv) $R_p \leq 0.95/y_L$ for both PF and PF_2 (v) $PF_2 = 1.0$ for $y_L \geq u$ ($X_L \geq 1.0$) (vi) $R_p \geq (1 - 0.95*(1 - u)/y_L)/u$ for both PF and PF_2 , and (vii) $R_p = 1.0$ ($P = u$), therefore, $PF = 1.0$ and $PF_2 = 1.0$ for $y_L \geq 0.95$ (viii) If conditions (iii), (iv) and (vi) create inconsistent constraints on R_p and P , set $R_p = 1.0$ and $P = u$, therefore, $PF = 1.0$ and $PF_2 = 1.0$	May 2001
	16-39	Box 19	Change v/c to v/s	Feb. 2004
	16-47	Capacity worksheet	Add flow ratios to WB direction = 0.313 And to NB direction = 0.289	Feb. 2004
	16-50	Box 24	Change v/c to v/s	Feb. 2004

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	16-61	Example Prob. 2, Supplemental Worksheet for Ped/Bike Effects on Permitted Left and Right Turns	The EB left effective pedestrian green time should be 23.4 seconds. The subsequent calculations for the EB left will change slightly, with no change in the final ped-bike left turn adjustment factor. The WB right is already shown as 23.4 seconds, thus no change is required.	7/28/2001
	16-73	Capacity worksheet	Add flow ratios: $N_{B_{pro}} = 0.084$ $N_{B_{per}} = 0.000$ $S_{B_{per}} = 0.418$ $S_{B_{ThRt}} = 0.322$ $E_{B_{per}} = 0.237$ $E_{B_{ThRt}} = 0.170$ $W_{B_{ThRt}} = 0.233$.	
	16-144	Correct Equation F16-3 (both versions)	The last part of Equation F16-3 should read: $...u = 1 - \frac{cT}{Q_b} [1 - \min(1, X)]$	1/12/2004
	16-151, 16-152	Equations G16-2 through G16-5	Replace N_{LG} in the denominator of each equation with $(f_{LU} * N_{LG})$	1/14/2002
	16-153	Equation G16-9	All places where $(X_L - 1)$ appears should be replaced with $(X_L - 1) + Q_{bL} / (c_L * T)$. All places where $k_B X_L$ appears should be replaced with $k_B X$. The results should be expressed in its simplest form.	1/14/2002
	16-153	Terms under Equation G16-9	Define k_B as "second-term incremental factor"	1/14/2002
	17	Definitions	Until the full HCM can be corrected, the HCQS Committee approves the following definitions: <u>Headway</u> : the time between the passing of the same reference point of two successive vehicles in a traffic stream. <u>Gap</u> : the time between the passing of the rear of the leading vehicle and the front of the following vehicle in a traffic stream. Wherever the HCM is incorrect in its use of the term "critical gap," the correct term is "critical headway." These changes affect the use of these terms in Chapters 5, 6, 7, 10, 11, 17, 18, 19, and 30.	7/15/05

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	17-7	1 st paragraph and sidebar	<p>Change the third sentence in top paragraph to read "Base values of t_c and t_r are shown for two- and four-lane major streets. Due to limitations in the available data, this procedure is not applicable to intersections with six-lane major streets."</p> <p>Delete the sidebar - "Base values for a six-lane major street are assumed to be the same as those for a four-lane major street." and replace with "This procedure is not applicable to intersections with six-lane major streets."</p>	7/28/2001, 6/29/2002
→	17-7	Correct definition of the grade term, G	<p>Delete the portion of the definition for G that converts percent grade to a decimal value:</p> $G = \text{percent grade, divided by 100}$	08/01/2007
	17-15	Equations 17-18, 17-19 and surrounding text	<p>" The time to discharge the vehicles that arrive during the red is given by Equation 17-18.</p> $g_{q1} = \frac{v C (1 - P)}{s} \quad (17-18)$ <p>where v is either v_T or $v_{L,prot}$.</p> <p>The time to discharge the vehicles that arrive on the green and join the back of the queue is given by equation 17-19.</p> $g_{q2} = \frac{v C P g_{q1}}{s g_{eff} - v C P} \quad (17-19)$ <p>where v is either v_T or $v_{L,prot}$."</p>	6/29/2002
	17-16	Exhibit 17-12	Replace with two figures (see attached figures).	6/29/2002
	17-16	Redefining f	" f = the proportion of through and protected left turn traffic which departs the upstream signalized intersection and subsequently arrives at the subject two-way stop-controlled intersection with respect to the through and protected left turn traffic departing the upstream signalized intersection. If there are no opportunities for vehicles to leave the roadway between the upstream signalized intersection and the TWSC intersection, then f is equal to 1."	6/29/2002

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	17-16	Add Equation 17-21b and text	<p>“The downstream flow after a period equal to the green time after the platoon reaches the unsignalized intersection is $v_{c,g}$ and is given by:</p> $v_{c,g} = vR_p f + (v_{c,max} - vR_p f)(1 - F)^{g - gq}$ <p>Again, v is either v_T or $v_{L,prot}$</p>	6/29/2002
	17-17	Equation 17-22	Replace with the multi-part equation and following text (see attached material).	6/29/2002
	17-19	Equation 17-28	<p>The equation 17-28 should read</p> $v_{c,u,x} = \begin{cases} \frac{v_{c,x} - 1.5v_{c,min}(1 - p_x)}{p_x} & \text{if } v_{c,x} > 1.5v_{c,min}(1 - p_x) \\ 0 & \text{otherwise} \end{cases}$ <p>Remove the definition “s” under equation 17-28 and add “$v_{c,min}$ = as defined on page 17-17”</p>	6/29/2002, modified 7/26/2003
	17-19	New Equation 17-28a	<p>Below equation 17-28 and the references to the variables in the equation, insert the following:</p> <p>“The user can provide values of the proportion of unblocked time for a particular unsignalized intersection movement caused by upstream signals, the p_x values. Similarly the flow in the blocked period can also be given as v_{block} in veh/h. The appropriate conflicting flow for the unblocked period is given by Equation 17-28a.</p> $v_{c,u,x} = \begin{cases} \frac{v_{c,x} - v_{block}(1 - p_x)}{p_x} & \text{if } v_{c,x} > v_{block}(1 - p_x) \\ 0 & \text{otherwise} \end{cases}$ <p>(see attached material)</p>	7/26/2003
	17-21	Flared Minor-Street Approaches	Modify procedure (see attached material)	6/29/2002
	17-23	Correct a word	<p>Correct 5th sentence to read: “Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final finally acceleration delay.”</p>	7/15/2005

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	17-23,24	Correct 1 st paragraph under Control Delay	Delete the last two sentences starting with “With respect to...” and replace with the following: “It is very difficult to directly measure control delay in the field. For this reason, many analysts prefer to measure stopped delay in the field and estimate the time required for deceleration to join the queue and acceleration back to free-flow speed. Chapter 16, Appendix A provides information on determining control delay using field measurements. Although this information is intended to apply to signalized intersections, many of the principles can also be applied to unsignalized intersections.”	7/15/2005
	17-36	4 th paragraph, 2 nd sentence	“The volume on the subject approach is increased incrementally until the degree of utilization on any one approach exceeds 1.0.”	1/12/2004
	17-53, 17-61, 17-62, 17-71, App. A	Correct Worksheet 5a and 5b	Correct Worksheet 5a and 5b by changing the left column heading under “Movement 2” and “Movement 5” to V_T instead of $V_{T,prog}$.	1/12/2004
	18-24	Correct Example Problem 3, Step 4	The top equation in step 4 should read: $v_{tot} = 48 + 27 + 40 + 21 + 20 = 156$ p/cycle	1/12/2004
	18-25	Correct Example Problem 3, Step 5	The last equation in step 5 should read: $t = 3.2 + \frac{46.0}{4.0} + \left(2.7 * \frac{14}{16.0} \right) = 17.1s$	1/12/2004
	20-1	Revise text	Paragraph to be added after the first paragraph under the section titled - Limitations of the Methodology " The operational analysis methodologies in this chapter are not intended to address capacity and traffic flow on two-lane highways in developed areas. Typically, two-lane highway segments in these areas (for example, a two-lane highway through a small town) are subject to lower speed limits and have few to no passing zones. In addition, the effects of operations at signalized and/or unsignalized intersections, which may be significant, are not accounted for in the current methodology."	10/13/2004
	20-3	Correct sentence	Change the second sentence, sentence paragraph, under LEVELS OF SERVICE to read: “Exhibit 20-2 reflects the boundary maximum values of percent...”	1/12/2004
	20-10	Equation 20-7	To reduce the potential for misunderstanding, HCM Equation (20–7) should be rewritten using the exp function, as shown below, rather than as e raised to a power: $BPTSF = 100 (1 - \exp(-0.000879v_p))$	10/13/2004
	20-20	Replace Equation 20–16	Replace with Equation 7, NCHRP Project 20-7 (160). (See attached material.)	10/13/2004

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	20-22	Equation 20-17	To reduce the potential for misunderstanding, HCM Equation (20-17) should be rewritten using the exp function, as shown below, rather than as e raised to a power: $BPTSF_d = 100 (1 - \exp (av_d^b))$	10/13/2004
	20-23	Replace Exhibit 20-20	Replace with Table 10, NCHRP Project 20-7 (160). (See attached material.)	10/13/2004
	20-24	Replace Exhibit 20-21	Replace with Table 9, NCHRP Project 20-7 (160). (See attached material.)	10/13/2004
	20-39 to 20-41	Update Example Problem 3	According to changes in Exhibit 20-20 and 20-21, and Equation 20-16.	10/13/2004
	20-41	Correct exhibit references	In the fourth box under "Average Travel Speed," change the references to "(Exhibit 20-7 or 20-13)"	1/12/2004
	20-42	Correct equation in Step 2	Change the coefficient to 2 as the multiplier for 1.7 in the denominator (numerator not shown) of the ATS_{pi} calculation as follows: $1 + 2.3 + \left(\frac{1}{1.11} \right) + \frac{2(1.7)}{1 + 1.11}$	7/24/2004
	20-42 to 20-43	Update Example Problem 4	According to changes in Exhibit 20-20 and 20-21, and Equation 20-16.	10/13/2004
	22-19, 22-46	Correct box numbering	In the hexagonal box titled "Adjust HCM capacities?" delete the number 5 reference to a step.	1/12/2004
	22-56	Correct term in equation A22-3	Revise the last term in the equation to read: $\dots - OFRD (i - 1, p)$	10/13/2004
	23-5	Exhibit 23-3	Correct Exhibit 23-3 figure to comply with Exhibit 23-2 values [no curves going beyond max flow rate of 2400 pc/h/ln nor dropping below 50mph; LOS A density line angled to the left to intersect the 55mph curve at 600 pc/h/ln] (see revised figure)	6/29/2002
	24-8	Exhibit 24-7	Correct the N_w equation for Type C configuration: the middle term should be ... 0.00011L ... and not 0.00011.	6/29/2002
	25, multiple pages	Corrections for determining v_{12}	The methodology for determining the proportion of volume in lanes 1 and 2 on a 6-8 lane freeway is corrected. (See attached material.)	1/23/2006
	25-3	2 nd paragraph	Revise first bullet to read "Maximum total flow approaching a merge or diverge area on the freeway (v_F)"	6/29/2002
	25-6	Exhibit 25-5	Correct Equation 2 under 6-lane freeways: the third term should be ...-0.003296 S_{FR} ... and not -0.003296.	6/29/2002

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→	25-6	Exhibit 25-5	<p>Correct Equation 4 under 8-lane freeways to be:</p> $P_{FM} = 0.2178 - 0.000125v_R + 0.01115L_A/S_{FR} \text{ for } v_F/S_{FR} \leq 72$ $P_{FM} = 0.2178 - 0.000125v_R \text{ for } v_F/S_{FR} > 72$ <p>In the Metric manual:</p> $P_{FM} = 0.2178 - 0.000125v_R + 0.05887L_A/S_{FR} \text{ for } v_F/S_{FR} \leq 45.2$ $P_{FM} = 0.2178 - 0.000125v_R \text{ for } v_F/S_{FR} > 45.2$	8/01/2007
	25-17	Equation 25-12	Change the units in the definition for v_F to (pc/h) from (pc/h/ln)	6/29/2002
	27-38	Correct chapter reference	In the first checked sentence under “ Comments ” change the last reference to “(from Chapter 16);”	1/12/2004
	30-6 to 30-8	Equations 30-5, 30-6, 30-7, 30-8, Exhibit 30-4	Correct equations and exhibit under section titled “Determining Link Speed” (see attached material)	6/29/2002
	30-35	Correct Equation A30-15 (both versions)	<p>Correct Equation A30-15 by adding brackets as shown:</p> $D = 5 + \frac{3600X}{v} + 900T \left[(X - 1) + \sqrt{(X - 1)^2 + \frac{8X^2}{Tv}} \right]$	1/12/2004
	31-31	Add a reference	<p>Add an additional reference after number 1:</p> <p>1a. Elefteriadou, L., G. List, J. Leonard, H. Lieu, M. Thomas, R. Giguere, R. Brewish, G. Johnson. Beyond the Highway Capacity Manual: A Framework for Selecting Simulation Models in Traffic Operational Analyses. In <i>Transportation Research Record 1678</i>, TRB, National Research Council, Washington, D.C., 1999, pp. 96–106.</p>	10/13/2004