CETR3 Printing 2 Updates

TOPIC 1 UPDATES

yellow highlighted text* *and blue math differs from current content

PAGE 1-14: RIGHT COL, 3RD PARA

Change from: VOC emissions,
Change to: volatile organic compound (VOC) emissions,

PAGE 1-16: SOUND AND NOISE SECTION, 1ST PARA, INSERT 1A

Sound occurs when an ear senses pressure vibration, while *noise* is unwanted sound. *Noise impact studies* are used to compare existing background noise levels, called *ambient sound levels*, to *predicted future noise levels* to a set of *noise abatement criteria* (NAC) for land use activity categories. Sound levels are measured at the L_{10}, L_{50}, and L_{90} levels, or sound levels that are exceeded 10%, 50%, and 90% of the time. FHWA noise regulations state that traffic noise impacts require consideration of abatement when the worst-hour noise levels approach or exceed the NAC shown in Table 1.2.

PAGE 1-16: SOUND AND NOISE, 2ND PARA, INSERT 1B

Change from:
Sound levels are expressed in levels of pressure and measured in decibels (dB). The decibel scale is logarithmic at base 10, meaning a change of 1 dB reflects a ten-fold change in sound pressure level. The sound level *A-weighted scale*, which suppresses low frequency sounds, is often used to simulate human hearing response, in which case the sound level is given in A-weighted decibels (dBA). The *reference level* for sound in air is usually chosen as 0.02 MPa. This is the lowest level of normal sensitivity for the human ear found in those without hearing damage due to loud noise exposure. The maximum audible field (MAF) threshold varies with audible frequency, measured in hertz. The following four levels are often used for reference.

- 70 dB at 2 Hz
- 100 dB at 100 Hz
- 0 dB at 2000 Hz
- 20 dB at 16,000 Hz

Change to:

Reference: FHWA-HEP-18-067, ANSI S3.6-1989

Sound intensity levels are expressed in levels of pressure using the auditory threshold of 0.2 MPa as the *reference level* of 0 decibels (dB). The dB is logarithmic at base 10, meaning a change of 1 dB reflects a tenfold change in sound pressure level. Pressure sensitivity varies with frequency, with the reference level (0 dB) occurring in the range of 2000 to 4000 Hz for the normal human ear. The lowest audible sound pressure for various frequencies is called the *minimum audible field* (MAF). Examples of MAF responses that match data plots on response curves are

- 70 dB at 2 Hz
- 10 dB at 100 Hz
- 0 dB at 1000 to 4000 Hz
- 20 dB at 16,000 Hz

Sound level meters convert the absolute sound pressures as defined in ANSI S1.1-2013 to a weighted scale. For instance, the weighted scale would apply a −70 dB to the 2 Hz range, −10 dB to the 100 Hz range, 0 dB to the 1000 Hz to 4000 Hz range, and −20 dB to the 16,000 Hz range for the example MAF. This weighted scale allows reporting sound level readings without the detail of MAF responses. The *A-weighted scale*, shown as dBA, is most often used for environmental sound studies since dBA compares closely to the human ear response to sound.

The *threshold of discomfort* … at approximately 145 dB.

PAGE 1-16: SOUND AND NOISE, 4TH PARA

Traffic noise studies are ~~commonly~~ required by the FHWA for federally funded transportation projects.

PAGE 1-16: SOUND AND NOISE, 5TH PARA

Sound levels are recorded over a period of hours, days, or months, depending on the study objective, to determine if a substantial noise increase will occur. ~~Recorded noise … … environment occurs.~~ The FHWA defines …

PAGE 1-17: LEFT COL, LAST PARA

Transportation is … … and, in some cases, heat energy. VOCs are also produced from construction materials such as asphalt binders, plastics, adhesives, and paint coatings.

PAGE 1-17: TABLE 1.2, INSERT D

Table 1.2 *Noise Abatement Criteria (NAC) Hourly Sound Level A-Weighted Decibels (dBA)*[1]

activity category	activity L_{eq} (hr)	criteria[2] L_{10} (hr)	evaluation location	activity description
A	57	60	exterior	lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B[3]	67	70	exterior	residential
C[3]	67	70	exterior	active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	55	interior	auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[3]	72	75	exterior	hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A through D or F
F				agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G				undeveloped lands that are not permitted

[1] Either L_{eq} (hr) or L_{10} (hr) (but not both) may be used on a project.

[2] The L_{eq} (hr) and L_{10} (hr) activity criteria values are for impact determination only and are not design standards for noise abatement measures.

[3] Includes undeveloped lands permitted for this activity category.

Reprinted from *Code of Federal Regulations, Title 23, Part 772, Table 1, U.S. Department of Transportation, Federal Highway Administration*

PAGE 1-19: PROBLEM 3B

Change from:
b) The number of employed adults living in the study zone is most nearly
(A) 378
(B) 510
(C) 3560
(D) 6570

Change to:
b) The number of employed adults living in the study zone is most nearly
(A) 378
(B) 510
(C) 1260
(D) 6570

PAGE 1-19: PROBLEM 3C

Change from:
c) The number of employed adults living in the study zone who have transit access is most nearly
(A) 440
(B) 1070
(C) 1460
(D) 5670

Change to:
c) The number of employed adults living in the study zone who have transit access is most nearly
(A) 390
(B) 440
(C) 1070
(D) 1460

PAGE 1-22: SOLUTION 3B

Change from:
(b) The number of employed adults is found by multiplying the total population of the study zone by the proportion of employed adults per household.

$$\begin{aligned} N_a &= (\text{population})\, p_e \\ &= (4860)(0.74) \\ &= 3596 (3600) \end{aligned}$$

Change to:
(b) The number of employed adults is found by multiplying the total households of the study zone by the proportion of employed adults per household.

$$N_a = (\text{households})\, p_e$$
$$= (1700)(0.74)$$
$$= 1258 \;\; (1260)$$

PAGE 1-22: SOLUTION 3C

Change from:

(c) To find the number of employed adults that have transit access, multiply the number of employed adults by the proportion of employed adults working at transit-accessible locations.

$$N_{a,t} = N_a P_{a,t}$$
$$= (3560)(0.31)$$
$$= 1068 \;\; (1070)$$

Change to:

(c) To find the number of employed adults that have transit access, multiply the number of employed adults by the proportion of employed adults working at transit-accessible locations.

$$N_{a,t} = N_a P_{a,t}$$
$$= (1258)(0.31)$$
$$= 390$$

CETR3 Printing 2 Updates

TOPIC 2 UPDATES

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PAGE 2-15: LEFT COL, STEP 3, EQ. 2.15

$$S = \text{FFS}_{\text{adj}} \quad \left[\upsilon_p \le \text{BP}\right] \qquad [\text{SI}] \quad 2.15\text{(a)}$$

Change from:

$$\text{S} = \text{FFS}_{\text{adj}} - \frac{\left(\text{FFS}_{\text{adj}} - \dfrac{c_{\text{adj}}}{D_c}\right)\left(\upsilon_p - \text{BP}\right)}{(c_{\text{adj}} - \text{BP})} \quad \left[BP \le \upsilon_p \le c\right] \quad [\text{U.S.}] \quad 2.15\text{(b)}$$

Change to:

$$S = \text{FFS}_{\text{adj}} - \frac{\left(\left(\text{FFS}_{\text{adj}} - \dfrac{c_{\text{adj}}}{D_c}\right)\left(\upsilon_p - \text{BP}\right)\right)^a}{(c_{\text{adj}} - \text{BP})^a} \quad [a = 2.00 \text{ for freeways, } 1.31 \text{ for multilane highways}] \quad 2.15$$

PAGE 2-16: LEFT COL, PARA BELOW TABLE 2.10

Change from: P_T and P_R are decimal ratios.

Change to: P_T is a decimal ratio.

PAGE 2-22: LEFT COL, 3RD PARA

Change from: RCEs for RVs for specific upgrades are found in Table 2.26 at the end of Sec. 2.6

Change to: PCEs for RVs for specific upgrades are found in Table 2.26 at the end of Sec. 2.6.

PAGE 2-25: LEFT COL, 2ND PARA

Change from/to: E_T and E_R are the passenger car equivalents for trucks and buses and for RVs, respectively. Truck and bus counts can be combined because trucks and buses share similar performance characteristics. ~~When the number of trucks is more than five times the number of RVs for multilane highways and freeways, the RV count can be included with trucks rather than evaluated separately.~~

This paragraph is about two-lane highways. The deleted sentence refers to multilane and highway segments for which RVs and trucks are no longer differentiated.

PAGE 2-25: RIGHT COL, STEP 5, 4TH PARA

Change from: For level terrain, $f_{g,\text{PTSF}}$, the grade adjustment factor is 1.0.

Change to: From *HCM* Exh. 15-16, for level terrain, $f_{g,\text{PTSF}}$, the grade adjustment factor is 1.0.

PAGE 2-28: EQ. 2.34

Change from: $s = s_o\, f_w\, f_{\text{HVg}}\, f_p\, f_{\text{bb}}\, f_a\, f_{\text{LU}}\, f_{\text{LT}}\, f_{\text{RT}}\, f_{\text{Lfb}}\, f_{\text{Rfb}}\, f_{\text{wz}}\, f_{\text{ms}}\, f_{\text{sp}}$

Change to: $s = s_o\, f_w\, f_{\text{HVg}}\, f_p\, f_{\text{bb}}\, f_a\, f_{\text{LU}}\, f_{\text{LT}}\, f_{\text{RT}}\, f_{\text{Lpb}}\, f_{\text{Rpb}}\, f_{\text{wz}}\, f_{\text{ms}}\, f_{\text{sp}}$

PAGE 2-29: LEFT COL, PARA BELOW FIG. 2.11

Change from: s is saturation flow rate, s_o is base saturation flow rate, and f_w is lane width in feet. For populations greater than or equal to 250,000 use 1900 pcphpl; otherwise use 1750 pcphpl.

Change to: s is saturation flow rate, s_o is base saturation flow rate, and f_w is the adjustment factor for lane width. For populations greater than or equal to 250,000, use a base saturation flow rate of 1900 pcphpl; otherwise use 1750 pcphpl.

PAGE 2-29: EQ. 2.35

Change from: $f_{\text{HVg}} = \dfrac{100}{100 + P_{\text{HVg}}} = \dfrac{100 - 0.79P_{\text{HV}} - 2.07P_g}{100}$

Middle equation deleted

Change to: $f_{\text{HVg}} = \dfrac{100 - 0.79P_{\text{HV}} - 2.07P_g}{100}$

PAGE 2-30: LEFT COL, 3RD PARA BELOW EQ. 2.38

Change from: f_a is the type.

Change to: f_a is the area type adjustment factor.

PAGE 2-31: REPLACE EQ. 2.39, INSERT 2A

Change from:

$$f_{\mathrm{LT}} = \frac{1}{1.05 P_{\mathrm{LT}}} \qquad 2.39(a)$$

$$f_{\mathrm{RT}} = \frac{1}{1.18 P_{\mathrm{RT}}} = \frac{1}{E_{\mathrm{RT}}} \qquad 2.39(b)$$

Change to:

$$f_{\mathrm{LT}} = \frac{1}{E_L} = \frac{1}{1.05} = 0.95 \qquad 2.39(a)$$

$$f_{\mathrm{RT}} = \frac{1}{E_R} = \frac{1}{1.18} = 0.85 \qquad 2.39(b)$$

~~f_{LT} is then 0.95 and f_{RT} is 0.85.~~

PAGE 2-31: LEFT COL, 2ND EQUATION DISPLAY

For pedestrian and bicycle conflicts, use the equations for right turns and left turns, respectively.

$$f_{\mathrm{Rpb}} = 1.0 - P_{\mathrm{RT}}(1 - A_{\mathrm{pbT}})(1 - P_{\mathrm{RTA}})$$

$$f_{\mathrm{Lpb}} = 1.0 - P_{\mathrm{LT}}(1 - A_{\mathrm{pbT}})(1 - P_{\mathrm{LTA}})$$

The preceding equations are for shared lanes and account for the proportions, *P*, of turning vehicles. The following equations are for right-turn exclusive lanes and left turns from a one-way street, which are different conditions.

$$f_{\mathrm{Rpb}} = A_{\mathrm{pbT}}$$

$$f_{\mathrm{Lpb}} = A_{\mathrm{pbT}}$$

PAGE 2-31: LEFT COL, 3RD EQUATION DISPLAY

Change from:

In the case of pedestrian-only conflicts,

$$A_{p\mathrm{rT}} = 1 - \frac{f V_{\mathrm{ped}}}{2000}$$

Change to:

In the case of pedestrian-only conflicts,

$$A_{pbT} = 1 - \frac{fV_{\text{ped}}}{2000}$$

This factor is the time-space occupied by pedestrians in the preceding two factor equations.

PAGE 2-31: LEFT COL, 4TH PARA

Change from:

The value for *f* is either 0.6 or 1. If the number of turning lanes is the same as the number of receiving lanes, then *f* = 0.6. If the number of turning lanes is smaller than the number of receiving lanes, then *f* = 1.

Change to:

The value for *f* is either 0.6 or 1. If the number of turning lanes is the same as the number of receiving lanes, then *f* = 1. If the number of turning lanes is smaller than the number of receiving lanes, then *f* = 0.6.

PAGE 2-32: RIGHT COL, PARA BEFORE EQ. 2.47

Change from: For intersections with *pedestrian crossings*, the minimum green interval may be selected by

Change to: For intersections with *pedestrian crossings*, the minimum green interval may be selected by Eq. 2.47 [*HCM* Eq. 31-70].

PAGE 2-32: UNIFORM DELAY SECTION, INSERT 2B

Change from:

The *uniform delay, d_1,* is determined assuming uniform arrivals, stable flow, and no initial queue at the beginning of green [*HCM* Eq. 19-19].

$$d_1 = \frac{0.5C\left(1 - \frac{g}{C}\right)^2}{1 - \left(\min(1, X)\right)\left(\frac{g}{C}\right)}$$

Change to:

The *uniform delay*, d_1, is determined assuming uniform arrivals, stable flow, and no initial queue at the beginning of green, as shown in Eq. 2.49 [*HCM* Eq. 19-19], Eq. 2.50(a) [*HCM* Eq. 19-20], and Eq. 2.50(b) [*HCM* Eq. 19-21].

$$d_1 = \mathrm{PF}\frac{0.5C\left(1-\frac{g}{C}\right)^2}{1-\left(\min\left(1,X\right)\right)\left(\frac{g}{C}\right)} \qquad 2.49$$

$$\mathrm{PF} = \frac{1-P}{1-\frac{g}{C}} \times \frac{1-y}{1-\min(1,X)P} \times \left[1+y\frac{1-\frac{PC}{g}}{1-\frac{g}{C}}\right] \qquad 2.50(a)$$

$$y = \min(1,X)\frac{g}{C} \qquad 2.50(b)$$

PAGE 2-33: EQ. 2.53

Change from: $c_a = 3600\frac{g_a sN}{C}$

remove 3600

Change to: $c_a = \frac{g_a sN}{C}$

PAGE 2-33: TABLE 2.42

Clarification: The title of the table is self-explanatory in that if all the delays are at saturated flow the level of service is F.

Table 2.42 *LOS Designation for Automobile Mode Based on Signal Delay and V/C*

Exhibit 19-8
LOS Criteria: Motorized Vehicle Mode

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio[a] ≤1.0	>1.0
≤10	A	F
>10–20	B	F
>20–35	C	F
>35–55	D	F
>55–80	E	F
>80	F	F

Note: [a] For approach-based and intersectionwide assessments, LOS is defined solely by control delay.

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PAGE 2-34: EQ. 2.60

Change from: $c_{e,pce} = 1130e^{(-1.0\times10^{-3})v_{c,pce}}$

Change to: $c_{e,pce} = 1380e^{(-1.02\times10^{-3})v_{c,pce}}$

PAGE 2-38: TABLE 2.12 TITLE

Change from: Table 2.12 Specific Segment PCEs for Mix of Single Unit Trucks and Tractor Trailers

Change to: Table 2.12 *Specific Segment PCEs for a Mix of 30% Single Unit Trucks (SUTs) and 70% Tractor Trailers (TTs)*

PAGE 2-38: TABLE 2.12 SOURCE

Change from: Used with permission from *Highway Capacity Manual*, 6th Edition: A Guide for Multimodal Mobility Analysis, 2016, Exhibits 12-26, 12-27, 12-28 . . .

Change to: Used with permission from *Highway Capacity Manual*, 6th Edition: A Guide for Multimodal Mobility Analysis, 2016, Exhibit 12-26 . . .

PAGE 2-51: BEFORE LAST PARA, INSERT 2C

Calculate the density using *HCM* Eq. 12-11.

$$D_{\text{upgrade}} = \frac{v_{p,\text{upgrade}}}{S} = \frac{1257 \text{ pcphpl}}{56 \text{ mph}} = 22.4 \text{ pcpmpl}$$

$$D_{\text{downgrade}} = \frac{v_{p,\text{downgrade}}}{S} = \frac{1227 \text{ pcphpl}}{56 \text{ mph}} = 21.9 \text{ pcpmpl}$$

From Table 2.13 [*HCM* Exh. 12-15]. . .

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TOPIC 3 UPDATES

yellow highlighted text and blue math differs from current content

PAGE 3-3: WALKING SPEED SECTION, 2ND PARA

Change from:

On normal, level, uncongested sidewalks, average walking speed can be assumed to be 5.0 ft/sec (1.5 m/s). When flow traffic includes elderly persons, up to 20% elderly populations can use 4.0 ft/sec (1.2 m/s), and more than 20% elderly can use 3.5 ft/sec (1.0 m/s). For crosswalks, flow populations of up to 20% elderly can use 3.5 ft/sec (1.0 m/s), and populations with more than 20% elderly should use 3.0 ft/sec (0.9 m/s) average speed. When the walkway has an upgrade of 10% or more, the average speed should be reduced by 0.5 ft/sec (0.2 m/s).

Change to:

On normal, level, uncongested sidewalks, average walking speed can be assumed to be 5.0 ft/sec (1.5 m/s). When flow traffic includes elderly persons, up to 20% elderly populations can use 4.4 ft/sec (1.3 m/s), and more than 20% elderly can use 3.3 ft/sec (1.0 m/s). For crosswalks, flow populations of up to 20% elderly can use 4.0 ft/sec (1.2 m/s), and populations with more than 20% elderly should use 3.3 ft/sec (1.0 m/s) average speed. When the walkway has an upgrade of 10% or more, the average speed should be reduced by 0.3 ft/sec (0.1 m/s).

PAGE 3-10: RIGHT COL, BULLET POINTS

Change from:

cross-flow areas, 23 ped/min/ft sum of both flows

Change to:

cross-flow areas, 17 ped/min/ft sum of both flows

PAGE 3-12: TABLE 3.6, LOS A SCORE

Change from: 1.50

Change to: ≤ 1.50

PAGE 3-15: FIG. 3.13 SOURCE

change from: Exhibit 18-4

change to: p. 18-4 margin exhibit

PAGE 3-16: FIG. 3.14 SOURCE

change from: Exhibit 18-5

change to: p. 18-5 margin exhibit

PAGE 3-17: TABLE 3.8, INSERT 3A

replace HCM Exh. 18-19

Condition	Variable When Condition Is Satisfied	Variable When Condition Is Not Satisfied
$v_m > 160$ veh/h or $W_A > 0$ ft	$W_v = W_{ol} + W_{bl} + W_{os}^* + W_{pk}$	$W_v = (W_{ol} + W_{bl} + W_{os}^* + W_{pk}) \times (2 - 0.005\ v_m)$
$p_{pk} > 0.25$ or $W_{bl} + W_{os}^* + W_{pk} \leq 10$	$W_l = W_{bl} + W_{os}^* + W_{pk}$	$W_l = 10$

Notes: W_{ol} = width of the outside through lane (ft);
W_{os}^* = adjusted width of paved outside shoulder; if curb is present $W_{os}^* = W_{os} - 1.5 \geq 0.0$, otherwise $W_{os}^* = W_{os}$ (ft);
W_{os} = width of paved outside shoulder (ft);
W_{bl} = width of the bicycle lane = 0.0 if bicycle lane not provided (ft); and
W_{pk} = width of striped parking lane (ft).

Exhibit 18-19
Variables for Pedestrian LOS Score for Link

PAGE 3-18: PARA AFTER EQ. 3.36

Change from: If the crossing is at location A in Eq. 3.37,

Change to: If the crossing is at location A in Fig. 3.16,

PAGE 3-18: RIGHT COL, LAST SENTENCE

Change from: For illegal midsegment crossings, the waiting delay is d_{pw}=0.0.

Change to: For illegal midsegment crossings, the waiting delay d_{pw} is not considered for calculation of the crossing delay.

PAGE 3-19: EQ. 3.39

Change from: $$I = 0.75\left[\frac{\left(F_{\text{cd}}I_{p,\text{link}}+1\right)^3\frac{L}{S_p}+\left(I_{p,\text{int}}+1\right)^3 d_{\text{pp}}}{\frac{L}{S_p}+d_{\text{pp}}}\right]+0.125$$

Change to: $$I_{p,\text{seg}} = 0.75\left[\frac{\left(F_{\text{cd}}I_{p,\text{link}}+1\right)^3\frac{L}{S_p}+\left(I_{p,\text{int}}+1\right)^3 d_{\text{pp}}}{\frac{L}{S_p}+d_{\text{pp}}}\right]^{1/3}+0.125$$

PAGE 3-22: EX. 3.1 SOLUTION

Change from: $$d_p = \frac{\left(C-g_c\right)^2}{2C} = \frac{(0.5)(75\text{ sec - }30\text{ sec})^2}{(2)(75\,\text{sec})}$$

The change is to remove (0.5) from the equation.

Change to: $$d_p = \frac{\left(C-g_c\right)^2}{2C} = \frac{(75\text{ sec}-30\text{ sec})^2}{(2)(75\,\text{sec})}$$

PAGE 3-25: EQ. 3.44

Change from: $$F_m = \frac{Q_{\text{ob}}}{\text{PHF}}\left(1+\frac{S_p}{S_b}\right) \quad [\mathit{HCM}\text{ Eq. 24-5}] \qquad 3.44$$

Change to: $$F_m = \frac{Q_{\text{ob}}}{\text{PHF}}\left(1+\frac{S_p}{S_b}\right) \quad [\mathit{HCM}\text{ Eq. 24-6}] \qquad 3.44$$

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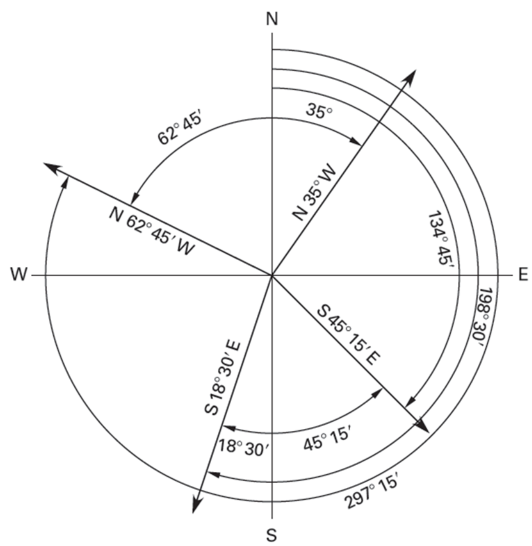
TOPIC 4 UPDATES

yellow highlighted text* and *blue* *math differs from current content



PAGE 4-5: EX. 4.1 GRAPHIC

Change from: N 35°W

Change to: N 35°E

Change from: S 18°30′E

Change to: S 18°30′W

PAGE 4-16: EQ. 4.34A AND B

$$L_{s,\min} = \sqrt{24 p_{\min} R} \quad [\textit{GDHS}\ \text{Eq. 3-28}]$$

$$= 0.0214 \frac{v^3}{RC} \quad [\textit{GDHS}\ \text{Eq. 3-29}]$$

Change from:

$$L_{s,\min} = \sqrt{24 p_{\min} R} \quad [\textit{GDHS}\ \text{Eq. 3-28}]$$

$$= 3.15 \frac{v^3}{RC} \quad [\textit{GDHS}\ \text{Eq. 3-29}]$$

$$L_{s,\min} = \sqrt{24 p_{\min} R} \quad [GDHS \text{ Eq. 3-28}]$$

$$\text{or} = 0.0214 \frac{v^3}{RC} \quad [GDHS \text{ Eq. 3-29}]$$

Change to: $L_{s,\min} = \sqrt{24 p_{\min} R} \quad [GDHS \text{ Eq. 3-26}]$

$$\text{or} = 3.15 \frac{v^3}{RC} \quad [GDHS \text{ Eq. 3-27}]$$

PAGE 4-16: EQ. 4.35

Change from: $L_{s,\max} = \sqrt{24 p_{\max} R} \quad [GDHS \text{ Eq. 3-30}]$

Change to: $L_{s,\max} = \sqrt{24 p_{\max} R} \quad [GDHS \text{ Eq. 3-28}]$

PAGE 4-37: EQ. 4.67

Change from: $L_R = \left(\frac{WN_L e}{\Delta_{\%}}\right) b_w \quad [GDHS \text{ Eq. 3-25}]$

Change to: $L_R = \left(\frac{WN_L e}{\Delta_{\%}}\right) b_w \quad [GDHS \text{ Eq. 3-23}]$

PAGE 4-42: EQ. 4.84

Change from: $\text{HSO} = R\left(1 - \cos\frac{28.65S}{R}\right)$

$$[GDHS \text{ Eq. 3-38}]$$

Change to: $\text{HSO} = R\left(1 - \cos\frac{28.65S}{R}\right)$

$$[GDHS \text{ Eq. 3-36}]$$

PAGE 4-53: TABLE 4.8 SOURCE

Change from: Interpreted from *A Policy on Geometric Design of Highways and Streets*, 2011, by the American Association of State Highway and Transportation Officials, Washington, D.C. Table 3-43 and Table 3-44. Used by permission.

Change to: Interpreted from *A Policy on Geometric Design of Highways and Streets*, 2011, by the American Association of State Highway and Transportation Officials, Washington, D.C. Figure 3-43 and Fig. 3-44. Used by permission.

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TOPIC 6 UPDATES

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PAGE 6-6, AFTER FIG. 6.1, INSERT 6A

Data provided in Table 6.2 and Table 6.3 are used as a resource to solve example problems in the text. Other reliable and timely crash data are available from the National Highway Traffic Safety Administration (NHTSA), the Insurance Institute for Highway Safety (IIHS), the Bureau of Labor Statistics (BLS), the Federal Highway Administration (FHWA), among others.

PAGE 6-10: LEFT COL, 2ND PARA

Change from: Curves that are flatter than 2860 ft (900m) do not need to be adjusted.

Change to: Curves that are flatter than 2950 ft (900m) do not need to be adjusted.

PAGE 6-16: LEFT COL, LAST PARA

Change from: B-noncapacitating injury;

Change to: B-non-incapacitating injury;

PAGE 6-16: EQ. 6.14

Change from: $N_{\text{SPF,rural,crashes/yr}} = \text{AADT}_{\text{veh/day}} \times L_{\text{mi}} \times 365 \times 10^{-6} \times e^{-4.865}$

HSM erratum

Change to: $N_{\text{SPF,rural,crashes/yr}} = \text{AADT}_{\text{veh/day}} \times L_{\text{mi}} \times 365 \times 10^{-6} \times e^{-0.312}$