

Variable	Name	Unit	Deterministic value/ probabilistic distribution	Value reference
$h_{\text{Lahar}}$	Lahar height	m	Lahar intensity	Hazard intensity
$K_w; K_2; K_\phi$	Flow skew factor	–	1.0	Bridge inventory (MOP)
$K_\sigma; K_g; K_d$	Granulometric dispersion factor	–	1.0	MOP (2016)
$K_{\text{gr}}$	pier group factor	–	Uniform (1.0; 1.9)	MOP (2016)
$K_R$	Foundation emergence factor	–	Triangular (1.0; 1.06; 1.06)	MOP (2016)
$h_{\text{Design}}$	Flow design depth	m	Log-normal (1.16; 0.53) – 1.0	Bridge inventory (MOP)
NP	Number of lanes	–	1 lane; 57.8 % 2 lanes; 42.2 %	Bridge inventory (MOP)
$T$	Bridge width	m	Burr (4.5; 14.1; 4.9)	Bridge inventory (MOP)
$b$	Column width	m	Triangular (0.063 L; 1.0 L; 0.08 L)	Bridge inventory (MOP)
$i$	Bed slope around bridge	°	Uniform (1.0; 1.3)	Bono (2014)
$L_{\text{Bridge}}$	Bridge length	m	Log-normal (0.78; 2.79)	Bridge inventory (MOP)
$K_1$	Pier shape factor	–	Triangular (0.65; 1.2; 1.1)	Bridge inventory (MOP)
$K_3$	Bed condition factor	–	1.1	MOP (2016)
$K_E$	Debris accumulation factor	–	Uniform discrete (0.21; 0.79)	Zavenbergen et al. (2007)
$W_d/b$	Debris width / pier width ratio	–	Normal (15.1; 8.2)	Zavenbergen et al. (2007)
$b_F/L_B$	Lahar width / bridge length ratio	–	Uniform (1.22; 1.83)	Self-prepared with historical data
$\mu_{\text{Lahar}}$	Lahar consistency index	$\text{kg m}^{-1}$	Uniform (5; 2260)	Laenen and Hansen (1988)
$K_F$	Abutment shape factor	–	Triangular (0.3; 1.0; 0.75)	Bridge inventory (MOP)
$K_I$	Flow intensity factor	–	1.0	MOP (2016)
$C_D$	Drag coefficient	–	1.4	AASHTO (2012)
$\gamma_{\text{Lahar}}$	Lahar specific weight	$\text{N m}^{-3}$	Triangular (15 598; 19 031; 19 031)	Pierson et al. (2009)
$\gamma_{\text{Gravel}}$	Gravel specific weight	$\text{N m}^{-3}$	24 525	Vallance and Iverson (2015)
$D_{\text{Gravel}}$	Gravel diameter	mm	Triangular (0.031; 32.0; 2.0)	Castruccio et al. (2010)
$k$	Effective contact stiffness	$\text{MN m}^{-1}$	14.0	Haehnel and Daly (2004); AASHTO (2012)
$\gamma_{\text{Sub}}$	Substructure specific weight	$\text{N m}^{-3}$	Concrete (24 500; 61.6 %) Wood (7450; 35.8 %) Steel (7450; 2.6 %)	Bridge inventory (MOP); Cobb (2008)
$\gamma_{\text{Super}}$	Superstructure specific weight	$\text{N m}^{-3}$	Concrete (24 500; 45.7 %) Wood (7450; 53.8 %) Steel (7450; 0.5 %)	Bridge inventory (MOP); Cobb (2008)
$\gamma_{\text{Soil}}$	Soil on abutment specific weight	$\text{N m}^{-3}$	Uniform (12 250; 19 600)	MOP (2016)
NA	Number of deck supports	–	2 supports; $L_{\text{Bridge}} \leq 19.05$ m 3 supports; $19.05$ m $< L_{\text{Bridge}} \leq 32.10$ m 4 supports; $L_{\text{Bridge}} > 32.10$ m	Bridge inventory (MOP)
$\mu_{\text{super}}$	Static friction sub-super	–	Concrete-concrete (0.50; 44.9 %) Concrete-wood (0.48; 17.1 %) Concrete-steel (0.70; 0.4 %) Wood-wood (0.35; 35.0 %) Wood-steel (0.40; 2.6 %) Steel-steel (0.80; 0.0 %)	Bridge inventory (MOP); Cobb (2008)
$h_{\text{imp}}$	Gravel impact height	m	Triangular (0; $h_{\text{Lahar}}$ ; $h_{\text{Lahar}}$ )	Assumption
$e_{\text{Super}}$	Superstructure thickness	cm	Gen. ext. value (18.6; 4.7; 0.3)	Bridge inventory (MOP)