WHE-PAGER PHASE 2: DEVELOPMENT OF ANALYTICAL SEISMIC VULNERABILITY FUNCTIONS

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Structure type (describe as broadly as possible):	Mid-rise Reinforced Concrete MRF
Geographic or other limitations:	n/a
	Add rows as desired

Basic pushover curve for this structure type

Pushover X-axis:	X	Choose spectral displacement (Sd), inches; or Roof displacement (Deltar), inches. Change and state units if desired.
Pushover Y-axis:		Choose spectra acceleration (Sa), g; or base shear (V), kip. Change and state units if desired.
Elastic damping ratio:	0.05	Small-amplitude damping ratio, fraction of critical
1st mode participation factor:	1.29	PFfR; generally 1.3 to 1.5; same as (effective height)/(total roof height)
Effective mass coefficient:	0.83	alpha1; generally 0.7 to 0.8
Building weight:	1500	W, tons. Change and state units if desired
How were these values & pushover points derived?	From pushover analyses of typical existing buildings	
		Add rows as desired

Pushover curve control point	X	Y	Damping	Comment	
0	0	0	0.05		Control point for plotting purposes
1	1.52	0.12			E.g., yield point?
2	14.06	0.14			E.g., ultimate point?
3					E.g., beginning of lower plateau?
4					Add rows as desired

Optional: upper and lower-bound range of pushover curves for this structure type

Upper-bound pushover curve, e.g., 99 out of 100 buildings of this type would have pushover curve inside the area bounded between this curve and the Y-axis?

Author's meaning of "upper bound":	mean+standard deviation
How were these values & pushover points derived?	from analyses of buildings
	Add rows as desired

Optional upper-bound pushover curve

Pushover curve control point	X	Y	Damping	Comment	
0	0	0			Control point for plotting purposes
1	1.87	0.16			E.g., yield point?
2	19.46	0.18			E.g., ultimate point?
3					E.g., beginning of lower plateau?
4					Add rows as desired

Lower-bound pushover curve, e.g., 99 out of 100 buildings of this type would have pushover curve inside the area bounded between this curve and the X-axis?

Author's meaning of "lower bound":	
How were these values & pushover points derived?	See "A Screening Procedure for Seismic Risk Assessment in Urban Building Stocks" by H. Sucuolu, U. Yazgan, and A. Yakut, Earthquake Spectra 23, 441 (2007). The data has been adopted from there.
	Add rows as desired

Optional lower-bound pushover curve

Pushover curve control point	X	Y	Damping	Comment	
0	0	0			Control point for plotting purposes
1	1.17	0.08			E.g., yield point?
2	8.64	0.1			E.g., ultimate point?
3					E.g., beginning of lower plateau?
4					Add rows as desired

Other requested parameters

D14	0.0067	median drift (in same units as pushover X-axis) associated with complete structural damage, i.e., drift with 50% chance that the structural component of the building cannot be economically repaired
B14	0.00026	standard deviation of drift associated with complete structural damage. May need to be guessed
Sdc	0.012	the median value of drift (in same units as pushover X-axis) associated with collapse, e.g., Sdc = (roof drift at collapse)/PFfR.
L15	1-1.5 fatalit	indoor fatality rate given collapse. Many contributors may be unable to provide this value. Porter, Comartin, and Holmes will fill such gaps
PC		mean fraction of building area collapsed, given complete structural damage. Again Porter, Comartin, and Holmes will fill gaps
kshort		If HAZUS-style damping preferred, and author can judge, this is the degradation factor for short-duration (M <= 5.5) events
kmed		If HAZUS-style damping preferred, and author can judge, this is the degradation factor for medium-duration (5.5 < M < 7.5) events
klong		If HAZUS-style damping preferred, and author can judge, this is the degradation factor for long-duration (M >= 7.5) events

Explain how these values were arrived at, providing citations if appropriate: Pushover curves derived analytically, with empirical validation. Fatalities are statistical information.

Add rows as desired