APPENDIX A to "The SAFER geodatabase for the Kathmandu Valley: geotechnical and geological variability".

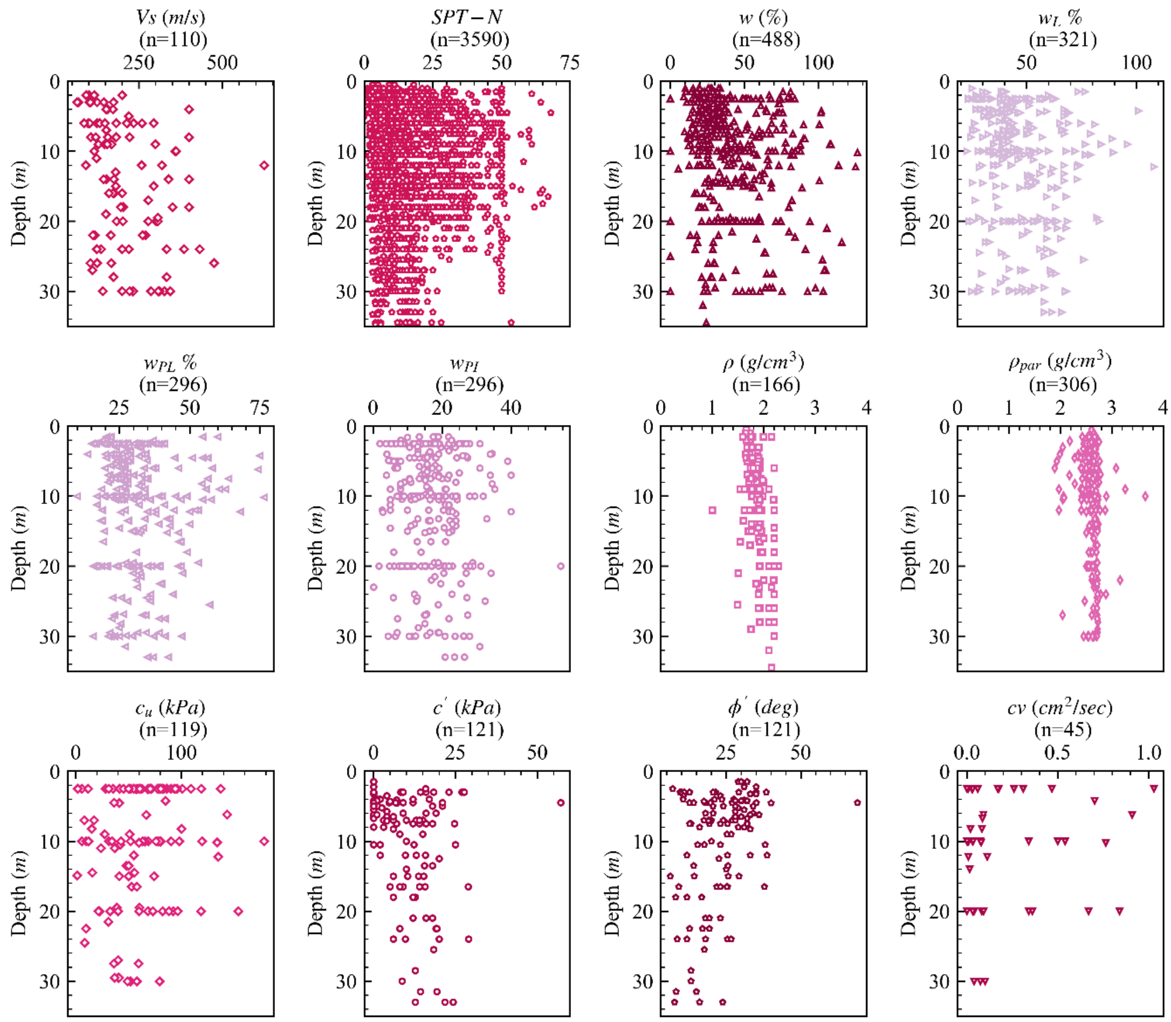

Figure A1. Database geotechnical parameters with depth (m below ground level). V_s = shear wave velocity (m/s); *SPT-N* = uncorrected SPT value in number of blows; w = moisture content (%); w_L = liquid limit (%) (number of non-plastic samples is 65); w_{PL} = plastic limit (%); ρ = bulk density (g/cm³); ρ_{par} = particle density (g/cm³); cv = coefficient of consolidation(cm²/sec). Geotechnical strength values from unconsolidated undrained triaxial tests, c_u = undrained shear strength (kPa). c' = effective cohesion (kPa) and ϕ' = effective angle of friction (deg). Data for Made Ground is included.

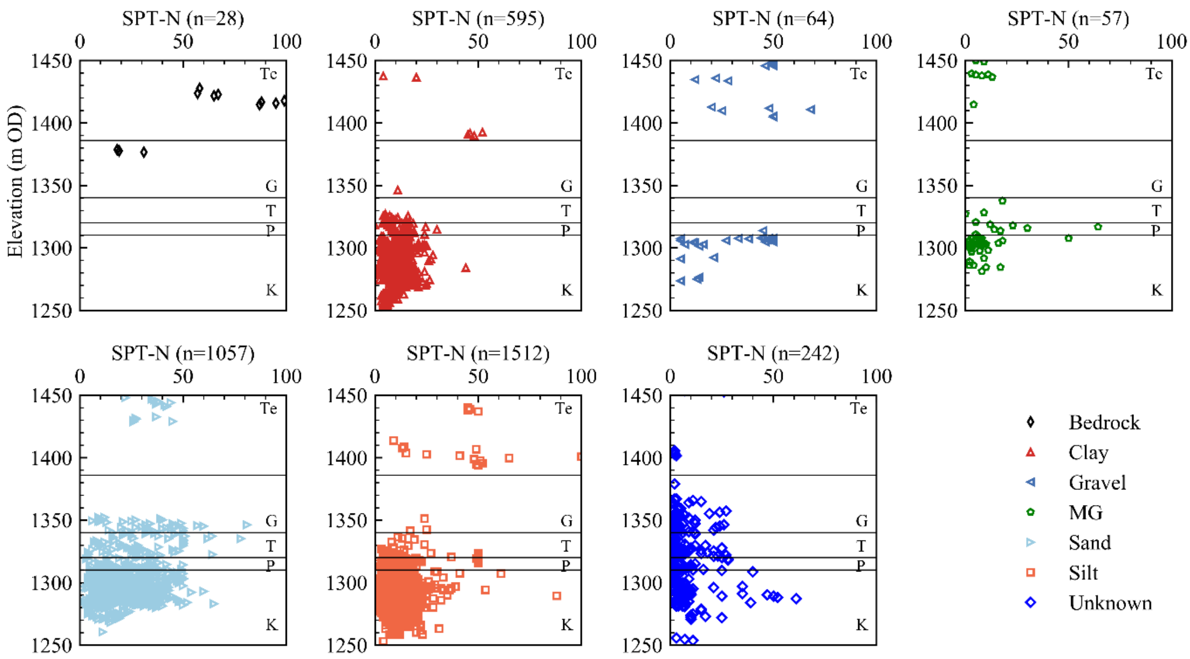

Figure A2. SPT-N with elevation separated by material types. Elevation categories informed from Sakai (2001) cross-section and provides possible separation by geological formation; Te = terrace deposits, G = Gokarna Formation, T = Thimi Formation, P = Patan Formation and K = Kalimati Formation. 35 points are not included due to unknown locations.

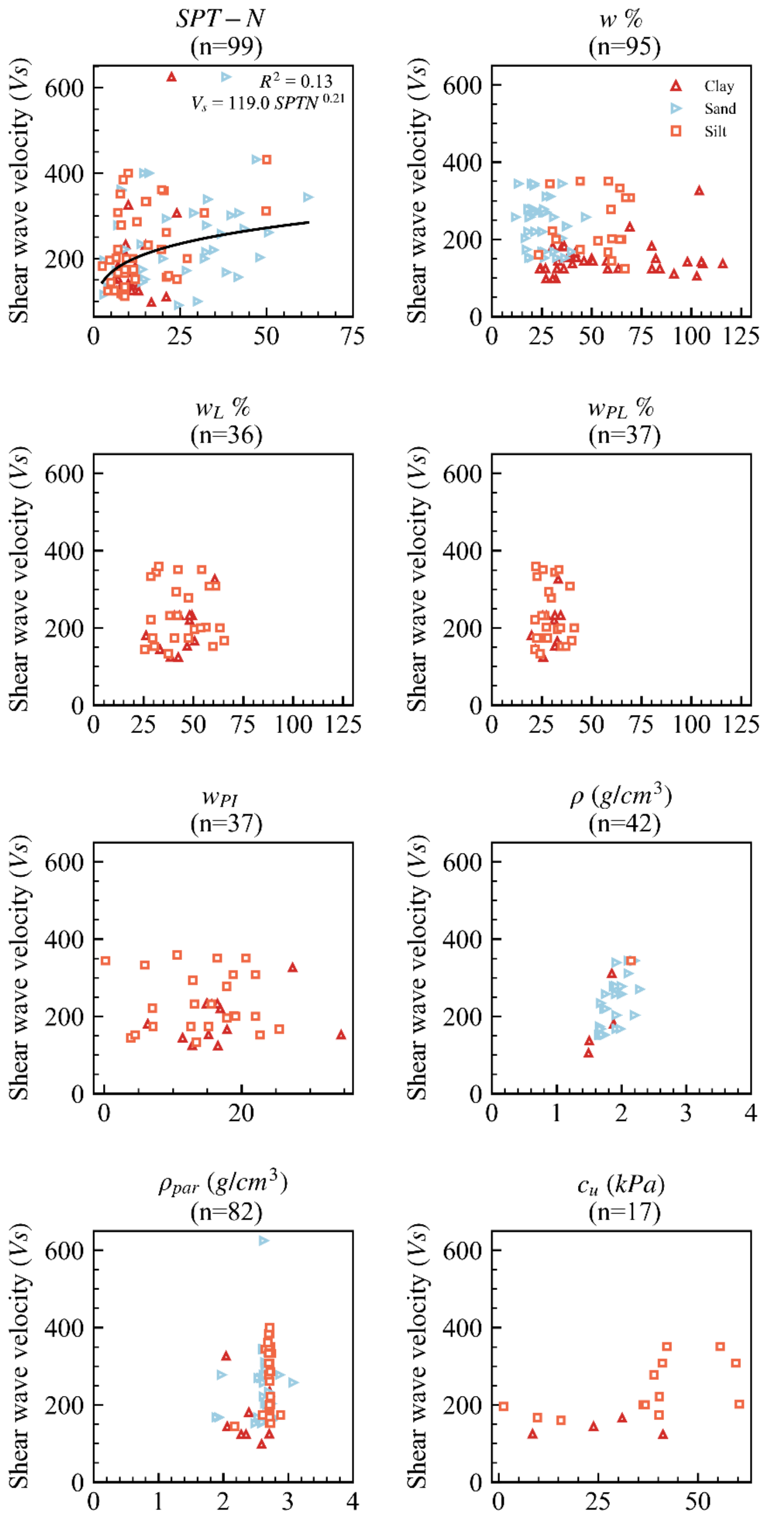

Figure A3. Database geotechnical parameters with shear wave velocity (m/s). Plot is separated for material type. SPT-N values represent the average values over each geophysical interval. Other plots provide duplicate values if more than one test is in each geophysical layer. The SPT-N with *Vs* plot is showing there is not a statistically meaningful relationship between these parameters using the empirical equation $Vs = c_1 N^{C_2}$ with the data currently available.

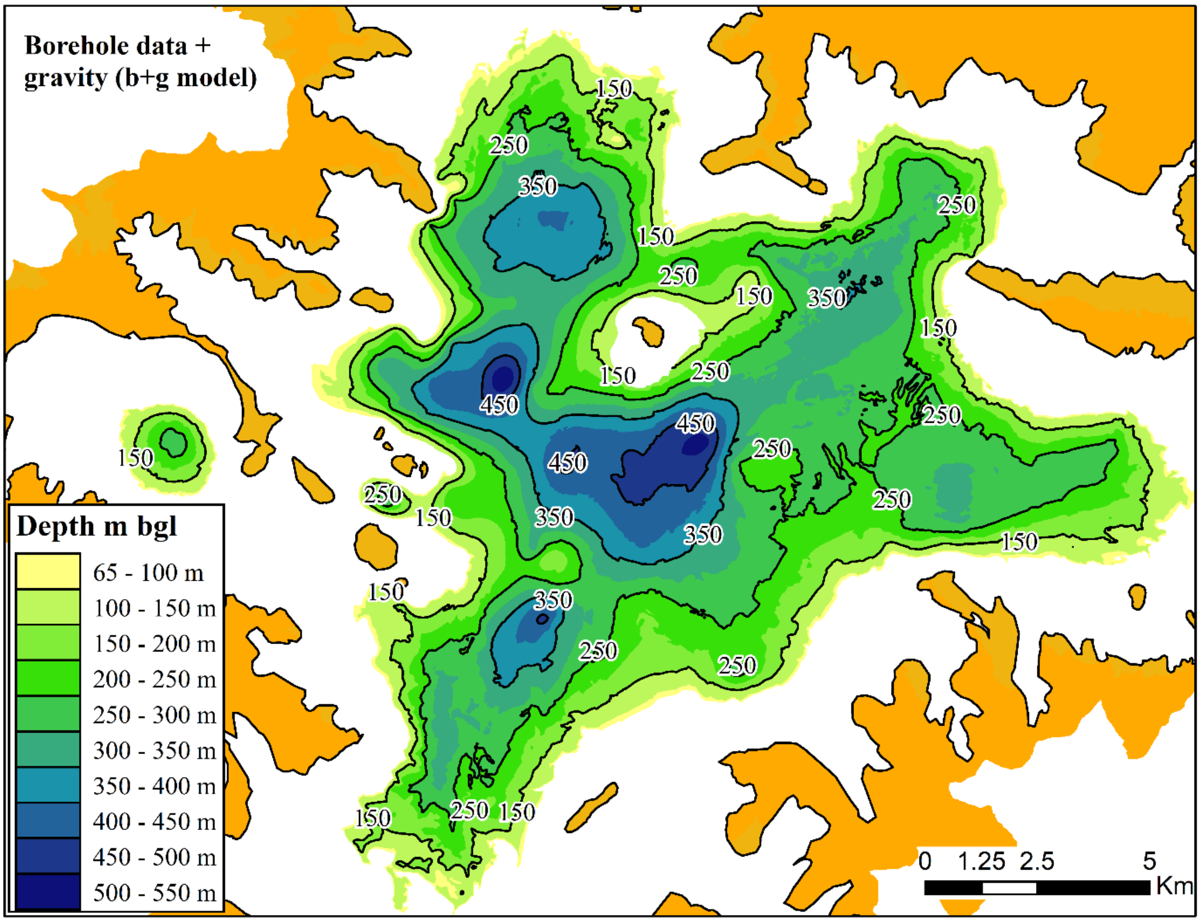

Figure A4. Model b+g raster displayed as a function of depth. Orange region is showing where bedrock is outcropping at the surface so is a zone where depth = 0 m.

Table A1. List of V_{S30} values derived from downhole measurements

ID [1]	Source reference	Database record		Measurement final depth (m bgl)	V_{S30} (m/s) [3]	
					Calculated	Inferred
B1	JICA (2002)	R_JICA_2002	BH1	30	180	-
B2			BH2		231	-
B3			BH3		219	-
B4			BH4		198	-
B5			BH5		216	-
B6	Industrial [2]	IND_Bakh_2006	BH1	30	135	-
			BH3		146	-
B7		IND_Bans_2007	BH3	30	236	-
			BH5	18	-	261
			BH8	30	265	-
B8	J-RAPID (2016)	R_JRAP_2016	BH1	11	-	140
B9			BH2	15	-	203
B10			BH3	13	-	147
B11			BH4	15	-	139
B12			BH5	9	-	170
B13	Pokhrel (2006)	RES_Pokh_2006	BH6	30	237	-
B14			BH7	88	207	-
B15	Gilder et al. (2019)	RES_Safe_2018	BH1	30	257	-

[1] ID's correspond to map locations in De Risi et al. (2019).

[2] Industrial references are mainly via personal communication due to confidentiality on data (see database manual at the datasets DOI for more details).

[2] V_{S30} values calculated according to Eurocode 8 (CEN 2004), from geophysical intervals as recommended for direct downhole seismic methods described in Kim et al (2004). The values listed as inferred are corrected using Boore (2004) so are the result of extrapolation. Where 9m depth was reached the regression co-efficient for 10m was used.

Table A2. Material properties by elevation and soil type in Kathmandu Valley from laboratory testing

Soil Type [1]	Elevation category (m OD)	Stats [2]	Soil Properties [3]						
			w	w_L	w_{PL}	ρ	c_u	c'	ϕ'
Clay	>1386	*min*	18.9	37.0	20.4	2.48	8.2	-	-
		max	62.5	42.6	24.6	2.59	17.4	-	-
		μ	32.3	39.9	22.8	2.55	12.8	-	-
		n	13	11	8	14	2	-	-
		σ	11.8	2.0	1.8	0.03	6.5	-	-
	1386 - 1310	*min*	25.2	43.1	29.4	2.49	-	2.0	6.2
		max	36.6	52.2	34.5		-	24.7	23.0
		μ	30.0	47.7	32.6		-	10.5	15.0
		n	3	2	4	1	-	7	7
		σ	5.9	6.4	2.3	-	-	7.2	6.4
	<1310	*min*	16.2	26.2	13.7	1.97	8.5	0.0	8.0
		max	115.8	82.0	53.1	2.72	74.1	29.0	40.0
		μ	47.8	45.8	30.1	2.48	43.7	13.4	21.2
		n	83	48	47	26	13	40	40
		σ	24.4	13.7	9.3	0.26	16.5	7.4	8.4
Silt	>1386	*min*	31.9	39.5	22.0	2.58	-	-	-
		max					-	-	-
		μ					-	-	-
		n	1	1	1	1	-	-	-
	1386 - 1310	*min*	24.9	30.4	22.0	2.55	36.2	4.7	9.9
		max	65.1	67.0	41.2	2.73		27.0	33.0
		μ	37.6	45.3	30.9	2.67		13.7	20.0
		n	6	13	10	10	1	8	8
		σ	15.2	12.4	6.0	0.07	-	7.3	8.7
	<1310	*min*	5.4	24.6	20.0	2.17	1.3	0.0	7.0
		max	108.5	95.9	63.8	2.88	60.4	57.2	69.0
		μ	55.0	49.3	34.5	2.60	35.8	9.9	23.1
		n	68	95	84	59	15	34	34
		σ	22.0	16.2	12.5	0.14	17.0	10.7	10.7
Sand	1386 - 1310	*min*	10.0	35.0	-	1.89	-	0.0	11.8
		max	47.1	42.0	-	3.26	-	16.0	38.0
		μ	24.1	38.5	-	2.61	-	9.8	23.0
		n	129	2	-	67	-	6	6
		σ	7.0	4.9	-	0.22	-	5.8	11.9
	<1310	*min*	10.5	26.5	-	2.61	-	0.0	18.0
		max	39.4	47.0	-	2.76	-	27.7	38.4
		μ	24.8	36.4	-	2.65	-	7.0	28.7
		n	14	6	-	10	-	8	8
		σ	10.0	7.6	-	0.05	-	10.6	6.8

(1) Unknown soil types are not included in table but spread of this data can be deduced from Fig 3.

(2) min = minimum; max = maximum, μ = mean, n = number of tests, σ = standard deviation.

(3) w = moisture content (%); w_L = liquid limit (%); w_{PL} = plastic limit (%); V_s = shear wave velocity (m/s); ρ = bulk density (g/cm³). Values from unconsolidated undrained triaxial test, c_u in kPa. c' in kPa and ϕ' in degrees. For elevation >1386 this is no sand data.

References

Boore, D. M., 2004. Estimating VS(30) (or NEHRP Site Classes) from Shallow Velocity Models (Depths <30 m). *Bulletin of the Seismological Society of America,* **94**(2), 591 – 597.

CEN (European Committee for Standardization), 2004. Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings. Brussels, Belgium.

De Risi R., De Luca, F., Gilder, C. E. L., Pokhrel, R. M. and Vardanega, P. J., 2019. SAFER Geodatabase for the Kathmandu basin: Bayesian kriging as strategy in data scarce regions. *Earthquake Spectra*, under review.

Gilder, C. E. L., Pokhrel, R. M., and Vardanega, P. J., 2019. A ground investigation to inform earthquake hazard assessment in the Kathmandu Valley, Nepal. 17th European Conference on Soil Mechanics and Geotechnical Engineering, (XVII ECSMGE-2019), Reykjavik, Iceland.

Japan International Cooperation Agency (JICA), 2002. The Study on Earthquake Disaster Mitigation in the Kathmandu Valley. Final Report, Volume I-IV.

J-RAPID., 2016. Japan-Nepal Urgent Collaborative Projects regarding the April 2015 Nepal earthquake within the J-Rapid Program: Investigation of foundation liquefaction susceptibility in the Kathmandu Valley, Final Report.

Kim, D-S., Bang, E-S., and Kim, W-C., 2004. Evaluation of Various Downhole Data Reduction Methods for Obtaining Reliable V_s Profiles. *Geotechnical Testing Journal* **27**(6), 585-597.

Pokhrel, R. M., 2006. Determination of soil dynamic properties of Kathmandu Valley by using down the hole seismic method, Masters Dissertation, Central Department of Geology, Institute of Science and Technology, Tribhuvan University, Kathmandu, Nepal.

Sakai, H., Fujii, R., Kawahara, Y., Upreti, B. N. and Shrestha, S. D., 2001. Core drilling of the basin-fill sediments in the Kathmandu Valley for Palaeoclimatic study: preliminary results. *Journal of Nepal Geological Society*, **25** (Special Issue), 9-18.