

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

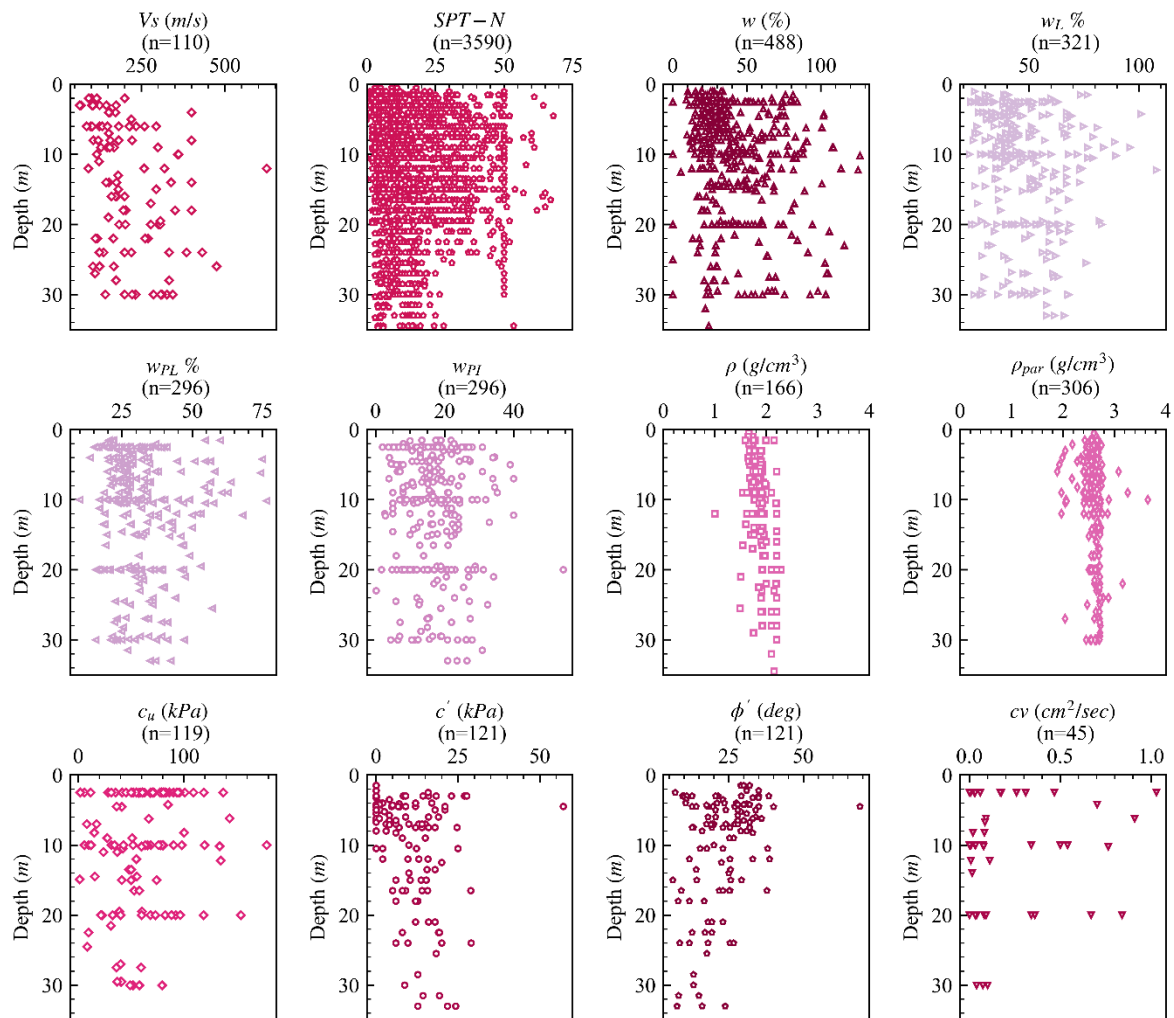


Figure A1. Database geotechnical parameters with depth (m below ground level). V_s = shear wave velocity (m/s); $SPT-N$ = uncorrected SPT value in number of blows; w = moisture content (%); w_L = liquid limit (%) (number of non-plastic samples is 65); w_{PL} = plastic limit (%); ρ = bulk density (g/cm^3); ρ_{par} = particle density (g/cm^3); c_v = coefficient of consolidation (cm^2/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.

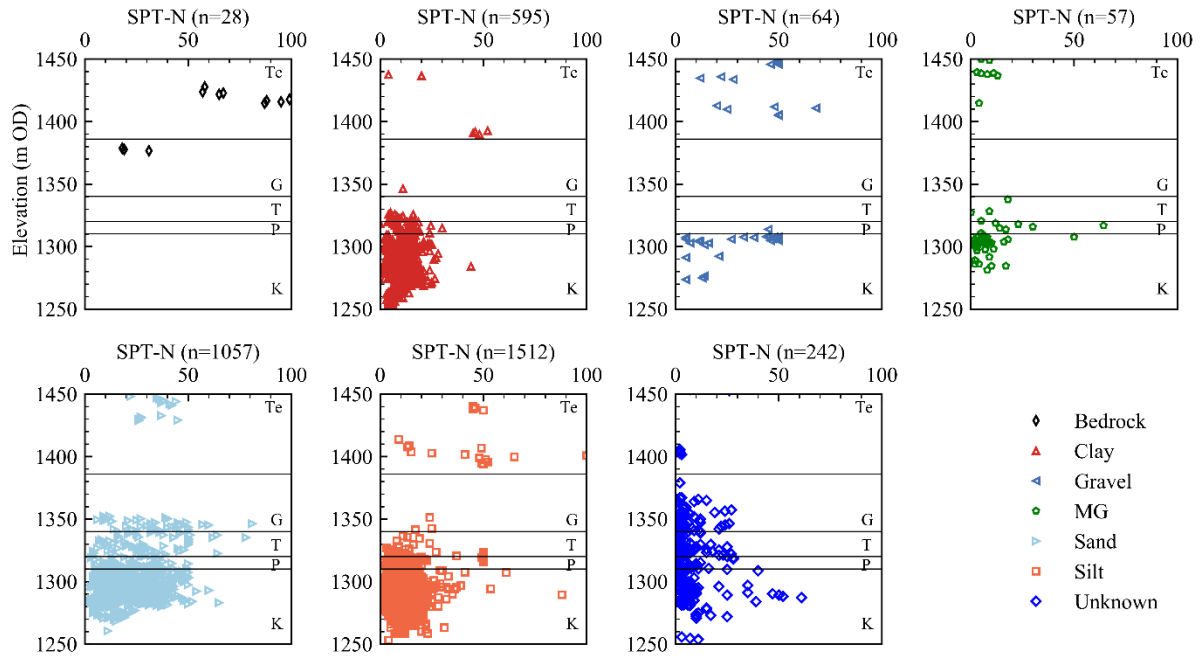


Figure A2. SPT-N with elevation separated by material types. Elevation categories informed from Sakai (2001) cross-section and provides possible separation by geological formation; Te = terrace deposits, G = Gokarna Formation, T = Thimi Formation, P = Patan Formation and K = Kalimati Formation. 35 points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

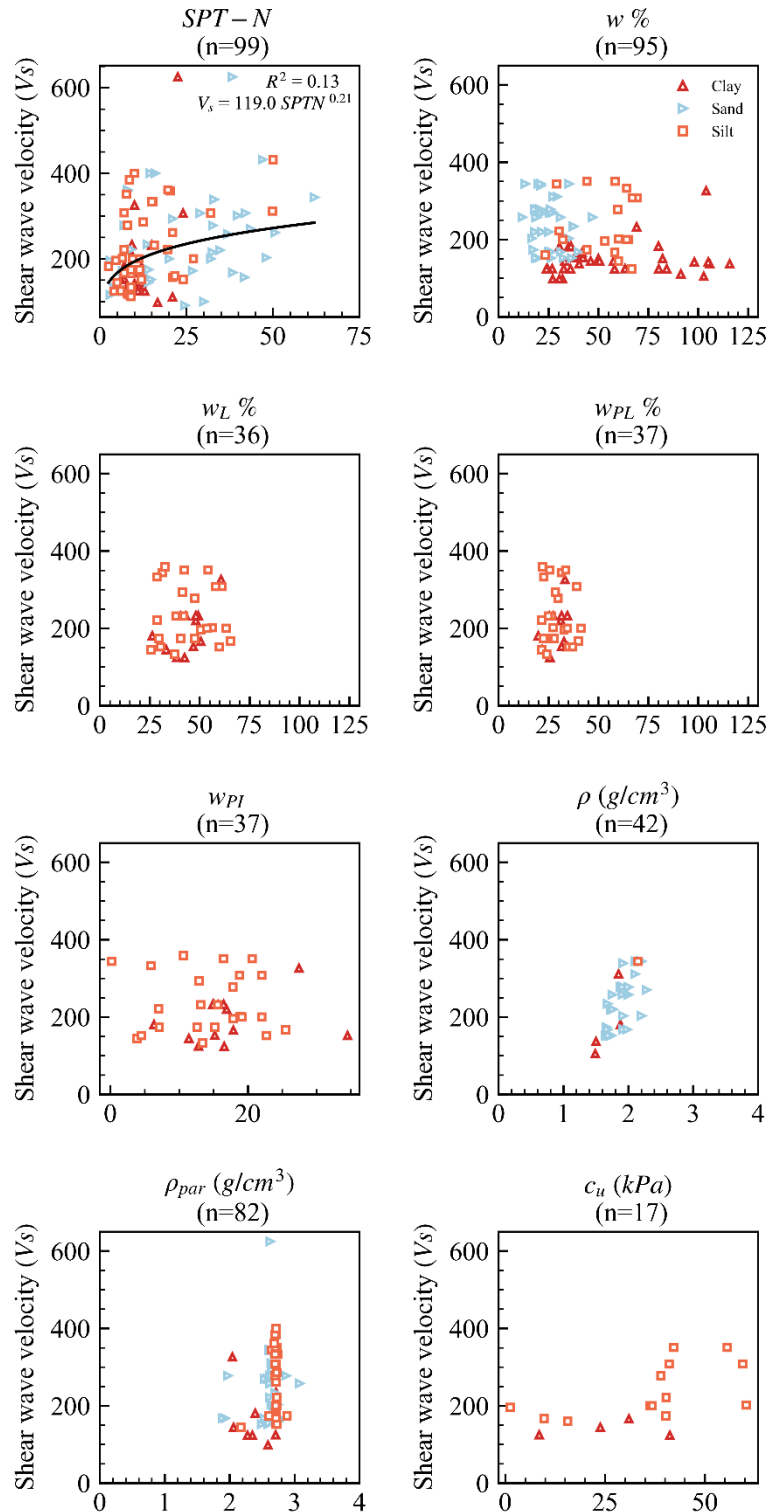


Figure A3. Database geotechnical parameters with shear wave velocity (m/s). Plot is separated for material type. SPT-N values represent the average values over each geophysical interval. Other plots provide duplicate values if more than one test is in each geophysical layer. The SPT-N with V_s plot is showing there is not a statistically meaningful relationship between these parameters using the empirical equation $V_s = c_1 N^{c_2}$ with the data currently available.

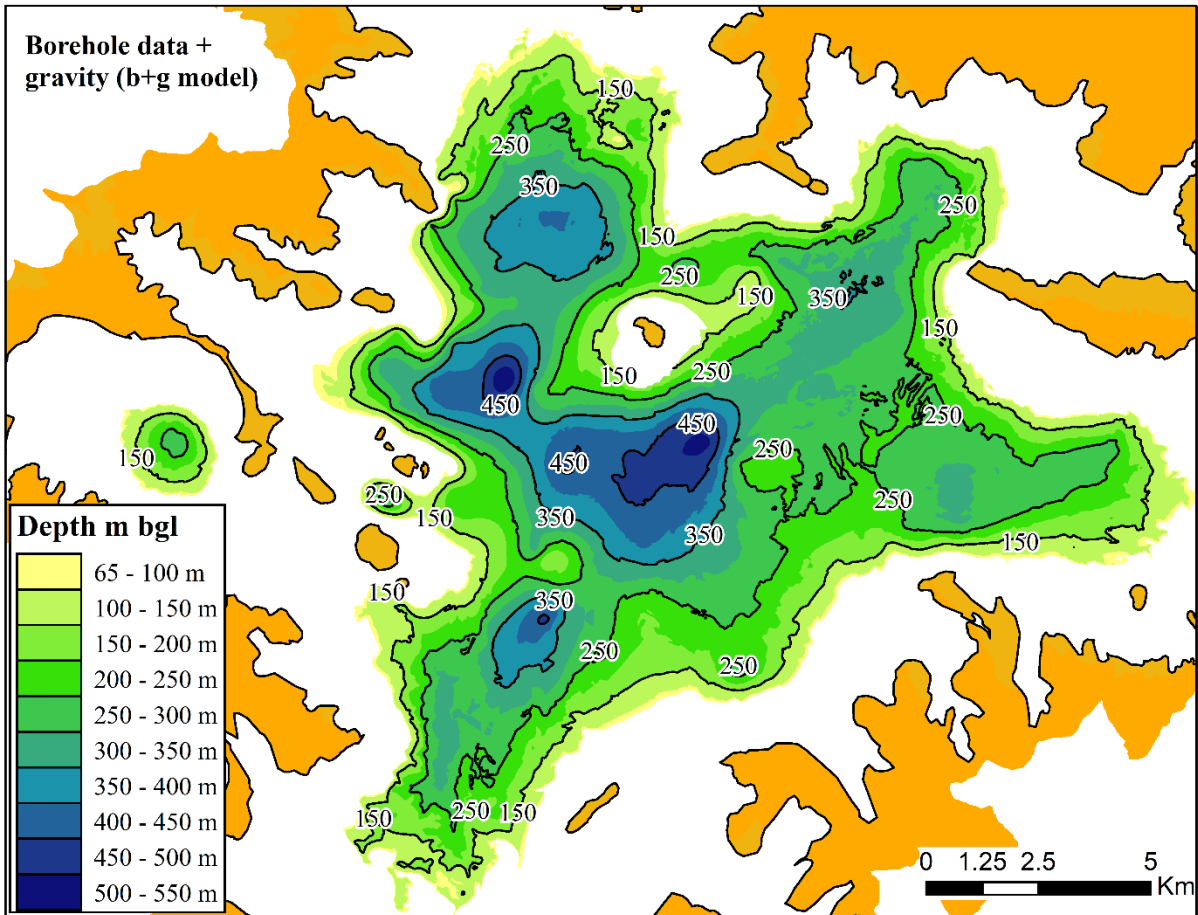


Figure A4. Model b+g raster displayed as a function of depth. Orange region is showing where bedrock is outcropping at the surface so is a zone where depth = 0 m.

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).

⁽³⁾ 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 | <i>min</i> | 18.9 | 37.0 | 20.4 | 2.48 | 8.2 | - | - |
| | | <i>max</i> | 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 | <i>min</i> | 25.2 | 43.1 | 29.4 | 2.49 | - | 2.0 | 6.2 |
| | | <i>max</i> | 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 | <i>min</i> | 16.2 | 26.2 | 13.7 | 1.97 | 8.5 | 0.0 | 8.0 |
| | | <i>max</i> | 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 | <i>min</i> | 31.9 | 39.5 | 22.0 | 2.58 | - | - | - |
| | | <i>max</i> | | | | | - | - | - |
| | | μ | | | | | - | - | - |
| | | n | 1 | 1 | 1 | 1 | - | - | - |
| | 1386 - 1310 | <i>min</i> | 24.9 | 30.4 | 22.0 | 2.55 | 36.2 | 4.7 | 9.9 |
| | | <i>max</i> | 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 | <i>min</i> | 5.4 | 24.6 | 20.0 | 2.17 | 1.3 | 0.0 | 7.0 |
| | | <i>max</i> | 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 | <i>min</i> | 10.0 | 35.0 | - | 1.89 | - | 0.0 |
| <i>max</i> | | | 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 | | <i>min</i> | 10.5 | 26.5 | - | 2.61 | - | 0.0 | 18.0 |
| | | <i>max</i> | 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.

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