Liquefaction Screening by the Simplified Procedure (SPT)

Cyclic stress ratio from peak ground acceleration and stresses, cyclic resistance ratio from clean-sand SPT blow count, magnitude scaling and factor of safety.

Input parameters

Unit system: SI

Parameter	Value	Unit
Depth of the layer	6.0000	m
Water table depth	2.0000	m
Unit weight above water table	18.000	kN/m³
Saturated unit weight	19.500	kN/m³
Peak ground acceleration	0.24000	
Earthquake moment magnitude	7.5000	
Clean-sand corrected SPT blow count	14.000	

Calculated results

Parameter	Value	Unit
Total vertical stress	114.00	kPa
Effective vertical stress	74.760	kPa
Stress reduction factor	0.95410	
Cyclic stress ratio	0.22696	
Cyclic resistance ratio (M 7.5)	0.15016	
Magnitude scaling factor	0.99964	
Factor of safety against liquefaction	0.66139	

Notes for this case

• Seed–Idriss: CSR = 0.65(a_max/g)(σ_v/σ'_v)r_d with the Liao–Whitman r_d; $CRR_{7.5}$ from the NCEER clean-sand curve fit; MSF = 10^2.24/M_w^2.56. FS below about 1.2–1.3 calls for detailed study. Fines and overburden (K_σ) corrections are assumed already applied to $(N_1)_{60}$cs or neglected. Soils with $(N_1)_{60}$cs ≥ 30 are taken as too dense to liquefy.

Formula and method

The formula is shown on the calculator page: https://calc.firecad.com/civil/foundations/liquefaction-screening-spt

Variables

z	Depth of the layer	m
z_w	Water table depth	m
γ	Unit weight above water table	N/m³
γ_{sat}	Saturated unit weight	N/m³
a_{max}/g	Peak ground acceleration	-
M_w	Earthquake moment magnitude	-
$(N_1)_{60cs}$	Clean-sand corrected SPT blow count	-
σ_v	Total vertical stress	Pa
\sigma'_v	Effective vertical stress	Pa
r_d	Stress reduction factor	-
CSR	Cyclic stress ratio	-
$CRR_{7.5}$	Cyclic resistance ratio (M 7.5)	-

MSF	Magnitude scaling factor	-
FS_L	Factor of safety against liquefaction	-

Method and standards

Liquefaction screening.

Assumptions and limits

- Level ground; depth up to 23 m; $(N_1)_{60}cs$ below 30.

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/foundations/liquefaction-screening-spt

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.