



# Comparative Analysis of Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) in Assessing Liquefaction Potential in the Philippine Geotechnical Context

\*Athena Bernice J. Lim<sup>1</sup>, Jonalyn L. Cabañas<sup>1</sup>, Marc Arthur Z. Go<sup>1</sup>, Alexis Philip A. Acacio<sup>2</sup>, and Lestelle V. Torio-Kaimo<sup>2</sup>

<sup>1</sup> Geotechnics Philippines, Inc., Quezon City, Philippines

<sup>2</sup> University of the Philippines – Diliman Campus, Quezon City, Philippines

\*evalteamphi@gmail.com

**Abstract.** The Philippines, located in a tectonically active region, is highly susceptible to seismic activity, making liquefaction a critical concern for infrastructure stability. Liquefaction, the process by which saturated, loose soils lose strength and stiffness during earthquake-induced shaking, poses significant risks to structures in such areas. This paper presents a detailed comparative analysis of Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) specifically for assessing liquefaction potential, based on field data gathered from four study areas in the Philippines across diverse soil types and environmental conditions. The study focuses on evaluating the effectiveness of each testing method in identifying liquefaction susceptibility, which is crucial for ensuring the safety and stability of infrastructure in seismic-prone areas. CPT provides continuous, high-resolution data that facilitates the assessment of subsurface soil behavior under cyclic loading conditions, with real-time pore pressure measurements enhancing the understanding of liquefaction potential. In contrast, SPT offers insights into soil strength and composition through blow count measurements and sample retrieval but requires supplementary laboratory testing to determine key properties such as grain size and consistency. While SPT is instrumental for evaluating liquefaction potential, its intermittent nature and reliance on post-field analysis limit its effectiveness compared to the continuous profiling offered by CPT. Correlations were utilized for SPT data in deriving the engineering properties, while the CPeT-IT software was used to derive CPT parameters. Furthermore, the liquefaction potential for both CPT and SPT was assessed using specialized liquefaction analysis software, providing a comprehensive evaluation of liquefaction risk. This comparison emphasizes the strengths and limitations of both methods in the context of liquefaction potential, highlighting their roles in foundation design and stability evaluations. By addressing these critical factors, the study aims to guide geotechnical engineers in selecting the most appropriate testing method for evaluating liquefaction potential, ultimately enhancing the accuracy and effectiveness of geotechnical assessments and contributing to improved engineering practices for local infrastructure projects in the Philippines.

**Keywords:** Liquefaction potential, CPT, SPT, Seismic prone areas, Engineering properties, Soil characterization, Correlation methods, CPeT-IT, Liquefaction analysis software, Philippines.

## 1 Introduction

Liquefaction, a process in which saturated, loose soils lose strength and stiffness due to seismic shaking, poses a significant risk in earthquake-prone regions [1]. The Philippines, situated along the Pacific Ring of Fire, is highly vulnerable to earthquakes, making it essential to assess the liquefaction potential of sites to ensure the stability and safety of infrastructure. Understanding and quantifying liquefaction potential is vital in the geotechnical field, particularly for the design and construction of foundations for critical structures such as bridges, roads, and buildings [2].

Geotechnical engineers often rely on methods such as Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) to assess liquefaction risk in subsurface soils [3]. Both tests provide valuable data on soil properties that are critical for evaluating liquefaction potential, but they differ in their techniques, data resolution, and application. While CPT offers continuous, high-resolution measurements of soil strength and pore pressure, SPT is a widely used method that measures the resistance of soil to penetration [4]. Despite their differences, both methods have been utilized extensively in liquefaction studies, with numerous empirical correlations developed to estimate liquefaction potential [5].

This study aims to provide a comparative analysis of CPT and SPT in the context of liquefaction assessment, using data from various geotechnical sites across the Philippines. By analyzing field data from sites in Luzon, Visayas, and Mindanao, the study evaluates the effectiveness of both testing methods in determining liquefaction potential, considering the influence of soil type, seismic conditions, and groundwater levels. Another objective is to highlight the strengths and limitations of each method and to provide guidance for selecting the most appropriate testing technique for site-specific liquefaction evaluation. Additionally, this study seeks to contribute to the advancement of geotechnical engineering practices in the Philippines by improving the accuracy and reliability of liquefaction risk assessments.

## 2 Review of Related Literature

### 2.1 Liquefaction in the Philippines

A liquefaction database [6] developed by the Philippine Institute of Volcanology and Seismology (PHIVOLCS) has identified 808 liquefaction occurrences in the Philippines from 1619 to 2020. Metro Manila and parts of Mindanao are particularly vulnerable due to high seismic activity and soil composition. The combination of loose, saturated sands and frequent earthquakes significantly increases liquefaction risks in these regions. The application of Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) for liquefaction assessment in the Philippines remains in the

development stage. While these methods are effective in identifying liquefiable zones, there is a need for improved local empirical correlations and further evaluation of site-specific conditions.

## 2.2 Liquefaction Assessment Techniques

Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) are the two most widely used methods for evaluating liquefaction potential, each offering distinct advantages. CPT provides continuous, high-resolution data on tip resistance ( $q_c$ ), sleeve friction ( $f_s$ ), and pore pressure ( $u$ ), making it particularly effective for detecting liquefiable layers and estimating cyclic resistance ratio (CRR) [7]. Its real-time pore pressure measurements enhance liquefaction assessments, especially in deeper layers where SPT may be less effective [8]. CPT is increasingly adopted in seismically active regions, including the Philippines. SPT, a more traditional method, estimates soil strength using blow counts (N-values) correlated with liquefaction resistance [2]. While widely used, its intermittent data collection and reliance on laboratory testing present limitations according to Das [9]. It is particularly effective in shallow soils but becomes less reliable at greater depths due to variability in energy transfer and soil stiffness changes based on a study done by Idriss and Boulanger in 2008 [10].

Studies comparing these methods highlight key differences in liquefaction risk assessment. According to Robertson, et al. [11], CPT is superior for deeper layers, providing more precise liquefaction predictions due to continuous profiling. SPT, on the other hand, is more effective in shallow soils, where sample retrieval is essential. Kokusho [12] found that CPT data correlated better with actual liquefaction occurrences, particularly in deep layers where SPT values are influenced by overburden pressure. A study by Hoque et al. [13] concluded that using both methods in combination improves assessment reliability, particularly in complex site conditions.

## 2.3 Integration of Cyclic Resistance Ratio (CRR) in Liquefaction Assessment

Cyclic Resistance Ratio (CRR) quantifies a soil's ability to resist cyclic loading and is essential in liquefaction analysis according to Seed and Idriss' study [2]. Both CPT and SPT-based approaches estimate CRR using empirical correlations. CPT-based CRR uses normalized tip resistance ( $q_{c1N}$ ) and pore pressure response, allowing for continuous liquefaction profiling [3]. SPT-based CRR relies on corrected N-values ( $N_{60}$ ), requiring additional laboratory testing to refine estimates [10]. CPT-based CRR methods tend to provide more conservative and reliable liquefaction risk estimates than SPT, particularly in variable soil conditions. When combined with factor of safety (FS) calculations, CRR helps determine the depth and extent of liquefiable zones, guiding geotechnical engineers in mitigation strategies for seismic-prone areas.

### 3 Methodology

Field data for this study were gathered from four (4) geotechnical sites across the Philippines, representing diverse soil types and seismic conditions. Both Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) were conducted at each site to assess liquefaction potential. To ensure a valid comparative analysis, CPT and SPT test points were positioned within the same test location, maintaining uniform topographic conditions. The proximity of test locations minimizes variations due to site-specific factors such as slope, elevation, and soil deposition patterns. Thus, any differences observed in test results can be attributed to the inherent characteristics of CPT and SPT rather than external site conditions. A total of 25 CPT and 33 SPT were conducted for the study. The location and number of field tests conducted for each site are shown in Table 1:

**Table 1.** Summary of field tests conducted for each site.

Site Name	Site Location	No. of CPT data	No. of SPT data
Site A	Luzon	4	6
Site B	Luzon	6	11
Site C	Visayas	4	6
Site D	Mindanao	11	10

Site A has relatively flat topography and is located near a river. Site B also has predominantly flat terrain, with some areas in close proximity to a lake. Meanwhile, Site C is situated offshore along a channel positioned between two islands in Visayas. Lastly, Site D is located near a gulf in Mindanao. The groundwater levels at each test location were measured and are summarized in Table 2.

**Table 2.** Average groundwater level measured per site.

Site	Average Groundwater Level* (m)
Site A	2.35
Site B	3.27
Site C	Offshore
Site D	2.09

*\*Measured below the existing ground level.*

#### 3.1 Cone Penetration Testing (CPT)

CPT was performed in accordance with ASTM D5778 [14]. CPT data were analyzed using CPeT-IT software, which provides continuous soil profiling and estimates key parameters.

### 3.2 Standard Penetration Testing (SPT)

SPT was performed in accordance with ASTM D1586 [15]. Additional laboratory tests were performed to the retrieved samples to analyze soil properties, which were then used to assess liquefaction potential via established empirical correlations [2][3][10].

### 3.3 Liquefaction Analysis

Liquefaction potential was evaluated for all sites using the LiquefyPro software, which is a specialized tool designed for liquefaction analysis based on established methodologies, incorporating both SPT and CPT results to assess soil susceptibility across different depths. Data were analyzed within the upper 20 meters of soil, where shallow, loose, and saturated cohesionless soils are most vulnerable. Moment magnitude of earthquake, maximum peak ground acceleration (PGA), and groundwater level were also considered in the analysis.

Cyclic resistance ratio (CRR) values were calculated from the processed CPT and SPT data. Equation 1 is the general formula for CPT-based CRR, while Equation 2 is for SPT-based CRR.

$$CRR = f(q_c, F_c, I_c, \sigma'_{vo}, K_\sigma, M_w) \quad (1)$$

$$CRR = f(N_{60}, F_c, D_r, \sigma'_{vo}, (N_1)_{60}, K_\sigma, M_w) \quad (2)$$

Where:

- $q_c$  = Corrected penetration resistance in MPa
- $I_c$  = Soil behavior type index
- $F_c$  = Fines content (%)
- $N_{60}$  = Corrected standard penetration resistance
- $D_r$  = Relative density of the soil
- $(N_1)_{60}$  = Overburden stress-corrected SPT blow count
- $\sigma'_{vo}$  = Effective vertical stress in kPa
- $K_\sigma$  = Overburden correction factor
- $M_w$  = Magnitude scaling factor

The cyclic stress ratio (CSR) represents the cyclic loading imposed on the soil due to earthquake-induced shear stresses. It is calculated using the simplified procedure proposed by Seed & Idriss [2] shown in Equation 3.

$$CSR = 0.65 \frac{a_{max}}{g} \frac{\sigma_0}{\sigma'_0} r_d \quad (3)$$

Where:

- $a_{max}$  = peak horizontal ground acceleration (PGA)
- $g$  = acceleration due to gravity (9.81 m/s<sup>2</sup>)
- $\sigma_0$  = total vertical overburden stress
- $\sigma'_0$  = effective vertical overburden stress

- $r_d$  = stress reduction coefficient

The Factor of Safety (FS) against liquefaction is computed as the ratio of the soil’s resistance (CRR) to the cyclic loading (CSR) as shown in Equation 4. An FS value below 1.0 signifies a potential risk of liquefaction.

$$FS = \frac{CRR}{CSR} \tag{4}$$

## 4 Results and Discussion

### 4.1 Liquefiable Depths and Factor of Safety

The analysis reveals that liquefiable soil layers are most prevalent in the upper 10 meters, where factor of safety (FS) values are lowest, indicating higher susceptibility to liquefaction. While liquefaction potential persists at greater depths, the increasing confining pressure and soil density beyond 10 meters generally reduce the liquefaction risk. The computed FS values indicate that CPT consistently detects more liquefiable layers compared to SPT, likely due to CPT’s continuous profiling capability, which provides a more detailed assessment of soil behavior.

Table 2 provides a detailed summary of FS values for CPT and SPT at each depth range per site, offering a clear overview of liquefaction risks.

**Table 3.** Summary of FS values for CPT and SPT at each depth range per site.

Site Name	Depth Range (m)	CPT		SPT		Liquefaction Status	
		Thickness of Liquefiable Layers (m)	FS	Thickness of Liquefiable Layers (m)	FS	CPT	SPT
Site A	0 - 5	4.17	<b>0.35</b>	0.00	-	Liquefiable	Not Liquefiable
	5 - 10	5.00	<b>0.35</b>	2.00	<b>0.67</b>	Liquefiable	Liquefiable
	10 - 15	2.97	<b>0.34</b>	2.02	<b>0.55</b>	Liquefiable	Liquefiable
	15 - 20	3.26	<b>0.34</b>	0.00	-	Liquefiable	Not Liquefiable
Site B	0 - 5	1.27	<b>0.33</b>	3.98	<b>0.43</b>	Liquefiable	Liquefiable
	5 - 10	4.84	<b>0.31</b>	5.00	<b>0.43</b>	Liquefiable	Liquefiable
	10 - 15	0.55	<b>0.29</b>	4.00	<b>0.43</b>	Liquefiable	Liquefiable
	15 - 20	0.00	-	2.03	<b>0.44</b>	Not Liquefiable	Liquefiable
Site C	0 - 5	0.81	<b>0.21</b>	1.97	<b>0.15</b>	Liquefiable	Liquefiable
	5 - 10	0.00	-	0.00	-	Not Liquefiable	Not Liquefiable
	10 - 15	0.37	<b>0.38</b>	3.00	<b>0.72</b>	Liquefiable	Liquefiable
	15 - 20	0.63	<b>0.26</b>	0.20	<b>0.99</b>	Liquefiable	Liquefiable
Site D	0 - 5	4.91	<b>0.22</b>	1.00	<b>0.52</b>	Liquefiable	Liquefiable
	5 - 10	3.69	<b>0.29</b>	3.00	<b>0.45</b>	Liquefiable	Liquefiable
	10 - 15	3.76	<b>0.04</b>	5.00	<b>0.42</b>	Liquefiable	Liquefiable
	15 - 20	0.12	<b>0.04</b>	4.00	<b>0.47</b>	Liquefiable	Liquefiable

### 4.2 Liquefiable Depth Distribution Across Sites

Analysis of liquefiable depths across different sites shows distinct regional trends:

- **Luzon (Sites A and B):** Liquefaction-prone layers are mostly concentrated within the 5–15 m depth range, with FS values as low as 0.29 (CPT) and 0.43 (SPT).
- **Visayas (Site C, Offshore):** Liquefaction occurs at deeper layers (beyond 10 m) due to the fully submerged conditions, which increase pore water pressure but also provide higher confinement near the seabed, reducing shallow liquefaction susceptibility.
- **Mindanao (Site D):** Liquefiable depths are similar to those in Luzon, with layers extending from 5–15 m and FS values below 0.52, indicating moderate to high liquefaction risk.

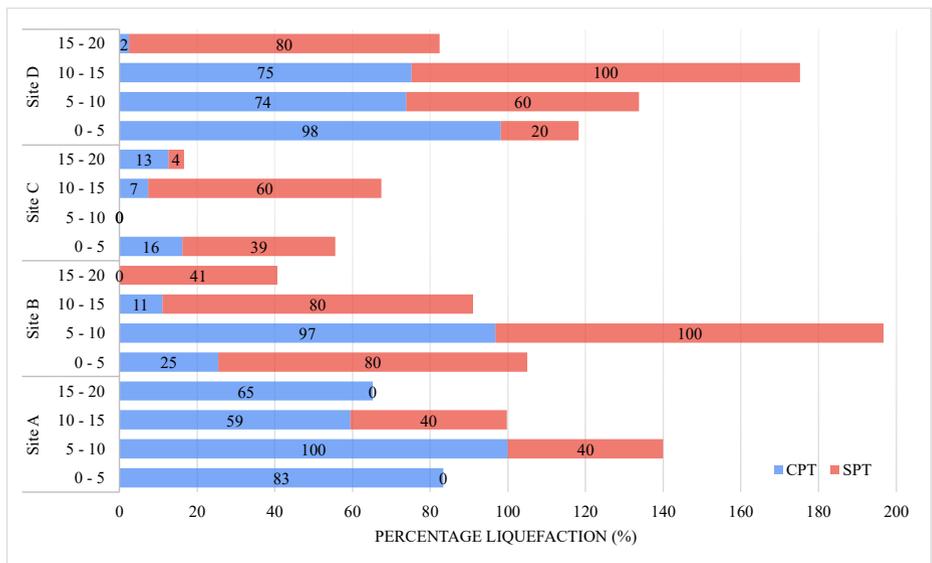


Fig. 1. Liquefaction potential by depth range per site.

### 4.3 Factor of Safety Trends

CPT consistently identifies liquefaction at shallower depths, typically within the 0–5 meter range, whereas SPT generally indicates an increasing liquefaction potential from 5–15 meters. Additionally, the factor of safety (FS) values derived from CPT are generally lower than those from SPT, highlighting that CPT offers a more conservative assessment of liquefaction risk. In offshore conditions, such as at Site C in Visayas, liquefiable layers extend beyond a depth of 10 meters. This observation underscores the impact of continuous water saturation, which helps sustain liquefaction susceptibility even at greater depths.

Figure 2 presents the comparison of the average FS values for CPT and SPT at different depths across all sites.

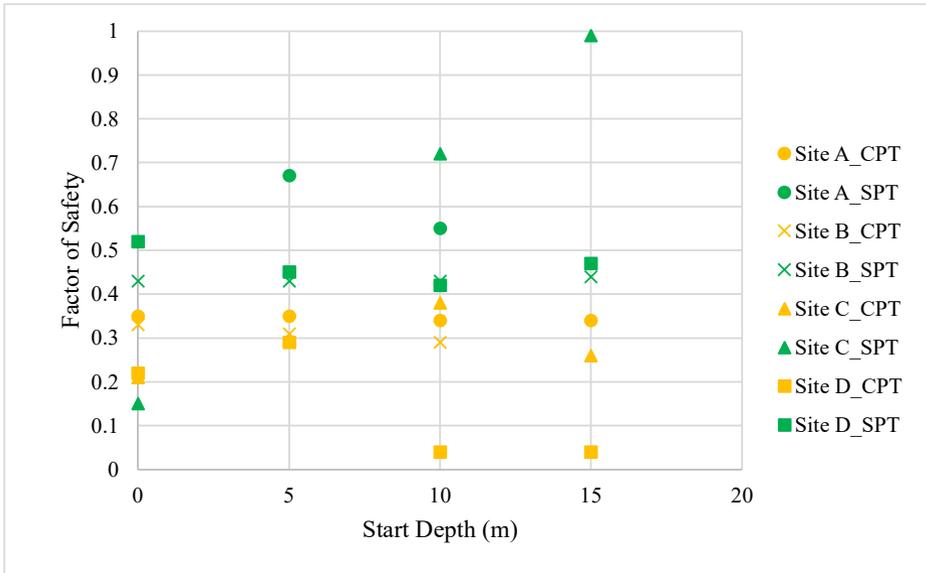


Fig. 2. Comparison of FS values for CPT and SPT across all sites.

#### 4.4 Cyclic Resistance Ratio (CRR) and Factor of Safety (FS) Trends

The comparison of CRR and FS between CPT and SPT across the sites reveals distinct trends in liquefaction resistance assessment. Generally, CPT-based CRR values tend to be higher than those derived from SPT, particularly at Sites B and D, suggesting that CPT may overpredict liquefaction resistance in these areas. However, at Sites A and C, SPT-based CRR values exceed those from CPT at certain depths, which may be attributed to variations in soil conditions, groundwater influence, and differences in the test methodologies. Site C, an offshore location, displays unique trends where variations in CRR and FS between CPT and SPT could be influenced by factors such as soil saturation, pore pressure response, and potential sampling disturbance during SPT. These factors, including potential soil disturbance, could lead to a relative overestimation of CRR from SPT compared to CPT at this site.

Results indicate a direct relationship between CRR and FS, where higher CRR corresponds to higher FS. In most cases, SPT-based CRR values are lower, particularly at Sites B and D, which may be influenced by energy losses, rod length effects, and hammer efficiency. In contrast, CPT provides a more detailed assessment of soil resistance, often resulting in slightly higher CRR estimates. At Sites A and C, however, these factors do not significantly affect the SPT results, possibly due to the more controlled sampling environment or less energy loss during testing. At Site C, the offshore

conditions and the potential for disturbance during SPT sampling may have contributed to relatively higher SPT-based CRR values compared to CPT.

Depth-wise, a general trend is observed where CRR and FS decrease with increasing depth, suggesting reduced soil resistance in deeper layers. This decrease is commonly expected, as deeper soil layers often exhibit weaker or more compressible properties. However, the rate of decrease varies across sites, with Site D showing a more significant decline in CRR and FS at greater depths, likely due to weaker soil strata or different soil characteristics at those depths.

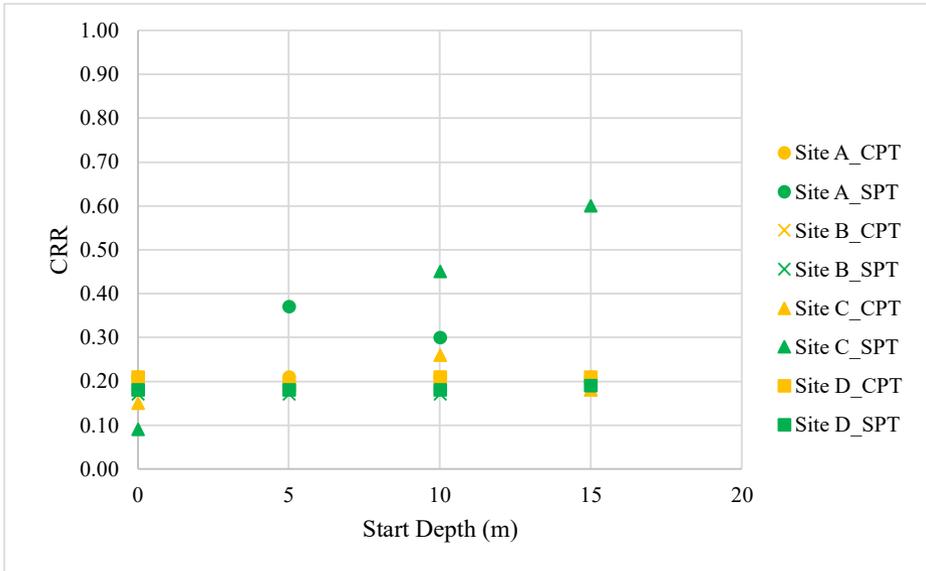


Fig. 3. Variation of CRR values across all sites.

#### 4.5 Influence of Soil Type and Groundwater Conditions

Liquefiable layers are primarily found in loose sands and silty sands. The results indicate that Sites A, B, and D (Luzon and Mindanao) contain thicker liquefiable layers, suggesting more extensive deposits of loose sands. In contrast, Site C (Visayas, offshore) exhibits thinner liquefiable layers, which may be attributed to a mix of coarse and finer sediments, typical of underwater depositional environments.

The measured groundwater levels influence liquefaction susceptibility, with Sites A, B, and D exhibiting shallow water tables that contribute to higher liquefaction risk in the upper 10–15 meters. Site C, being offshore, remains fully submerged, leading to deeper liquefiable layers and greater susceptibility beyond 10 meters due to constant saturation.

CPT identified more liquefiable layers than SPT, likely due to its continuous profiling capability. SPT results showed fewer liquefiable layers, potentially due to localized denser soil inclusions affecting blow count measurements. Despite differences in

detection, both methods indicate the highest liquefaction risk in the upper 20 meters, where soils are loose and influenced by groundwater fluctuations.

FS trends closely follow CRR values, with CPT generally yielding lower FS estimates, suggesting a more conservative liquefaction risk assessment. However, occasional higher SPT-derived CRR values at Sites A and C may be attributed to variations in soil structure, energy losses, or pore pressure dissipation.

## 5 Conclusion

The comparative analysis of Cone Penetration Testing (CPT) and Standard Penetration Testing (SPT) for liquefaction assessment across the four sites highlights significant variations in detected liquefiable layers and computed liquefaction resistance. The results confirm that liquefiable soil layers are most prevalent in the upper 10–15 meters, where the factor of safety (FS) and cyclic resistance ratio (CRR) values are lowest, indicating increased susceptibility to liquefaction. CPT generally identified more liquefiable layers than SPT, owing to its continuous profiling capability. However, at Sites A and C, SPT-based CRR values exceeded CPT-based values at certain depths, suggesting that site-specific factors, such as soil structure, pore pressure effects, and differences in test methodologies, influence liquefaction resistance estimates.

Groundwater conditions play a critical role in liquefaction susceptibility, as demonstrated at Site C, where fully submerged conditions led to deeper liquefiable layers despite increased confining pressure. Across all sites, CRR and FS show a direct relationship, reinforcing the positive correlation between these two parameters in terms of liquefaction risk assessment. The study also demonstrates that while CPT generally provides more conservative liquefaction estimates, SPT remains a valuable tool, particularly in soil conditions that require sample retrieval for laboratory analysis.

This study provides geotechnical engineers with a well-founded basis for selecting the most appropriate testing method for liquefaction potential evaluation. CPT is ideal for projects requiring high-resolution continuous profiling and pore pressure measurements, making it particularly suited for fine-grained and offshore soils. In contrast, SPT remains essential for projects that require soil sampling for laboratory analysis, especially in mixed soil profiles and gravelly conditions where CPT application may be limited.

Integrating both CPT and SPT methods can provide a more comprehensive understanding of subsurface conditions, leading to better-informed foundation design and risk mitigation strategies. This integrated approach not only improves the accuracy and reliability of geotechnical assessments but also supports the development of resilient infrastructure, particularly in seismic-prone regions. The insights gained from this research contribute to enhancing geotechnical engineering practices and infrastructure planning, ensuring long-term stability and safety.

## References

1. Youd, T. L., Idriss, I. M., Andrus, R. D., Arango, I., Castro, G., Christian, J. T., ... & Robertson, P. K.: Liquefaction resistance of soils: Summary report from the 1996 NCEER and 1998 NCEER/NSF workshops on evaluation of liquefaction resistance of soils. *Journal of Geotechnical and Geoenvironmental Engineering*, 127(10), 817–833. [https://doi.org/10.1061/\(ASCE\)1090-0241\(2001\)127:10\(817\)](https://doi.org/10.1061/(ASCE)1090-0241(2001)127:10(817)) (2001).
2. Seed, H. B., Idriss, I. M.: Simplified procedure for evaluating soil liquefaction potential. *Journal of Soil Mechanics and Foundations*, 97(3), 1249–1273, (1971).
3. Robertson, P. K., & Wride, C. E.: Evaluating cyclic liquefaction potential using the cone penetration test. *Canadian Geotechnical Journal*, 35(3), 442–459. <https://doi.org/10.1139/t98-017> (1998).
4. Boulanger, R. W., & Idriss, I. M. CPT and SPT based liquefaction triggering procedures. Report No. UCD/CGM-14/01. University of California, Davis (2014).
5. Department of Public Works and Highways (DPWH). 2018 DPWH Standard Specifications for Highways, Bridges, and Airports (Volume II). Bureau of Research and Standards, Philippines (2018).
6. Buhay, D. J., Legaspi, C. J., Dizon, R. P., Abigiana, M. I., Papiona, K., Bautista, M. L.: Development of a database of historical liquefaction occurrences in the Philippines. *Earth Science Reviews*, 251 (2024).
7. Robertson, P. K., Wride, C. E.: CPT as a tool for liquefaction assessment. *Geotechnical Testing Journal*, 21(3), 221–233 (1998).
8. Boulanger, R. W., Idriss, I. M.: State normalization of penetration resistances and the effect of overburden stress on liquefaction resistance. In: 11th International Conference on Soil Dynamics and Earthquake Engineering, and 3rd International Conference on Earthquake Geotechnical Engineering, vol. 2, pp. 484–91. Stallion Press (2004).
9. Das, B. M.: Principles of geotechnical engineering. 7th edn. Cengage Learning (2008).
10. Idriss, I. M., & Boulanger, R. W.: Soil liquefaction during earthquakes. Earthquake Engineering Research Institute (2008).
11. Robertson, P. K., Wichtmann, T., & Tatsuoka, F.: Use of the cone penetration test to estimate the liquefaction resistance of soils. *Canadian Geotechnical Journal*, 41(3), 512–533 (2004).
12. Kokusho, T.: Liquefaction and ground failure during earthquakes: Theories and case histories. CRC Press (1997).
13. Hoque, M. M., Ansary, M. A., Siddique, A.: Evaluation of liquefaction potential from SPT and CPT: A comparative analysis. In: Proceedings of the 19th International Conference on Soil Mechanics and Geotechnical Engineering. Seoul (2017).
14. American Society for Testing Materials International. Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils (2020).
15. American Society for Testing Materials International. Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils (2018).

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

