Geo-disaster Mitigation Engineering

IIS UNIVERSITY OF TOKYO GDM

Evaluation of liquefaction triggering potential using SPT and V_s data

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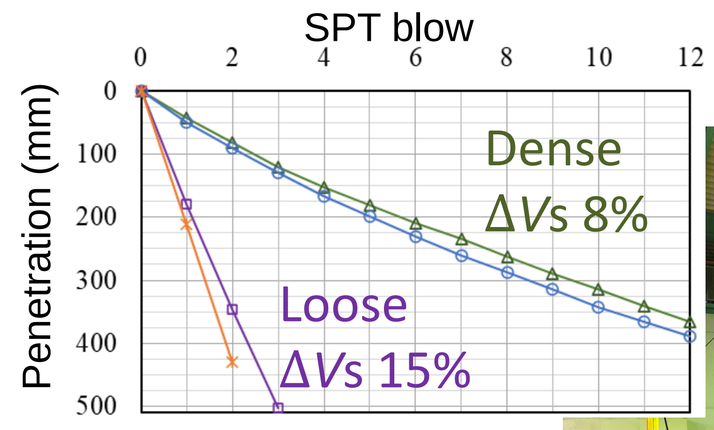
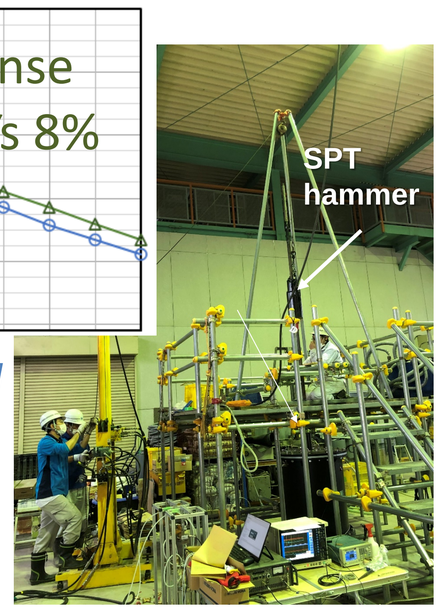
How can liquefaction resistance be assessed accurately?

Liquefaction resistance or cyclic resistance ratio *CRR*, depends on soil type, density, stress history as well as soil fabric. Current SPT or V_s methods tend to underestimate *CRR* because the interplay of two important factors, **density** and **soil fabric** effect has not been clarified. This study aims to develop a new, improved *CRR* evaluation method.



N-value not sensitive to soil fabric at a given density



Prediction by combined use of SPT and V_s data

From field measurements of SPT *N*-value and V_s

Considerations:

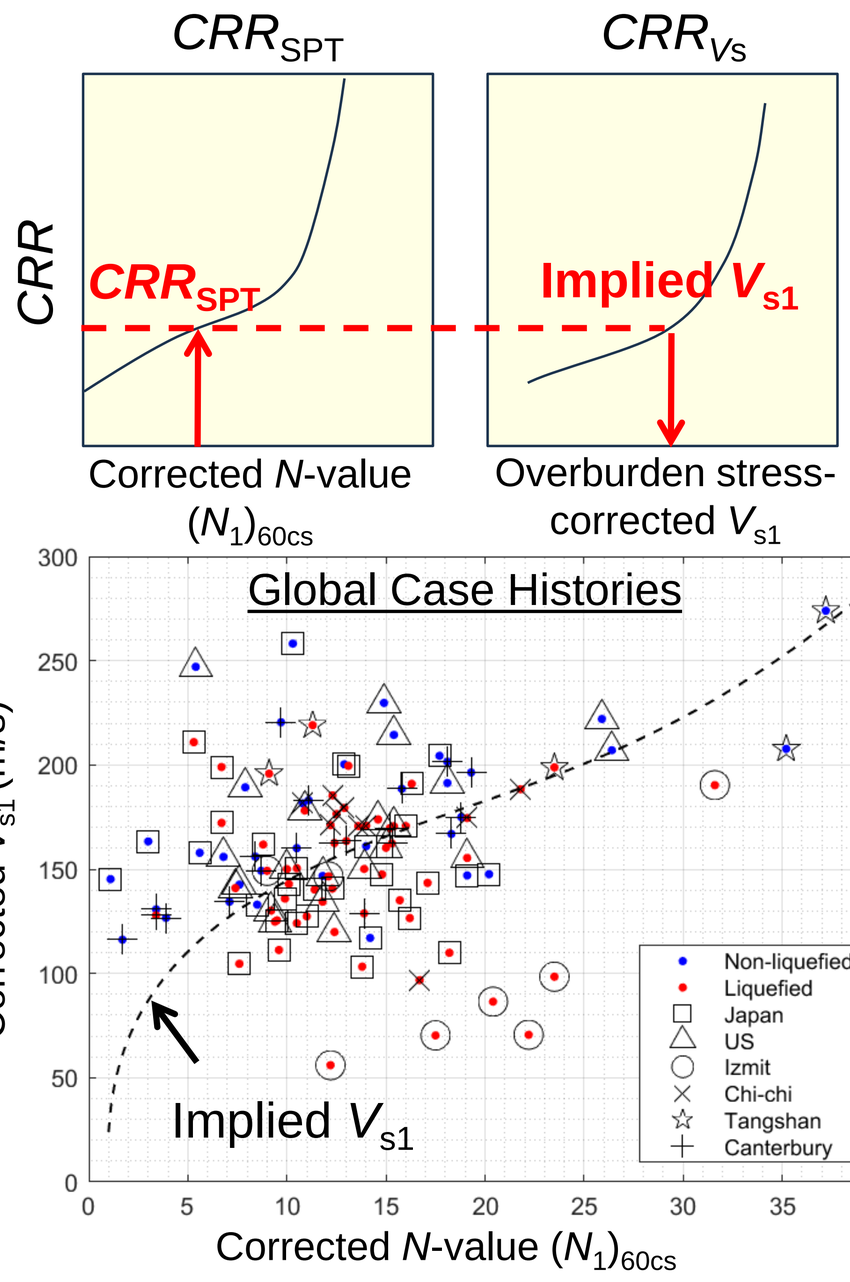
1. Density effect from *N*-value
2. Pairing of *N*-value & V_s at the same *CRR*
3. Comparing **in-situ & implied V_s** to adjust for fabric effect by the empirical formula (Kiyota *et al.*, 2019)

$$\frac{CRR}{CRR^*} = \left(\frac{V_s}{V_s^*}\right)^5$$

Proposed equation:

$$CRR_{SPT,V_s} = f(\text{density, soil fabric}) \cong f(N_{SPT}, V_s)$$

$$= CRR_{SPT}\left(\frac{\text{In-situ } V_{s1}}{\text{Implied } V_{s1}}\right)^5$$



Performance of new method:

★ **↓ False positive & ↑ Accuracy**

For cases predicted as 'liquefied' by the original method, 21% correctly evaluated as 'non-liquefied' and accuracy improved from 70% to 85%.

★ **Avoid over-engineering and better cost-effectiveness in countermeasures**

↑ *CRR* and F_L for same *N*-value but higher V_s, so our design can be more rational, accurate. It helps prevent unnecessary works. We can allocate budget to more vulnerable areas.