



Correcting SPT Blow Counts to N_{60} Values

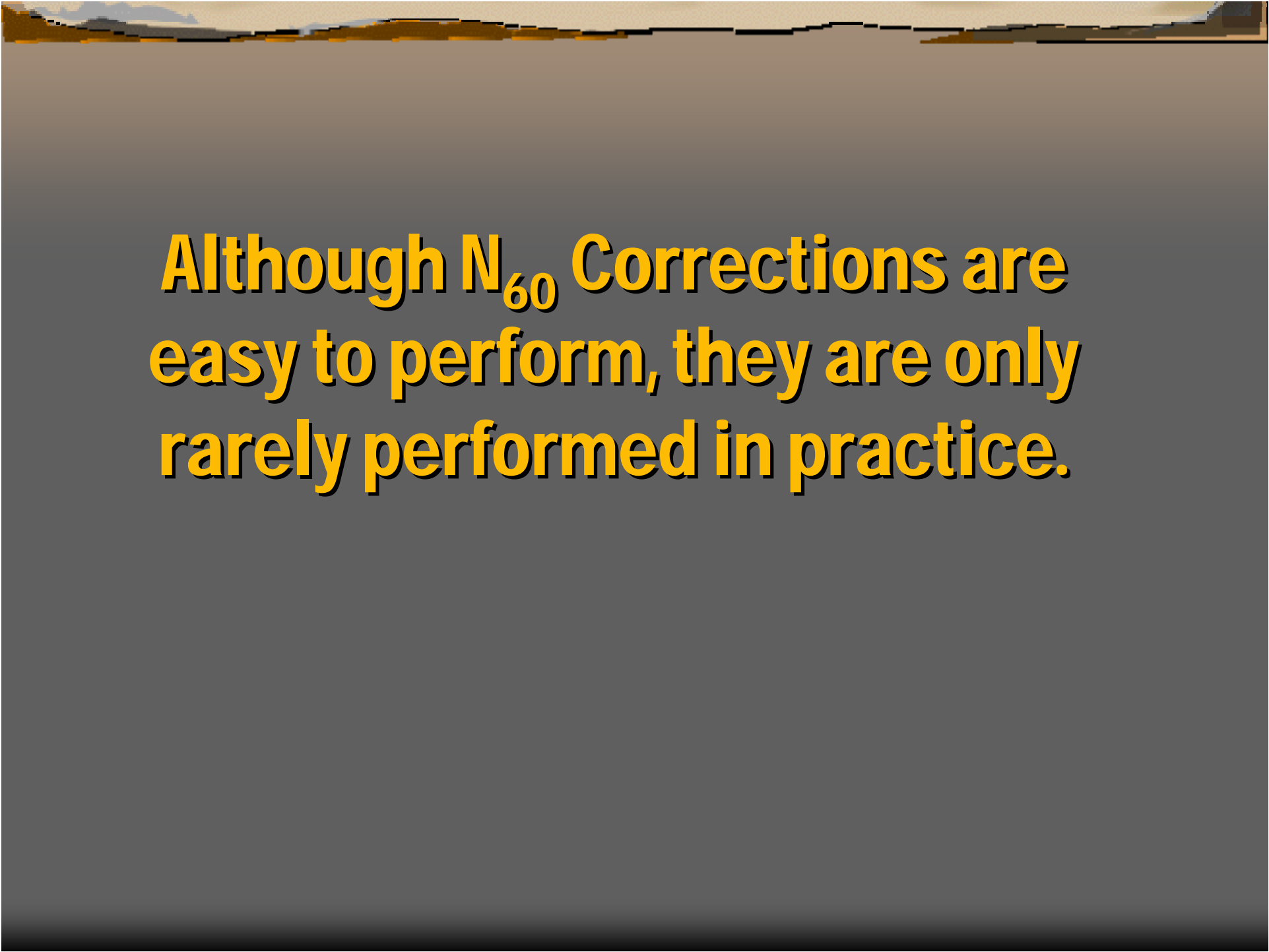
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WHY IS IT IMPORTANT ?

- ⇒ When SPT empirical design correlations were developed (1940s-1960s), experts believe that N_{60} values represent what those earlier researchers used.
- ⇒ SPT method has changed since the 1960s.
- ⇒ Uncorrected "N" values can vary by a factor of 3.

Earlier Research Methods

- ⇒ Mud rotary drilling was used instead of augers.
Reduces the geostatic stress release.
- ⇒ ID of barrel was same as tip.
- ⇒ Only safety and donut hammers were used.



Although N_{60} Corrections are easy to perform, they are only rarely performed in practice.

N_{60} Formula

$$N_{60} = \frac{E_m C_B C_S C_R N}{0.60}$$

Where:

N_{60} = SPT N value corrected for field procedures

E_m = hammer efficiency (from Table 4.3)

C_B = borehole diameter correction (from Table 4.4)

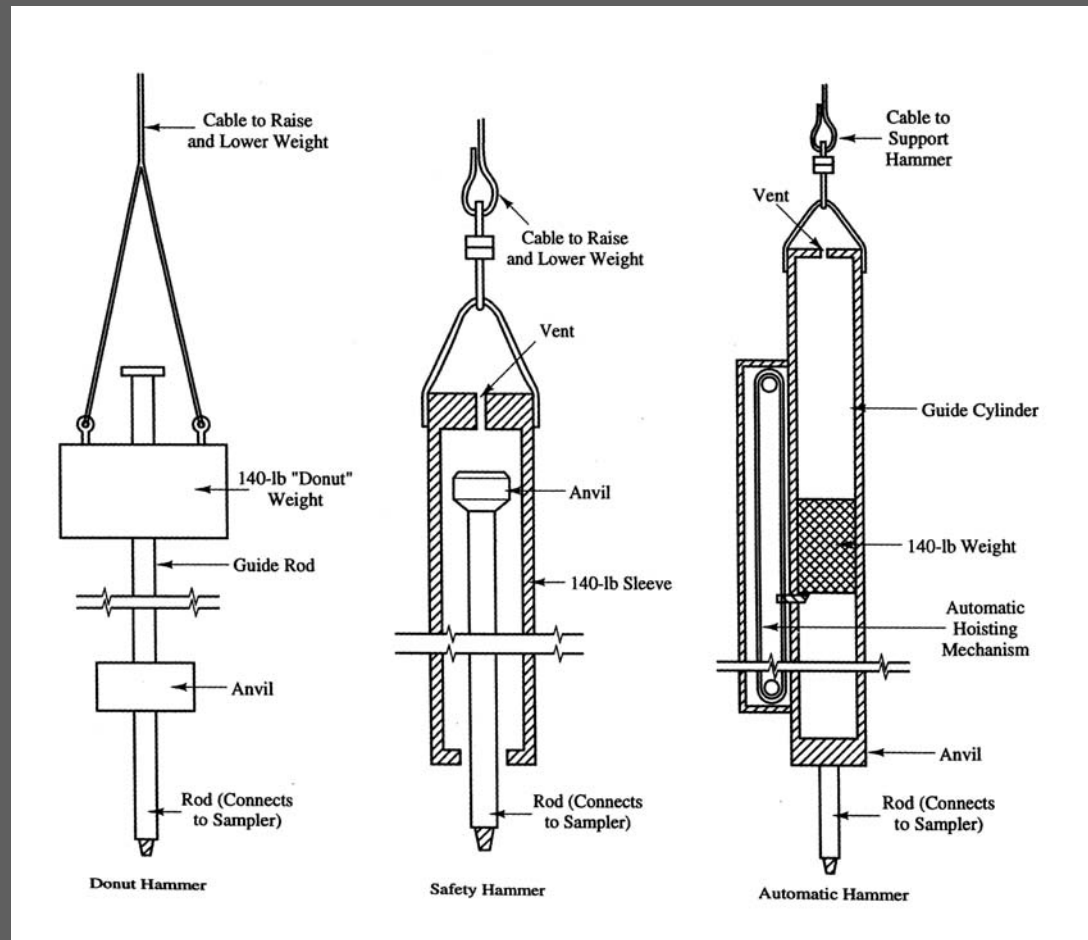
C_S = sampler correction (from Table 4.4)

C_R = rod length correction (from Table 4.4)

N = measured SPT N value

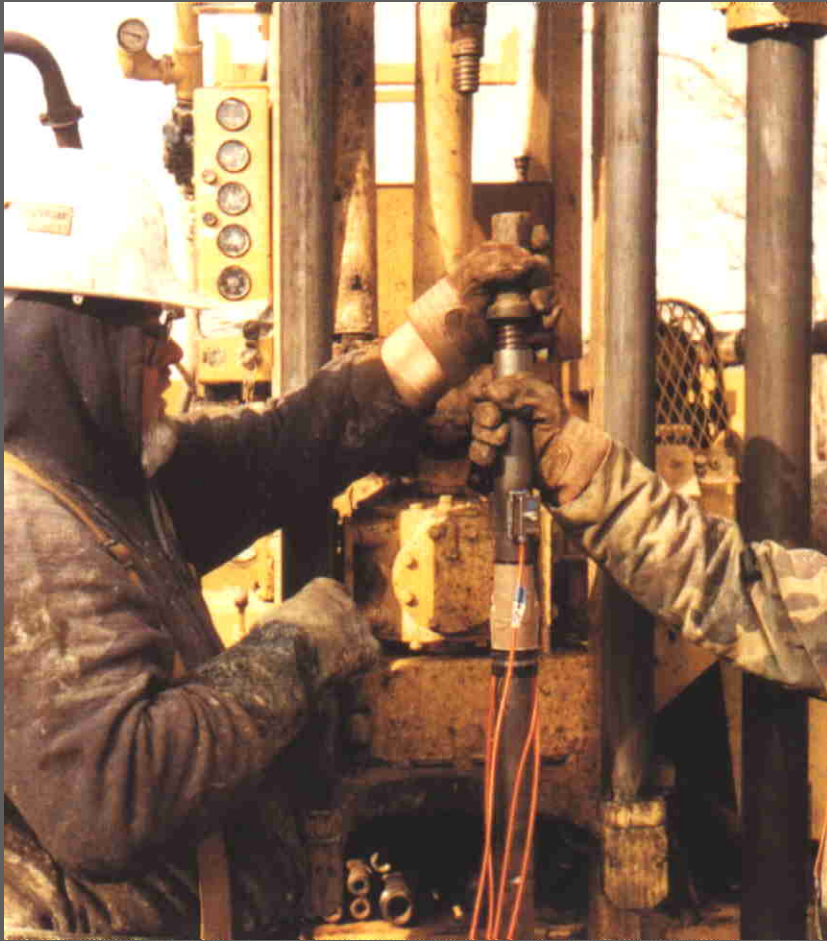
(After Coduto, 1994)

SPT Hammer Types



(After Coduto, 1994)

SPT Hammer Energy Calibration



Typical Hammer Efficiencies

- ⇒ Theoretical Energy = (30in)(140lbs) = 4200 ft-lbs
- ⇒ Donut -- 0.45
- ⇒ Safety -- 0.60
- ⇒ Automatic (CME) – 0.95
 - Consult Manufacturer

N_{60} Correction Factors

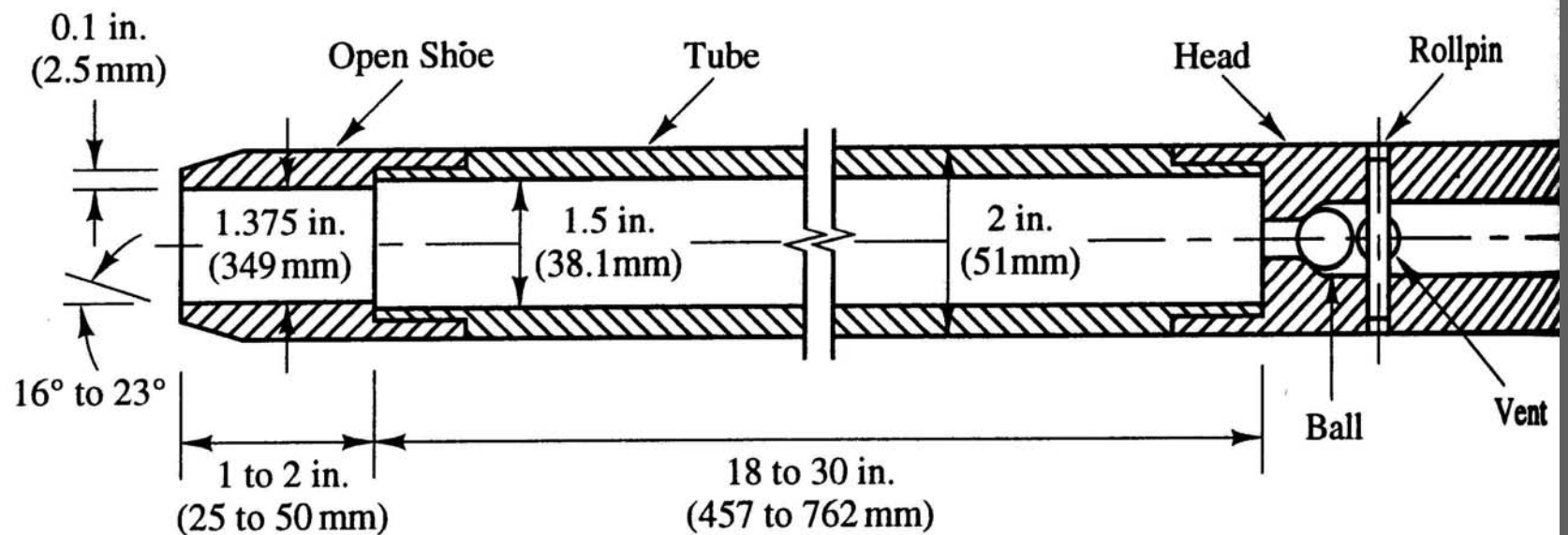
TABLE 4.4 BOREHOLE, SAMPLER, AND ROD CORRECTION FACTORS

Factor	Equipment Variables	Value
Borehole diameter factor, C_B	2.5 - 4.5 in (65 - 115 mm)	1.00
	6 in (150 mm)	1.05
	8 in (200 mm)	1.15
Sampling method factor, C_S	Standard sampler	1.00
	Sampler without liner (not recommended) (generally used)	1.20
Rod length factor, C_R	10 - 13 ft (3 - 4 m)	0.75
	13 - 20 ft (4 - 6 m)	0.85
	20 - 30 ft (6 - 10 m)	0.95
	> 30 ft (> 10 m)	1.00

Adapted from Skempton (1986).

(After Coduto, 1994)

Today's SPT Sampler



(After Coduto, 1994)

Borehole Diameter

- ⇒ Large inside diameters of boreholes reduce confinement making it easier for spoon to penetrate soil
- ⇒ Only important when I.D. is 6 inches or more

Rod Length Correction

- ➔ When the hammer strikes the rods, a compression wave travels down the rods and is reflected as a tension wave after it reaches the bottom of the split spoon.
- ➔ When the tension wave travels back to the hammer, the hammer is lifted and energy transfer essentially stops.
- ➔ Incomplete hammer energy is transferred when rod lengths are less than 30 feet.

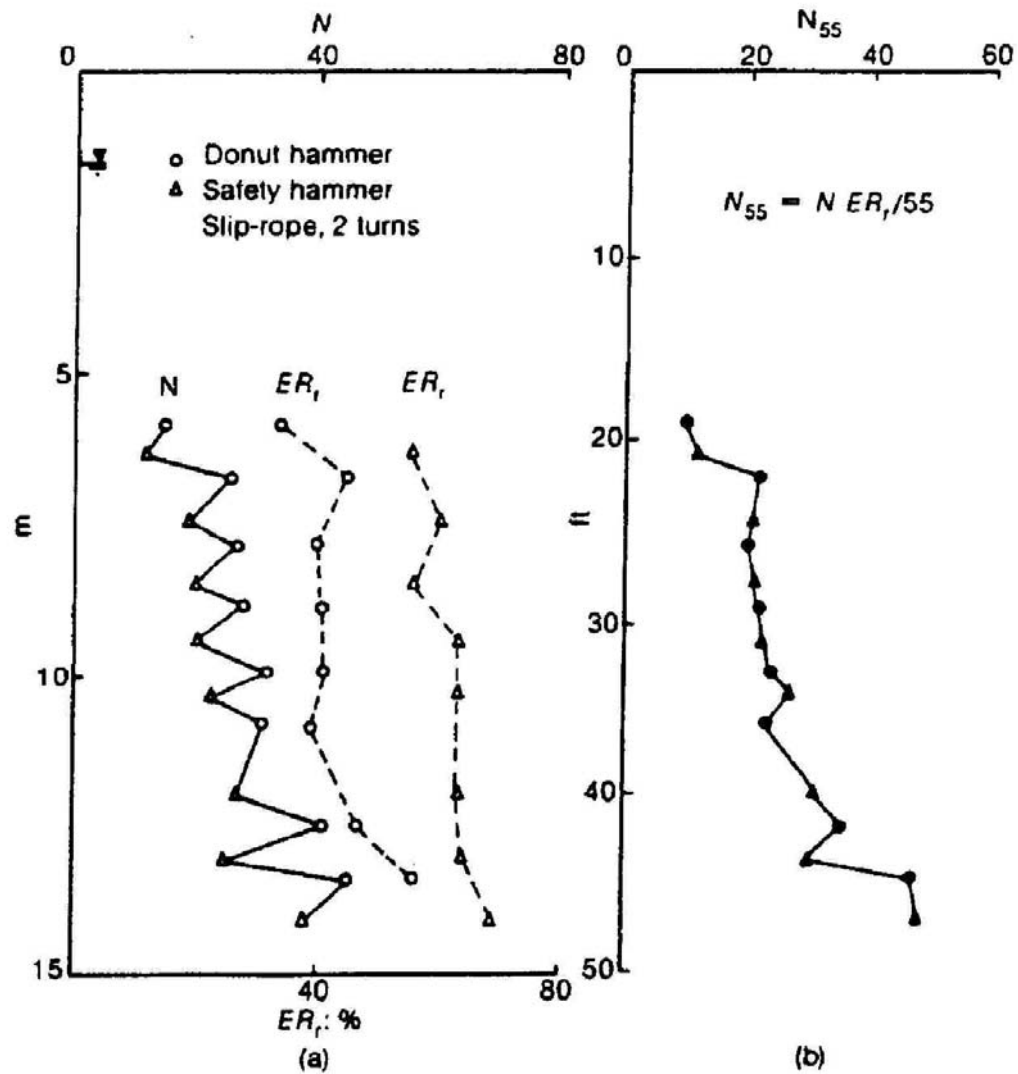


Fig. 3. Alternate tests in a borehole with varying N values and rod energy ratios ER_r , measured with the donut and safety hammers (after Robertson *et al.*, 1983) (Fraser River delta)

Conclusions

- ⇒ N_{60} values are needed for more accurate design analyses.
- ⇒ N_{60} values have less variability or scatter due to test method. {Standardization of field procedures}
- ⇒ Contractor fees may be reduced from consistent data reporting.
- ⇒ Consider revising geotechnical report guidelines to require N_{60} values on all boring logs



Worked Examples