

Industry Perceptions of Percentage Sample Size Required During Sample Commissioning

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The Future of Our Industry

- The worldwide focus is on making buildings more energy efficient and resilient
- Owners are far more concerned about how the building performs and their operating costs



Commissioning

Commissioning is a quality-focused process for enhancing the delivery of a project by verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owners Project Requirements (OPR).

ASHRAE - 2005



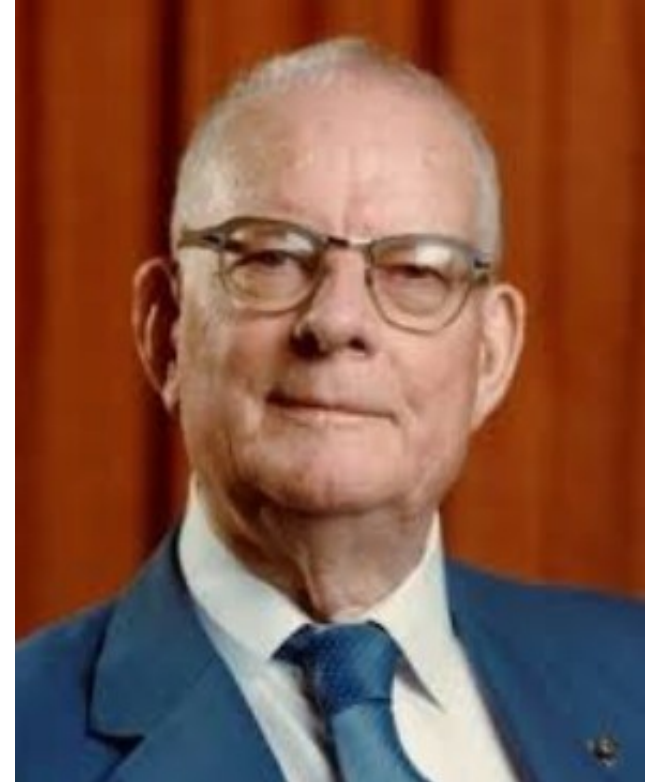
Sample Commissioning

The issue for the owner is the cost of commissioning, particularly with large buildings with many repetitive parts (e.g. fan coil units, heat pumps, etc.) Under standard commissioning all units would have to be tested to guarantee the integrity of the system



Sample Commissioning

- Is there a way to use the proven sampling methods popularized by Deming (1966) in the Japanese auto industry
- Sample commissioning aims to decrease testing time while still detecting inconsistencies



Sample Commissioning

- Sampling has been adopted by ASHRAE's new Standard 202-2018, *Commissioning Process for Buildings and Systems*
- Sampling has also been adopted by the U.S. Environmental Protection Agency (EPA) – *General Commissioning Requirements*
- Both have highly subjective criteria to define sample size



Table 1 – ASHRAE Standard 202-2018

	Sample Rate Determination	
Factor	Guidance	% of Components
Complexity	Components of greater complexity typically require additional maintenance space and access points, as well as have a greater likelihood of involving multiple OPR criteria. Therefore, with great complexity, the rate of sampling typically increases.	10% - 20% low complexity 20% - 40% medium complexity 40% - 100% high complexity
Criticality	As the criticality of a component increases, the sampling rate increases to provide a higher level of assurance the OPR will be achieved.	5% - 25% low criticality 100% - 600% high criticality
Length	A submittal that has very little information (length) will typically result in a high sampling rate, whereas one with hundreds of pages will typically result in a low sampling rate of the submittal document. For non-critical components, a random subset of the evaluation may be used	100% less than 3 pages 75% - 100% 4-10 pages 25% - 75% 11-100 pages 5% - 25% greater than 100 pages



Study Parameters

Pilot study conducted at MSOE

Questionnaire:

13 questions

3 commissioning topic areas

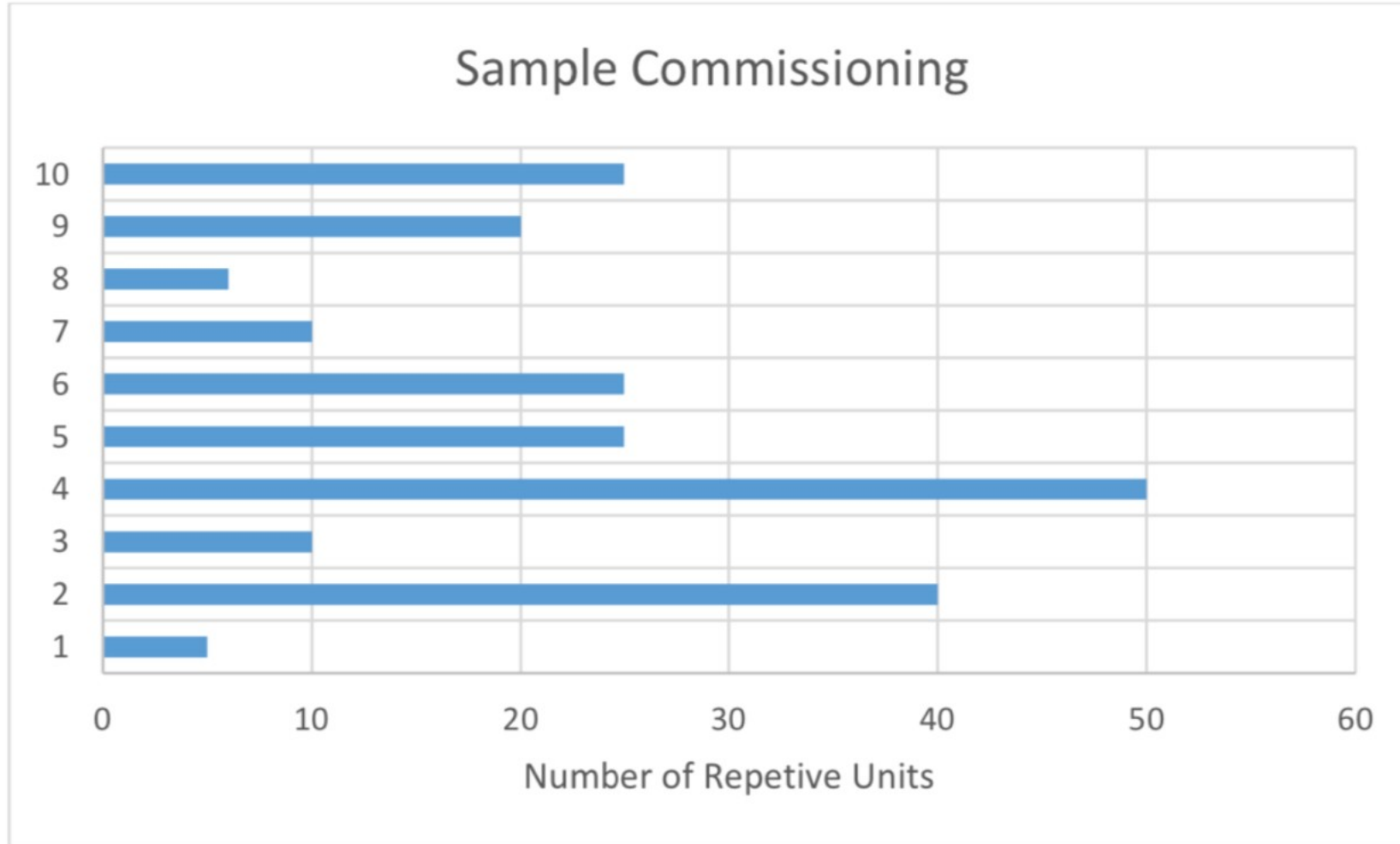
Size of population

The difference between random errors and systematic errors

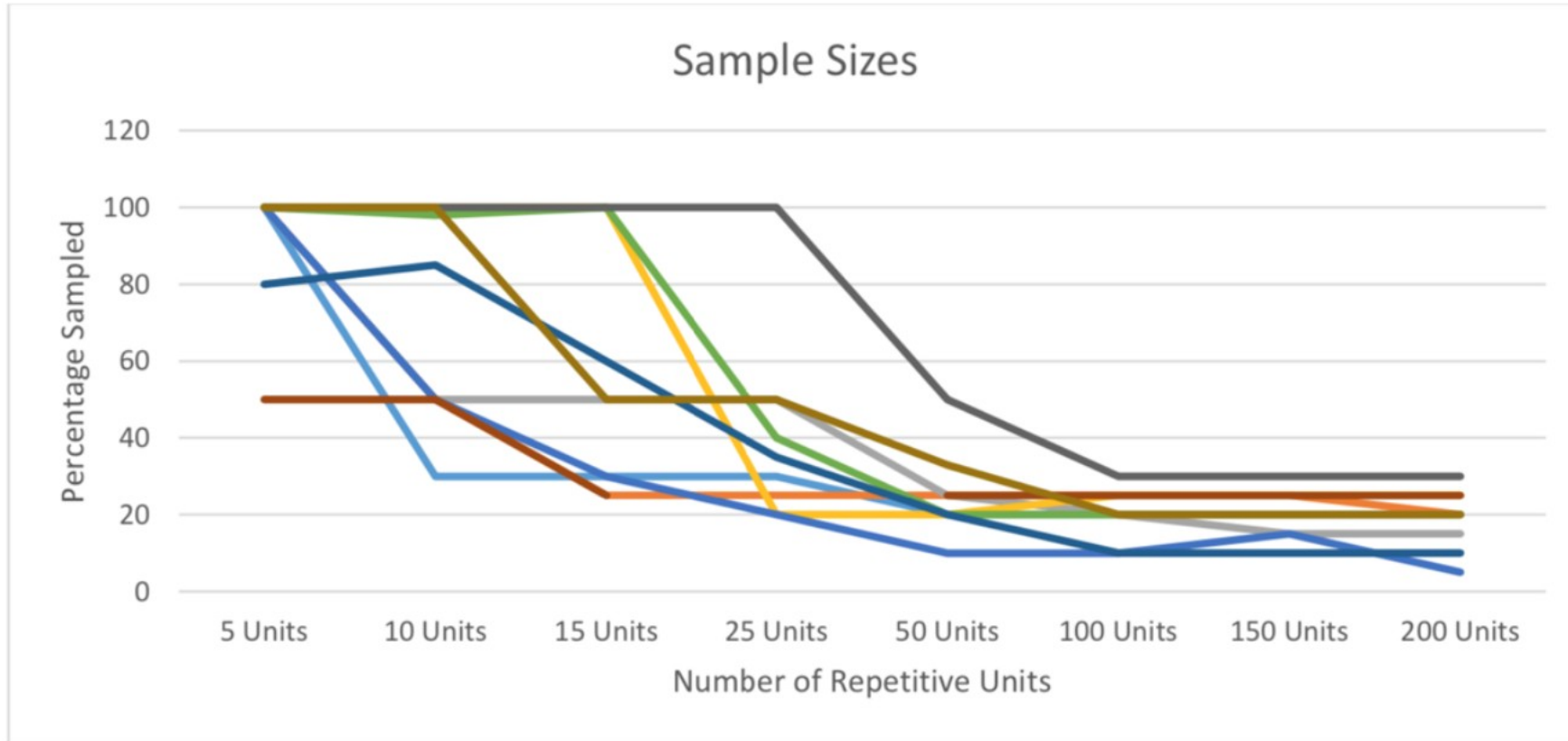
Sample size



Results – Number of Units Needed



Results – Sample Size based on Populations



Conclusions and Recommendations

- High interest in the topic
- Projects under 50 units there is a high variation in sampling (20% - 100%)
- Less variation over 50 units (10%-25%)
- Industry belief does not exactly match the ASHRAE guidelines
- Future research could help define the proper ranges

