TG5 – Using Significant Figures in Spreadsheets

TG Number:	TG5	**Author:**	Steven Anderson
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1　INTRODUCTION

Our test methods often call to round to a number of significant figures, unfortunately computers and calculators do not have this as a standard function. This is due to the complexity of the function, though formulas can be created to carry it out. This guideline aims to provide consistency amongst CETANZ members when recording and using spreadsheets to display and report significant figures.

The industry standard for using significant figures is ASTM D6026-13, Standard Practice for Using Significant Digits in Geotechnical Data - note that the ASTM standard says "Significant Digits" as opposed to "Significant Figures". Clause 5.2.3 recognises the difficulty of using a spreadsheet or computer to round to significant digits and acknowledges this is not to be regarded as nonconforming.

Key points:

- Recording significant digits for measured and calculated values shall follow ASTM D6026, unless the test method/standard specifies otherwise.
- Raw data should be recorded as displayed.
- Rounding to significant digits shall be obtained in one step and generally applied to intermediate and final results of calculations.
- Numbers to be reported are rounded at the end of calculations.
- Rounding results avoids the misleading impression of precision.

Spreadsheet number formats to emulate significant figures (SF):

- Instrument data - digital decimal places (DDP, unrounded)
- Rounding to "n" decimal places (RDP),

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2   EXAMPLES

Examples are presented below; one for water content and one for Atterberg plasticity index.

Table 1 Water content example – NZS4402 Tests 2.1

Test Step	Raw Data	Method Requirement	Computer Rounding	Example 1	Example 2	Example 3
Balance displayed weight	1-3 DDP	-	-	-	-	-
Recorded on worksheet weight	4-5 SF	-	-	-	-	-
Calculated Water content	Unrounded	-	-	6.45567	34.46734	120.3578
Reporting water content	-	Values < 10 2 SF	Values < 100 1 RDP	6.5	-	-
		Values ≥ 10 3 SF	Values < 100 1 RDP	-	34.5	-
			Values ≥ 100 0 RDP	-	-	120

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Table 2 Atterberg Plasticity Index example – NZS4402 Tests 2.4

Test Step	Raw Data	Method Requirement	Computer Rounding	Example 1	Example 2	Example 3
Balance displayed weight	4-5 DDP	-	-	-	-	-
Recorded on worksheet weight	4-5 SF	-	-	-	-	-
Calculated liquid or plastic limit	Unrounded	-	-	6.45567	34.46734	120.3578
Reporting plasticity index	-	Whole number	0 RDP	6	34	120

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3   DISCLAIMER

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4   ACKNOWLEDGEMENTS

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5   REFERENCES

ASTM D6026-13 Standard practice for using significant digits in geotechnical data

NZS4402:1986 Methods of testing soils for civil engineering purposes

New Zealand and International standards

Wikipedia – Significant figures