FACE CONSULTANTS LTD
Global Flooring Consultants

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FREE MOVEMENT SURVEYS
Concrete Society's Technical Report Number 34
2013 Edition
Table 3.1

Further explanatory information

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FREE MOVEMENT SURVEYS

Method statement to survey a floor's surface regularity, in accordance with The Concrete Society's Supplement to Technical Report No:34

Data analysis and permissible limits

Floor Class	Typical Floor Use	E	F
FM1	Where very high standards of flatness and levelness are required. Reach trucks operating at above 13m without side-shift.	**4.5**	**1.8**
FM2	Reach trucks operating at 8 to 13m without side-shift.	**6.5**	**2.0**
FM3	Retail floors to take directly applied finishes. Reach trucks operating at up to 8m without side-shift. Reach trucks operating at up to 13m with side-shift.	**8.0**	**2.2**
FM4	Retail floors to take applied screeds.	**10.0**	**2.4**

A representation of Table 3.1, showing the permissible values on Properties E and F levelness and flatness for free movement floor areas.

The Concrete Society's TR34 (table 3.1) recommends that 2 basic properties of the floor's surface regularity should be surveyed:-

1. Flatness - Property F, the change in elevational difference between two consecutive measurements of elevational difference each measured over 300mm.

2. Levelness - Property E, as the difference in elevation between two opposing points 3.0 metres apart, set out on a 3.0 x 3.0 metre grid.

In addition, the deviation in height of the surface of all new floor construction should be within +/-15mm of a fixed datum plane. The level data from the Property E survey is used for this purpose.

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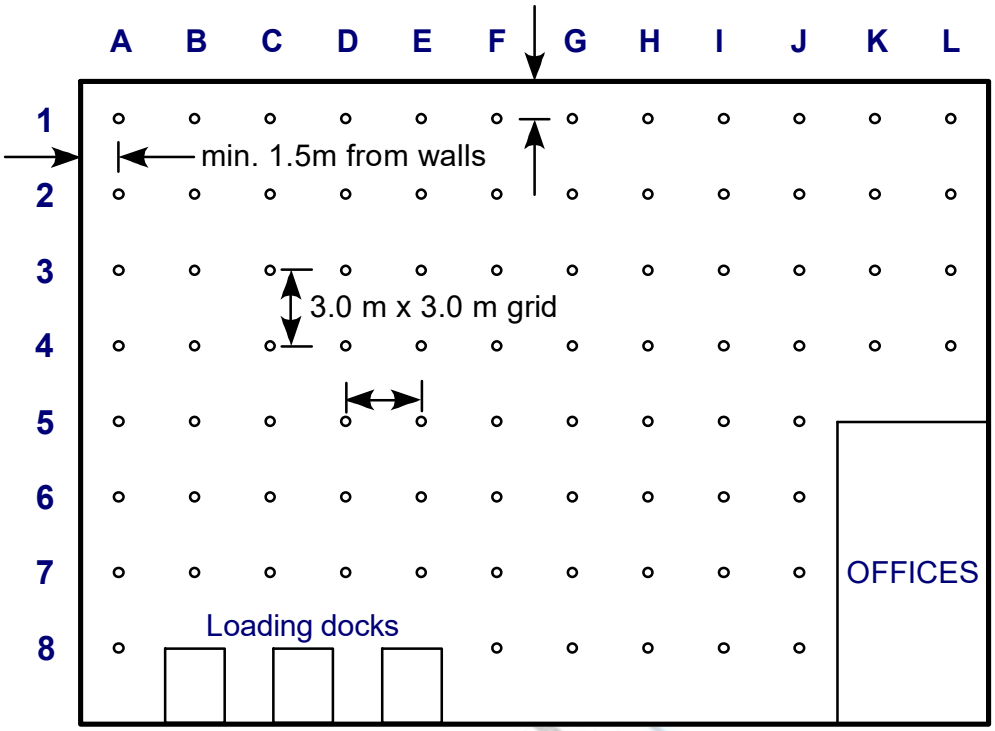
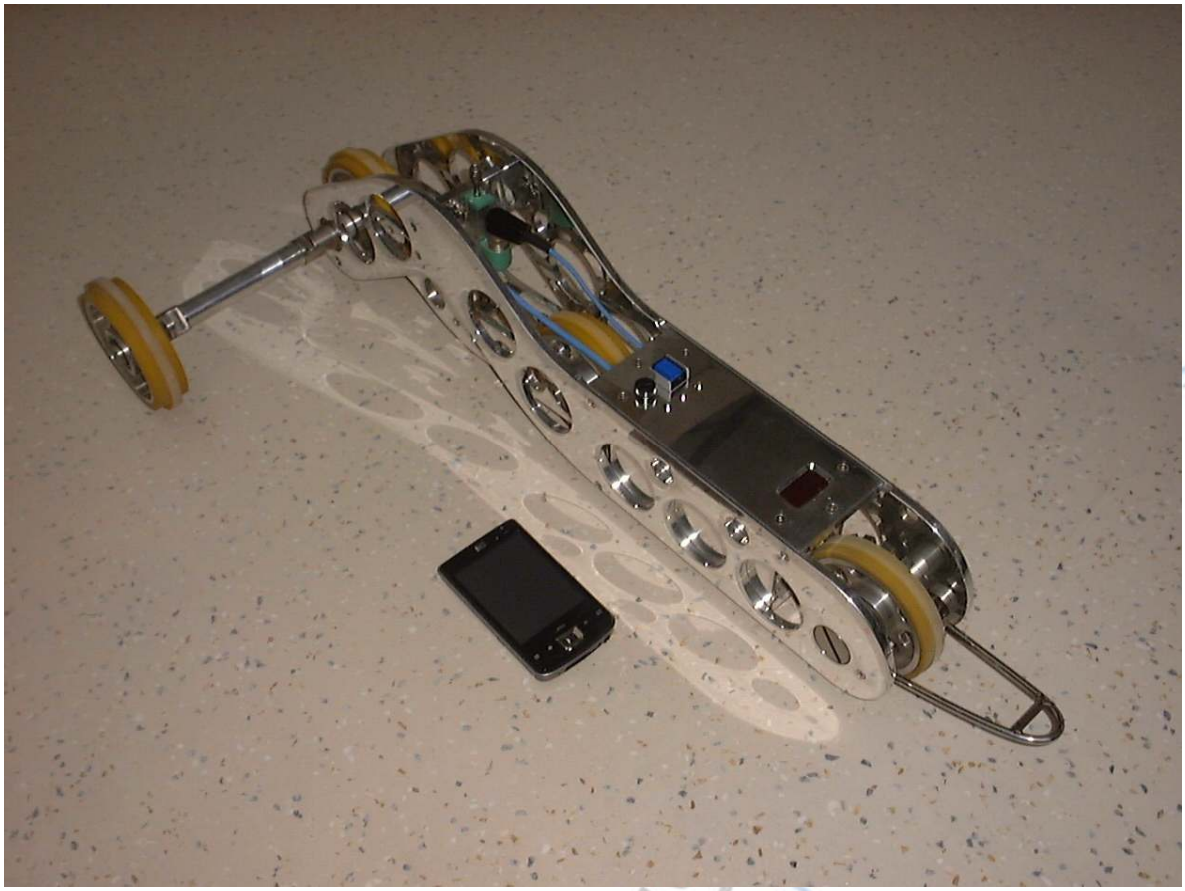
The above properties should be tested, by random sampling, in the following manner:

a) The area is accurately set out on a 3 metre grid pattern. Areas within 1.5m of a wall, column or other existing structure are not surveyed.

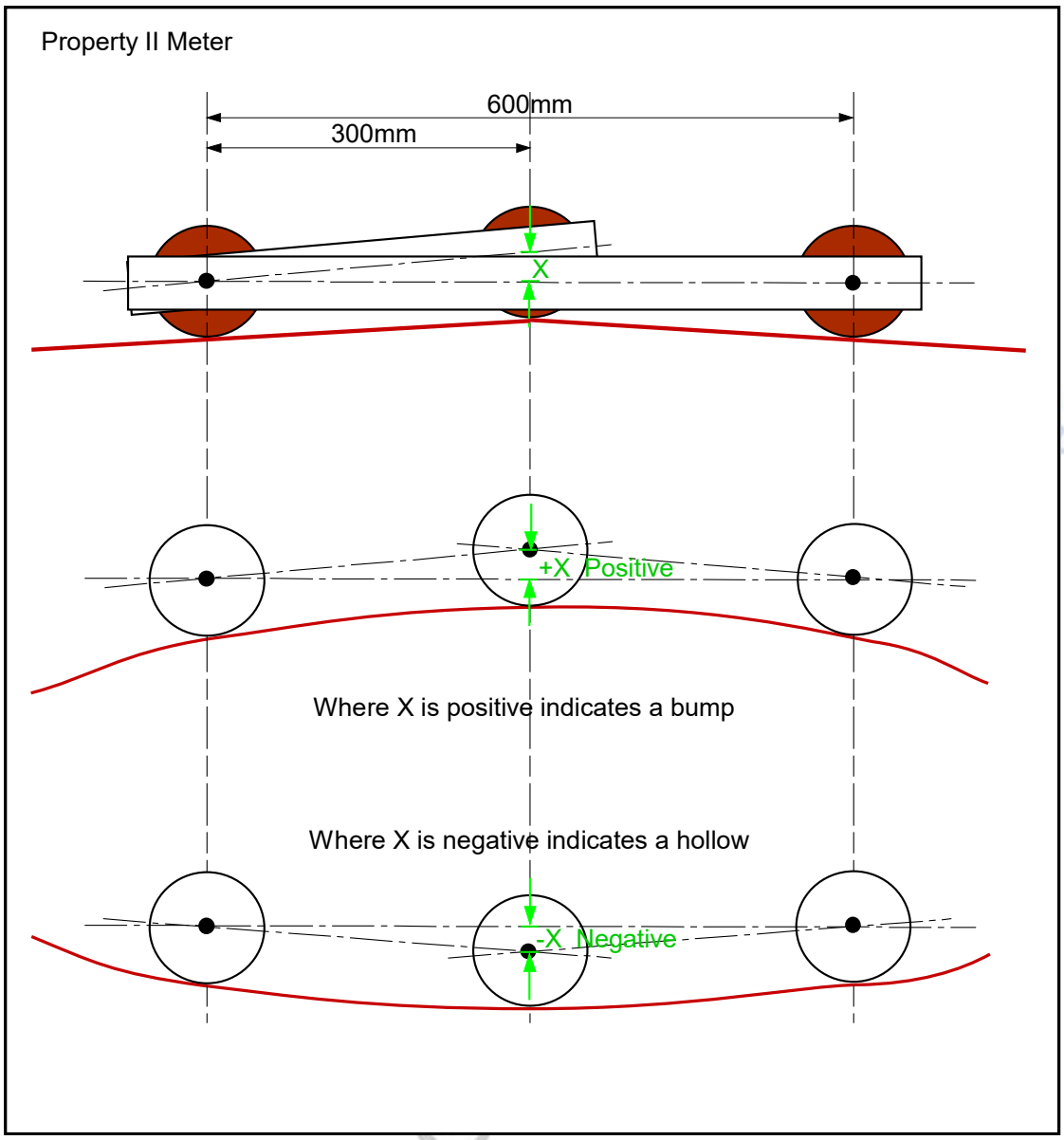


b) Level readings are taken at each grid intersection point, using an engineer's precise optical level, a parallel plate micrometer and an invar staff. This equipment takes readings to 0.1mm accuracy and the figures are used to calculate the Property E results.

c) The Property F element is measured by means of the Face Property II meter.

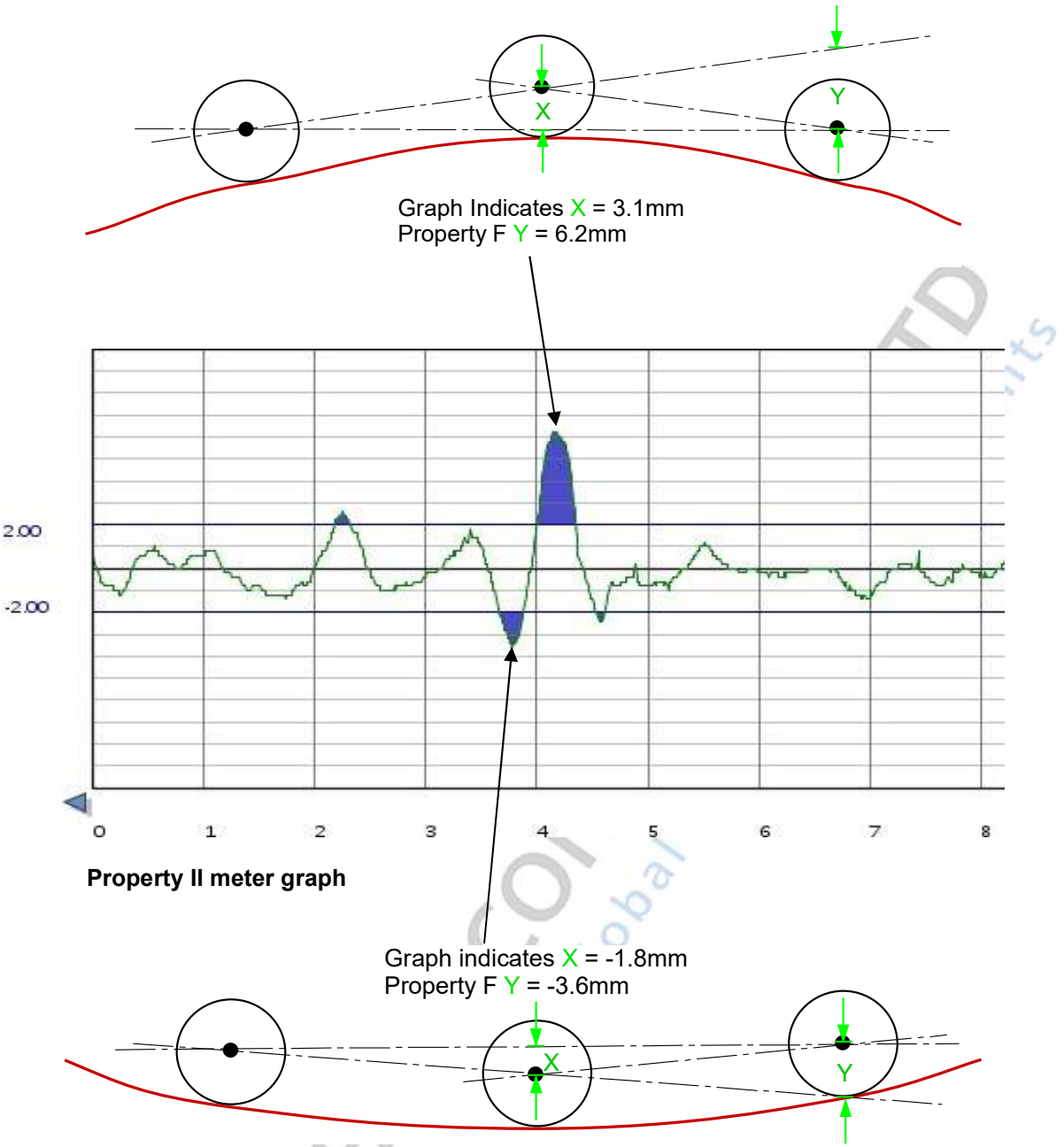


The Property II meter is simply walked along the floor and the data is collected digitally. At the end of a survey run the data is downloaded to a smart phone and then the next run can start. When the required length is surveyed the data is then transferred from the smart phone to a laptop or PC. At the touch of a button the data is analysed by the Face Property F software, the 95th percentile is calculated from all survey runs and the Property F graphs produced.



Property F graphic traces are presented for each run. Where the resultant graphs cross the tolerance limit lines this indicates the Property F 95th percentile is being exceeded at this particular point of the run. The values exceeding the 95 percentile limits are highlighted in blue.

The Property F data for the total sample of Property F runs are analysed and the 95th percentile value of the total sample is calculated and stated in the results table.



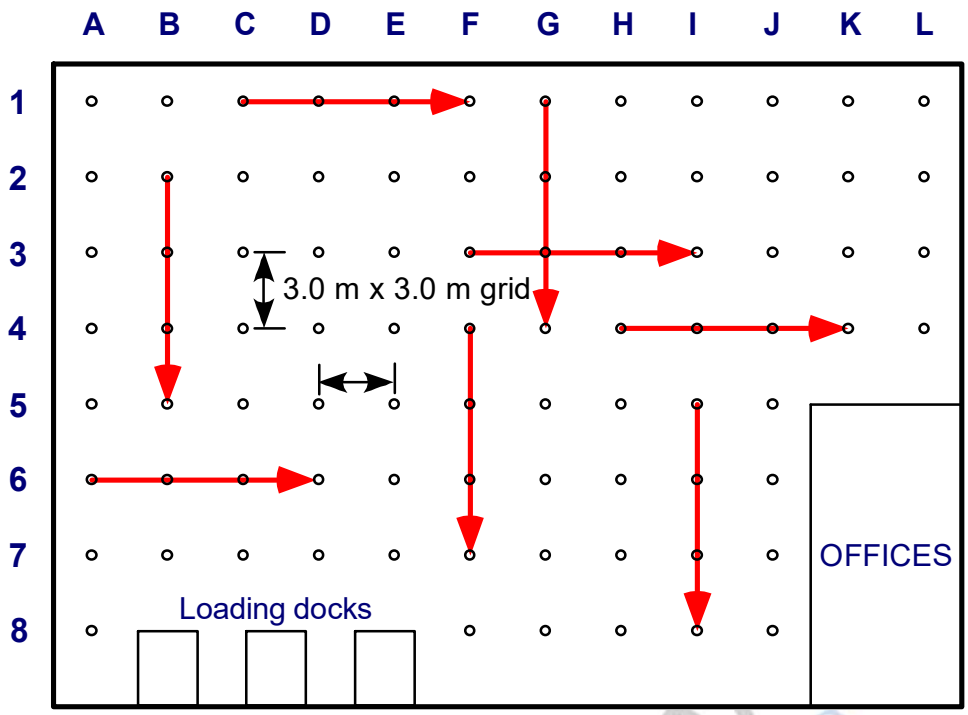
Property II meter graph

The Property II meter is simply run down sections of the floor at walking speed and the Property F rate in change values are collected continuously. The minimum total length of survey runs in metres is calculated as the floor area surveyed in square metres divided by 10. i.e. Minimum length of the survey runs (L in metres) equals Total floor Area (A) divided by 10.

E.g. A floor area (A) of 30m x 30m = 900m^2

Minimum total length of survey lines L = 900 / 10 = 90 metres

Half of the total length of survey line is to be run in one direction and the other half at right angles.



THE SURVEY RESULTS

The survey results are calculated from the data collected on site, to check compliance with the following:-

a) TR34 table 3.1, Property F

b) TR34 table 3.1, Property E

Property F

Below is an example of the summary sheet of results from a Face Property II meter survey.

The upper section of the table shows:

Project name, location, surveyor's initials, job number & date of survey
Classification tested against, FM1, FM2, FM3 or FM4.
The 95th percentile limit relating to the Classification tested against.

Summary Of Results

Job Name:	Example	Job Number:	fc.xx.xxxx
Location:	Unit 1	Date:	15/07/2013
Surveyor:	DB		

Specification	Description	
FM2 4th Edition	95th Percentile	

95th Percentile Limit	Achieved	Pass/Fail
2.0	2.2	Fail

The lower section of the summary sheet shows:

95th Percentile Limit
95th Percentile Achieved
Pass/Fail Percentile limit

Property E

From the level readings taken at the intersection points of the 3.0m grid, the difference in elevation between adjacent points can then be calculated. Any differences in elevation exceeding the 95th percentile value in table 3.1 dependent on classification are highlighted, and the total 95th percentile calculated to check compliance with the Property E classification. The highest and lowest elevation from datum is also calculated to check if any point on the grid falls outside the tolerance +/-15mm from datum.

Example, FM2 (TR34 4th Edition), Property E

Property E	Ref		A 0m		B 3m		C 6m		D 9m		E 12m		F 15m		G 18m
Level Reading	1	0m	1695.5	-3.4	98.9	1.8	97.1	2.5	94.6	0.5	94.1	-1.1	95.2	3.2	92.0
Diff. In Elev.			1.5		1.7		-0.2		-2.7		-0.9		-2.5		2.0
	2	3m	94.0	-3.2	97.2	-0.1	97.3	0.0	97.3	2.3	95.0	-2.7	97.7	7.7	90.0
			-0.5		2.7		5.8		5.8		6.5		6.1		-1.1
	3	6m	94.5	0.0	94.5	3.0	91.5	0.0	91.5	3.0	88.5	-3.1	91.6	0.5	91.1
			3.8		10.5		2.4		-0.2		2.1		-3.1		-1.2
	4	9m	90.7	6.7	84.0	-5.1	89.1	-2.6	91.7	5.3	86.4	-8.3	94.7	2.4	92.3
			0.0		-1.8		0.1		2.7		-1.2		3.1		-0.7
	5	12m	90.7	4.9	85.8	-3.2	89.0	0.0	89.0	1.4	87.6	-4.0	91.6	-1.4	93.0
							1.6		0.6		0.1		0.2		0.5
	6	15m	UTS		COL		87.4	-1.0	88.4	0.9	87.5	-3.9	91.4	-1.1	92.5

	Indicates area is over the 95th Percentile Limit (6.5mm)
	Indicates construction joint
UTS	Indicates Unable to Survey due to obstruction
COL	Indicates a Column within 1.5m radius
VOID	Indicates a Void area (not surveyed)

Results

Datum

Datum =	1692.1	mm
Tolerance	+/-15	mm
Highest Elev. from datum =	8.1	mm
Lowest Elev. from datum =	-6.8	mm

PASS

95th Percentile Limit

95th Percentile Limit	6.5	mm
95th Percentile Calculated	6.6	mm

FAIL

Additional Info

Greatest Diff. in Elev. over 3m =	10.5	mm
% of Results over 6.5mm =	6.0	%
Range (Max - Min) =	14.9	mm

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Non Compliance

Where the required property limits are exceeded, it is recommended that individual measurements are examined in detail to determine the significance of any possible effect on the performance of a floor. Remedial actions will affect the appearance of the floor.

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Further queries on these specifications or on any other floor flatness issue can be answered by calling Face Consultants Limited direct on:

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Copies of the 2013 edition of the Concrete Society's Technical Report No.34 (TR34) can be purchased through Face Consultants Ltd, or direct from the Concrete Society on:

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