

Excel problems in construction cost management

In Spain and other countries around us, where all estimates for construction are realised with Presto or other cost estimate software, it is unthinkable to use Excel for these tasks.

However, it is still widespread practice in other parts of the world.

Common mistakes

Excel is routinely reported as a source of errors that cost a lot of money in all sectors of industry and business.

<https://fpa-trends.com/article/88-spreadsheets-have-errors>

88% Spreadsheets Have Errors

July 26, 2017
By Ian Yates, Managing Director at Barcanet
FP&A Tags: Financial Planning and Analysis

Companies large and small spend countless hours every month developing, amending and updating the spreadsheets that measure performance and drive strategic decision-making.

So it's critical the data contained and output generated by these spreadsheets is timely, simple and above all, accurate. But is it?

Although spreadsheets have proven themselves as useful productivity tools for many years, they are poorly suited for managing the disparate and sizeable data produced by the modern business.

Errors are common, even with experienced users – the more data sources, the more formulas, the 'larger' the spreadsheet, the greater the chance for small errors to be magnified.

We have all experienced 'version numbering' issues and outputs that don't match as changes are made and 'master' spreadsheets not updated.

Exposing organisations to significant levels of risk:

According to experts, there are three primary error types:

1. **Mechanical error** – inputting, typing, copy/paste errors which may appear small but can fundamentally impact the integrity of the entire model as the complexity of the spreadsheet grows
2. **Logic error** – flawed calculations generated from inappropriate or incorrect formulas and algorithms
3. **Omission** – one of the most common and most difficult to spot errors is where data is simply not incorporated in the first place



88% Spreadsheets Have Errors | FP&A Trends (fpa-trends.com)

FINANCE
October 21, 2019

12 of the Biggest Spreadsheet Fails in History

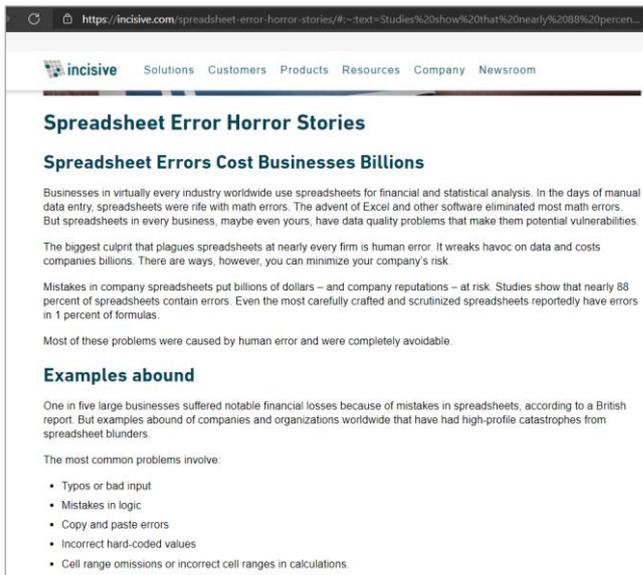
Christiane Soto
SENIOR MARKETING MANAGER - CX

8. **Emerson.** The construction company came up \$3.7 million short in their estimation of the total cost of a contract bid. One cell in a spreadsheet (which held the costs for electrical work) was not included in the spreadsheet formula that calculated total cost.

Bad math, transposition errors, and "fat finger" errors run rampant in companies of all sizes. Almost 90 percent of all spreadsheets have errors. Even the most carefully developed, tried, and tested spreadsheets have errors in 1 percent of all formula cells. In larger spreadsheets with thousands of formulas (that, let's face it, exist in every company), there are dozens of errors.



12 of the Biggest Spreadsheet Fails in History | Oracle SMB Blog



incisive.com/spreadsheet-error-horror-stories

The problems arising from the use of Excel to make estimates, perform the take-off, or any other part of the cost management process in a construction project are added to the problems common to other sectors:

- The obstacles to communication between the different actors involved
- The difficulty in analysing, auditing, and working with data
- The impossibility of reusing, referencing, and controlling information

Excel is an exceptional creator of computer science *immersed* in organizations, that is, of isolated silos of knowledge, turning construction technicians into low-level computer technicians dedicated to reinventing the wheel.

Excel is not a database

Excel is an extraordinary tool for its intended use: the realization of numerical calculations in rows and columns and the visualization of data or results, with very efficient graphic resources.

However, Excel is not a database: values can be entered without a defined structure, and relationships are created *a posteriori*. Cells and ranges can have a name, but data is not usually linked to them, but is based on changing references, such as row and column.

On the other hand, databases can be shared and understood by the different agents involved, since the structure of tables and fields is prior to the introduction of the data. In addition, databases that meet the relational model are formal and unique descriptions of the model they stand for.

When using Excel, all priority is given to the estimate calculation aspects, which are trivial, rather than concentrating on the content of the information, which is much more important.

Excel is not ready for the digital environment

The information in an Excel sheet, although it can be understood by a human operator who studies it on a case-by-case basis, cannot be processed in a generalized way in a digital environment. A project involving numerous agents, with hundreds or thousands of data, requires a structured information system, in which digital systems can interact with each other independently of human operators.

The difficulty in exchanging information is clear and no Excel document is free of this problem. No matter how strict the set of procedures established for the introduction and formatting of information is and the rigidity applied to follow them, Excel is not designed for sharing.

Examples taken from construction estimates

Codification

Lack of coding or the use of incorrect or improvised coding is not a problem specific to Excel, but Excel stimulates it, as it does not require a reference system between concepts.

When chapters are separated into Excel sheets, they may be comfortable for human readers, but do not serve when the information must be processed by another computer; for this, a hierarchical list structure is a much better solution.

For the trades, international standards are usually applied, but in the work units Excel users tend to improvise encodings, based on the position, such as letters ("A", "B"...) or decimal numbering (1.1, 1.2...). These systems prevent fixed references between project elements. For example, you cannot add a new item without changing the encoding of existing items.

	MEMBRANE WATERPROOFING	
	Waterproof membranes applied to below ground structures	
	FLUID APPLIED WATERPROOFING	
a	Cold applied fluid waterproofing to various areas	
b	PLASTIC VAPOUR BARRIER	
c	Polythene membrane layer:	

Encoding error

I	Suspended slab - 350mm thick	961	m3	
J	Ramp slab - 350mm thick	910	m3	
K	Suspended slab - 350mm thick	961	m3	

Incorrect coding makes it difficult to know if there is an error in work units "I" and "K".

In the following example, when the list of work units is longer than a physical page, the encoding from "A" is restarted again, making it even more difficult to refer to the work unit, since there may be several "A" work units in the same chapter.

	<u>DIVISION - 3 : CONCRETE (Cont'd)</u>			
	<u>SUPERSTRUCTURE</u>			
	<u>Reinforced vibrated concrete 400 kg/cm² with ASTM C-150 type-1 cement, including reinforcement, formwork, expansion & contraction joints, etc. all complete and all as required. (All exposed faces of the concrete elements shall be fair face finish)</u>			
A	Beams	61,238	m3	

Division 3, page 1

	<u>DIVISION - 3 : CONCRETE (Cont'd)</u>			
	<u>SUPERSTRUCTURE</u>			
A	Staircases complete	2,635	m3	

Division 3, page 2

Text

Excel is not a database, and neither is it a word processor. As long texts are difficult to manage and display in Excel, they are usually written using different cells for each line, which complicates the automatic export to other information systems. Excel also has no resources to properly format texts, such as hyphens or tabs.

	<u>Reinforced concrete - Sulphate resisting; include</u>	
	<u>all formwork, reinforcement etc.; as specified</u>	

Text in separate cells

Common mistakes and *ad-hoc* design

Most Excel sheets are only understood by a single person, the one who designed it, and usually have data or auxiliary expressions that deliberately fall outside the general and visible structure of the sheet; when another user tries to use or change the data, this hidden information leads to all sorts of errors.

Even experienced users sometimes enter lines that are mistakenly left unaffected by the necessary expressions, such as cells that fall outside a sum per range.

LS	11.895,820	11.895,820	11.955,600
LS	196.795,080	196.795,080	197.784,000
LS	3.365,590	3.365,590	3.382,500
LS	619.060,050	619.060,050	622.170,900

Personal colour codes and calculations outside the structure

Encryptions, exceptions, and personalized behaviours, which have minor impact when data is processed by people, are dangerous when the information must be processed by digital systems.

The difficulty of interpretation

Many Excel documents are designed to make it easier to read human and print on paper, not to analyse the data. However, in the digital age, summary or simplified definitions are no longer necessary; the size of the information is not important, if it is easy to filter the data that is always needed.

Let us look at the following example:

<u>DIVISION - 3 - CONCRETE</u>			
<u>03 10 00, 03 20 00, 03 30 00 - CONCRETE FORM WORK, REINFORCEMENT, ACCESSORIES, CAST IN-PLACE CONCRETE & FINISHES</u>			
<u>SUBSTRUCTURE (with sulfate resisting cement)</u> <u>Foundation & related works up to and including GF slab</u>			
<u>Plain concrete (140 Kg/cm²) with Sulphate resisting cement type V including formworks, additives etc. complete.</u>			
A	Blinding bed 70 mm thick	240,500	m2
Cement and Sand (1:4) with sulphate resisting cement type V			
B	50 mm thick cement & sand screed over waterproofing membrane on horizontal surfaces	263,400	m2
<u>Reinforced vibrated concrete (400 KG/cm²) with ASTM C-150 type V cement including formwork, reinforcement, water stops, expansion & construction joints, filler, additives, etc. complete as described.</u>			
C	Raft slab - 2000 mm thick	97,500	m3
D	Raft slab - 1500 mm thick	261,740	m3
E	Thickening below raft	101,440	m3
<u>Suspended Slab</u>			
F	Suspended slab - 400mm thick	2,200	m3
<u>Ditto - but concrete strength 550 kg/cm²</u>			
G	Columns necks	149	m3
H	Circular neck columns	639	m3

Formally digital document that needs human interpretation

To understand the meaning of the line "G: Columns necks", one must analyse the upper lines carefully. First, you must realize that it is a variant of an earlier work unit, with different strength. But it does not refer to the underlined line immediately above, but to the one above it ("F: Suspended slab"). In turn, the text is taken from the cells before the "C" line, where it says, "Reinforced vibrated concrete...". But this text is not enough; the human reader must deduce that this concrete needs sulfate-resistant cement, as shown in the text beginning with "SUBSTRUCTURE".

No computer program can reconstruct this reasoning.

In a digital environment, the right text for this unit of work would be:

"Columns necks. SUBSTRUCTURE (with sulfate resisting cement). Reinforced vibrated concrete (550 KG/cm²) with ASTM C-150 type V cement including formwork, reinforcement, water stops, expansion & construction joints, filler, additives etc. complete as described."

The following item has the same text, except for the difference: "Circular neck columns...".

Other Excel Difficulties

Difficulty visualizing important or complex information

- The resources of hiding rows and columns, and drop-down levels, not always understood by casual users, are not sufficient to visualize the hierarchical and complex information of construction projects.
- Data in tabs cannot be viewed together and cannot be easily exploited.
- If the sheet has long texts or measurements, the amount of information prevents you from selecting the data that needs to be viewed at a given time.

Impossibility of n-dimensional analysis

Excel is not a two-dimensional information system, since the first dimension, the lines, is occupied with the list of concepts, so there is only another one, the columns, to visualize the different data or values of the concept.

In a construction project, information requires a matrix structure of two or more dimensions: on the one hand, trades, contracts, or packages, on the other hand, functional spaces, zones, or subsystems. If trades, such as chapters or CSI divisions, are used for the main dimension, the information for the second dimension is difficult to extract from the same Excel document.

Adding a third one a temporal dimension, periodizing the data throughout the execution of the project, further complicates the information system.

Presto

Any specialized information system in the construction sector treats the problems mentioned above with different solutions.

Presto has powerful resources:

- Multidimensional information (operations, activities, calendar, approval statuses, building agents, etc...).
- A fixed data structure for each agent, with a very flexible visualization
- Free coding, but mandatory

In addition, Presto supports many other specific options, which make it an economical model of a construction project, very complete, but at the same time easy to understand and apply.

Excel2Presto

Converting Excel price tables and quotes into Presto works can be easily done using Excel2Presto, an Excel add-in that recognizes the data in rows and columns and generates the estimate to continue the work in Presto in the most effective way.

The screenshot shows a complex Excel spreadsheet with multiple columns and rows. A large 'Pagina 1' watermark is visible in the center. The spreadsheet appears to be a detailed cost breakdown for a project, with various sub-items and their associated costs.

Estimate in Excel with fields outside the visible sheet

Código	NaC	le	Resumen	CanPres Ud	Pres	ImpPres
1/0	0	1	0		0	0
2/1	1	1	Contenedor	1	4.499,732,74	4.499,732,74
3/1	2	2	Áreas interiores	1	1.424.667,41	1.424.667,41
4/2	2	2	Oficinas	1	285.945,38	285.945,38
5/2	2	2	Compartimentación Mampara según planos (medida hasta 2,5m)	445,77 m2	108,18	48.222,45
6/2	2	2	Albanelería zonas comunes	218,55 m2	50,00	10.927,50
7/2	2	2	Solados Linóleo (80% del total de solados)		71,00	0,00
8/2	2	2	Linóleo (40% del total de solados)		41,32	0,00
9/2	2	2	Suelo Técnico + moqueta (BMW carpet)	495,98 m2	88,65	44.067,82
10/2	2	2	Suelo Técnico acabado Linóleo (suelos, cocinas...)		71,00	0,00
11/2	2	2	Gres tipo TAU Ref. NICE TT 440 L 40°40°9° Precio base material 8,96 €/m2	172,98 m2	38,83	6.716,81
12/2	2	2	Gres tipo TAU Ref. NICE TT 440 L 30°30°13° Precio base material 13,4 €/m2		44,25	0,00
13/2	2	2	Techo falso techo tipo Armstrong (Alas y Ciclos)	63,82 m2	29,00	1.850,78
14/2	2	2	Revestimientos Entabaco y pintura s/ tabiquería	786,81 m2	18,52	14.566,40
15/2	2	2	Alicatsados	47,41	28,00	1.327,48
16/2	2	2	Capitaneos interior Aluminio	1.00 PA	2.000,00	2.000,00
17/2	2	2	Instalaciones eléctricas Estándar oficinas	668,96 m2	51,69	34.578,54
18/2	2	2	Detección y extinción de incendios Estándar oficinas	668,96 m2	18,63	12.462,72
19/2	2	2	Seguridad y voz datos Estándar oficinas	668,96 m2	13,22	8.843,05
20/2	2	2	Fortalezas Estándar oficinas	668,96 m2	14,42	9.656,40
21/2	2	2	Climatización y extracción Climatización y renovación. Roof-Top bomba calor	668,96 m2	96,17	64.333,88
22/2	2	2	Exposición de VIN, Recep. Directa y z. Comunes	1,00	161.111,80	161.111,80
23/2	2	2	Talleres de Coches y Motociclos (1.120 m2 Fase II acabado mínimos almaceas)	1,00	189.436,21	189.436,21
24/2	2	2	Revestidos	1,00	6.898,81	6.898,81
24.1	2	2	Compartimentación No especificado (testimio bloque de hormigón)	121,60 m2	50,00	6.080,00
25/2	2	2	Zona empalmados (cortina, botiquin, cocina, aseos y vestuarios)	1,00		
26/2	2	2	Zona Inst. y huecos escaleras	1,00		
26/2	2	2	Generes s/ instalaciones rampas	1,00		
27/1	3	3	Zonas exteriores	1		

The same estimate imported with Excel2Presto

Two-way communication between Presto and Excel

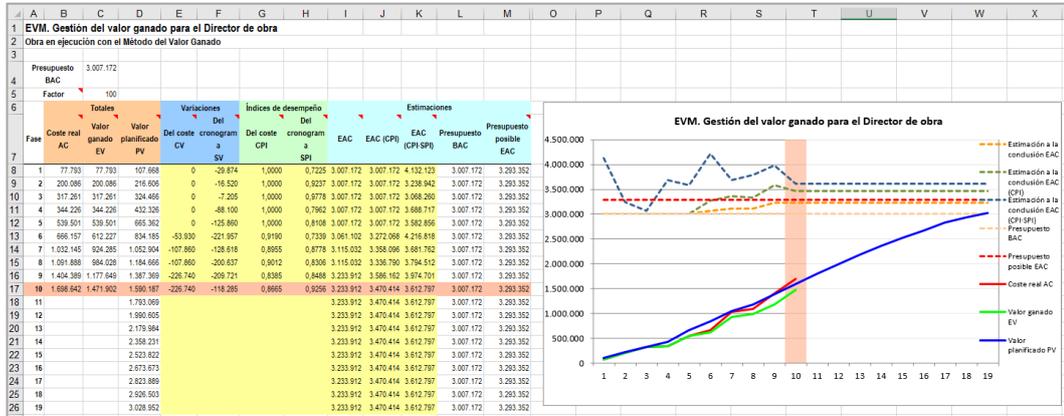
Presto has other Excel import options, for example, for the comparison of offers and other possibilities to successfully take advantage of the potential of Excel.

- Direct export to Excel of any Presto table or table range, including formulas, colours, and formats.

	A	B	C	D	E	F	G
	Código	le	Resumen	CanPres Ud	Pres	ImpPres	
3	0	eE	Presupuesto de vivienda unifamiliar obtenido de Revit		1	419.211,90	419.251,99
4	E02	eE	ACONDICIONAMIENTO DEL TERRENO		1	25.775,26	25.775,26
5	E04	eE	CIMENTACIONES		1	11.244,82	11.244,82
6	E04EAM010	eE	HORMIGÓN ARMADO CIMENT. ENCEPADO HA-25/B/20/11a VERT. MANUAL	1,21 m3	211,38	255,77	
7	E04LA1a0b	eE	LOSA CIMENTACIÓN HORM. ARM. HA-25/B/20/11a - 50 kg/m3 VERT. GRÚA	18,51 m3	165,89	3.070,62	
8	E04PI010	eE	PILOTE ENTUBACIÓN PERDIDA (CPI-S) D=550 mm HA-25/F/20/11a	67,65 m	117,05	7.918,43	
9	E05	eE	ESTRUCTURAS		1	21.299,16	21.299,36
10	E05AA7010	eE	PILAR PERFIL TUBULAR CUADRADO RHS 250x12 mm	9,00 m	158,57	1.427,13	
11	E05HL1bcb	eE	LOSA PLANA HORM. ARM. HA-25/B/20/11a - 80 kg/m3 e=20 cm VERT. GRÚA	126,00 m2	56,06	7.063,56	
12	E05HL1cbb	eE	LOSA PLANA HORM. ARM. HA-25/B/20/11a - 80 kg/m3 e=25 cm VERT. BOMBA	96,25 m2	69,54	6.693,23	
13	E05HL1ebc	eE	LOSA PLANA HORM. ARM. HA-25/B/20/11a - 80 kg/m3 e=35 cm VERT. BOMBA	38,46 m2	91,91	3.534,86	
14	E05HS8abc	eE	HORM. ARM. HA-25/B/20/11a PILAR CIRCULAR h<4 m D=400 mm ENCOF. LISO VISO - 100 kg/m3 VERT. GRÚA	4,10 m3	564,92	2.316,17	
15	E05PE090	eE	ESCALERA HORMIGÓN ARMADO TIPO C SIN ANGULAR PELDAÑEADA Y MESETA COMPENSADA	1,00 u	921,54	921,54	
16	E05PE090	eE	ESCALERA HORMIGÓN ARMADO TRAMO RECTO SIN ANGULAR PELDAÑEADA	2,00 u	718,77	1.437,54	
17	E05PM030	eE	MURO HORMIGÓN ARMADO AUTOPORTANTE e=35 cm h=6 m	9,91 m2	112,90	1.118,84	
18	E05PM060	eE	MURO SEMIPREFABRICADO DOBLE PARED e=30 cm h=3 m	31,33 m2	88,94	2.785,49	
19	E06	eE	PIEDRA NATURAL		1	4.095,22	4.095,22
20	E07	eE	CERRAMIENTOS Y DIVISIONES		1	139.214,99	139.214,99
21	E08	eE	REVESTIMIENTOS Y FALSOS TECHOS		1	23.041,08	23.041,28
22	E09	eE	CUBIERTAS		1	12.817,86	12.817,86

- If the export is on existing sheets, the cells with formulas and predefined graphs will be applied on the exported cells, so that Excel acts as an extension of Presto

to take advantage of all the estimate information and generate new results, as in the following example of Earned Value graphs.



- Support for Presto expressions in Excel sheets that have access to all estimate data and are automatically filled, for example, to generate a custom summary or certification sheet.

	A	B	C	D
1		Presupuesto de vivienda unifamiliar obtenido de Revit		
2		Samuel Macalister sample house design		
3		RESUMEN GENERAL DEL PRESUPUESTO		
4	E02	ACONDICIONAMIENTO DEL TERRENO	6,15%	25.775,26
5	E04	CIMENTACIONES	2,68%	11.244,82
6	E05	ESTRUCTURAS	6,51%	27.299,36
7	E06	PIEDRA NATURAL	0,98%	4.095,22
17	E17	ELECTRICIDAD Y DOMÓTICA	19,21%	80.539,32
18	E18	ILUMINACIÓN	1,33%	5.596,08
19	E20	FONTANERÍA	0,41%	1.702,30
20	E21	APARATOS SANITARIOS	0,60%	2.501,18
21	E22	CALEFACCIÓN Y A.C.S.	1,00%	4.192,27
22	E27	PINTURAS Y TRATAMIENTOS ESPECÍFICOS	0,74%	3.084,45
23	E30	EQUIPAMIENTO	2,65%	11.129,63
24	U13	TRATAMIENTO DE PARQUES Y JARDINES	0,29%	1.219,36
26		PRESUPUESTO DE EJECUCIÓN MATERIAL		419.251,99
27		Gastos generales	0,00%	0,00
28		Beneficio industrial	0,00%	0,00
29		Suma		419.251,99
30		IVA	21,00%	88.042,92
31		PRESUPUESTO BASE DE LICITACIÓN		507.294,91
32				
33		HONORARIOS PROYECTO	8,00%	33.540,16
34		Suma		#REF!
35		IVA	21,00%	#REF!
36				#REF!
37		HONORARIOS DIRECCIÓN DE OBRA	3,5 %	14.673,82
38		Suma		#REF!
39		IVA	21,00%	#REF!
40				#REF!
41	A	HONORARIOS DE PROYECTO Y DIRECCIÓN		#REF!
42				
43		DIRECCIÓN DE EJECUCIÓN	3,5 %	14.673,82
44		Suma		#REF!
45		IVA	21,00%	#REF!
46	B	HONORARIOS DE DIRECCIÓN DE EJECUCIÓN		#REF!
47				
48	Z = A + B	HONORARIOS		#REF!
49				
50	3 = 1 + 2	PRESUPUESTO LÍQUIDO		#REF!
51				
52				
53		Madrid	3 abril	2021
54		Samuel Macalister		
55				

Two-way communication allows you to use each program within its most effective scope, in the same way that Presto information is integrated with other Microsoft Office tools, such as Word and Project, and many other programs.