

FAST Modeling Standard

Practical, structured design rules for financial modeling

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Welcome to the Fast Modeling Standard

Welcome to the FAST Modeling Standard, a set of rules on the structure and detailed design of spreadsheet-based **models**. This standard set of rules provides both a clear route to good model design for the individual modeler, and a common style platform on which modelers and reviewers can rely when passing models amongst themselves. See How Rules are Organized, page 7, for a discussion on how these rules are organized and numbered.

The FAST Philosophy

The FAST Modeling Standard is published openly and regularly revised by the moderators of the FAST Modeling Alliance. The **Signatories** to the FAST Modeling Standard believe financial models must be **as simple as possible, but no simpler**. Any model that is unnecessarily complicated is not good. Without simplicity supported by rigorous structure a financial model will be poorly suited to its sole purpose – supporting informed business decisions.

The Standard advocates a philosophy of good financial model design rules founded on the acronym **FAST**: flexible, accurate, structured, and transparent. It advocates transparent model structure and clear, crisp modeling style. See section The Fast Acronym below for details on each of these fundamental design priorities.

The Standard has been developed from the experience of industry practitioners who have learned simple techniques to replace overly-clever ‘good ideas’ that proved bad in practice over time. It documents a skilled craft that is functional within the realities of the business environment. As a minimum objective, models must be free of fundamental omissions and logical errors, and this outcome must be achieved under short lead times. However, a good model must achieve more than this minimum standard. It must be easily used and reviewed by others and readily adaptable as circumstances change.

The FAST Modeling Standard speaks predominantly about outcomes, i.e what the final model should look like. It dwells little on the tradecraft of executing spreadsheet models, with specifics related to Microsoft Excel-based execution. For instance, it does

not detail the use of recommended Excel keystrokes or so-called shortcut keys – vastly superior to using a mouse in almost all circumstances – on which the FAST Modeling Standard relies.

However, no set of design rules can be entirely divorced from the manufacturing environment in which the product must be built. Many of the design rules are expressly recommended because of the strengths and weaknesses of the Microsoft Excel modeling environment, providing designs that take advantage of the environment's strengths and mitigating its weaknesses. Recommending design that takes advantage of efficient and error-reducing construction techniques is one of the prime objectives of The FAST Modeling Standard.

Finally, The FAST Modeling Standard presumes the reader has a good understanding of Excel; this is not a 'how to' document, but a professional Standard supported by expert modelers.

The FAST Acronym

Flexible Model design and modeling techniques must allow models to be both flexible in the immediate term and adaptable in the longer term. Models must allow users to run scenarios and sensitivities and make modifications over an extended period as new information becomes available -- even by different modelers. A flexible model is not an all-singing, all-dancing template model with an option switch for every eventuality. Flexibility is born of simplicity.

Accurate Models must reflect key business assumptions directly and faithfully without being over-built or cluttered with unnecessary detail. The modeler must not lose sight of what a model is: **a good representation of reality, not reality itself**. Spurious precision is distracting, verging on dangerous, particularly when it is unbalanced. For example, over-specifying tax assumptions may lead to an expectation that all elements of the model are equally certain and, for example, lead to a false impression, if the revenue forecast is essentially guesswork. An overly precise base case only serves to drown analytically more important scenario-based risk

analysis and likely ensure the model is incapable of conducting Monte Carlo analyses practically.

Structured Rigorous consistency in model layout and organization is essential to retain a model's logical integrity over time, particularly as a model's author may change. A consistent approach to structuring workbooks, worksheets and formulas saves time when building, learning, or maintaining the model.

Transparent Models must rely on simple, clear formulas that can be understood by other modelers and non-modelers alike. Confidence in a financial model's integrity can only be assured with clarity of logic structure and layout. Many recommendations that enhance transparency also increase the flexibility of the model to be adapted over time and make it more easily reviewed.

Fundamental to supporting each of these aims is the root definition of the term **analysis** – the concept of 'breaking things up'. This theme must be applied at different levels of Model design: tactically in forming short, simple formulas; functionally to separate timing, escalation, and monetary calculations; and structurally at the level of worksheet purpose.

How Rules are Organized

Nearly all modeling design decisions are objectively good or bad; a minority of modeling alternatives are simply one modeler's preferred approach over another. Hence The FAST Modeling Standard is fundamentally organized around a set of rules – dos and don'ts

Rules are meant to be broken. However, such pragmatic behavior does not render the rule book useless. Breaking rules must be a conscious decision made with justification. Inexperienced modelers will know they are on 'thin ice' when breaking rules and will learn from experience when they have regretted rule-breaking in the past. The Standard lists exceptions where breaking rules may be advisable.

Analogies between good modeling and good writing standards are legion, and this extends to the means of organizing this specification: what works for the budding author works for the financial modeler. For a writing method, an experienced author

would first counsel on how to organize the book into chapters, then drill into advice on structuring individual chapters into sections and paragraphs, and finally details on good sentence structure (including word choice).

In this spirit, the FAST Modeling Standard organizes its rules on good model design into four main chapters:

1. The **workbook** is analogous to the author's overall subject. Workbook rules are concerned with how the subject should be divided up, its chapters, and the logical order and organization of the overall model. The rules that relate to this level are collected in section Chapter 1: Workbook Design, page 11.
2. A **worksheet** is similar to a chapter in a book. Worksheet rules are concerned with design layout, including column usage and breaking the chapter's subject into 'sections' and 'paragraphs'. The rules for how to organize the worksheet are collected in Chapter 2: Worksheet Design, page 17.
3. The **line item** is analogous to a specific sentence. Line items should have clear labels, clear unit designation, and their formulas should be short, simple, direct, and readily understood. The rules that relate to line items are collected in Chapter 3: The Line Item, page 27.
4. **Microsoft Excel** is the tool used to create the model analogous to word processing software. Excel has numerous features that can be applied in modeling. Rules governing which features are good, which are bad, and which can be used, but with caution are listed in Chapter 4: Excel Features Used in Modeling, page 39.

A Living Document

The Standard is an evolving document and discussion on points of the Standard are ongoing. You can join in the discussion on the FAST Modeling Alliance website: <http://www.FASTstandard.org/>

The FAST website is being updated to accompany the new published Standard. You can sign up at <http://www.FASTstandard.org/> to be informed when the new site is available and the revised Standard has been published.

Following the recommendations of the FAST Modeling Standard moderators, this document is saved to a new version every time a major update is performed. The first version of the document is FAST01a, incrementing from a to z before reaching 02.

When a discussion has come to a conclusion, or a temporary agreement, the conclusions are added to the Standards document as rules and exceptions. A new version of the document is issued every three months, or when there are several new rules to add to it, or significant changes to make to the existing standard.

Document Conventions

The Standard is divided into chapters and sections; each section holds a number of rules. Rules are numbered according to the section:

FAST SECTIONNUMBER-RULENUMBER

For example, **FAST 1.01-2**

Exceptions to the main rules are expressed as sub-rules:

FAST-SECTIONNUMBER-RULENUMBER.n

For example, **FAST 1.10-2.1**

Exceptions are listed immediately after rules and are indented.

Rules are, for the most part, prescriptive and use prescriptive language: do not, always, never. When a rule is suggestive, less strong language is used: avoid, should.

A list of defined terms can be found in FAST Terminology, page 45. Defined terms are bold and blue: "good modeling practice begins at the **workbook** level".

Where keyboard shortcuts are referred to, they are expressed in one of two ways:

- Key sequences, where keys are pressed one after the other, are expressed with commas (,) separating the keys: F5, ENTER
- Key combinations, where the keys are pressed at the same time, are shown with the keys separated by plus (+) signs: CTRL + SHIFT + J

Throughout, the Microsoft style for referring to keys is used, so, for example, all keys in a sequence or combination are listed and the letters are always shown in capitals, as they are printed on the keyboard.

Additional Learning Resources



Many of the rules in this document has further discussion or illustration on the FAST Modeling Alliance website. Rules that have online video tutorials associated with them are marked with a “video tutorial” icon in the outer margin, like this.

The FAST website is being updated to accompany the new published Standard. You can sign up at <http://www.FASTstandard.org/> to be informed when the new site is available and the revised Standard has been published.

If you want to see a video tutorial for a rule that does not currently have one, go to the FAST Modeling Alliance website and let us know: www.FASTstandard.org/

Chapter 1: Workbook Design

Good modeling practice begins with an explicit and purposeful structure applied with consistent discipline at the **workbook** level. The high-level layout of a **model** must reflect the requirements of two fundamentally different groups of interested parties. To borrow on the automotive analogy, financial model design must cater to both drivers (users of financial models) and mechanics (modelers).

1.01 General Workbook Design Principles

The rules in this section apply generally to **workbook** design and/or all **worksheets** in a **model**.

FAST 1.01-01 Separate worksheets by type: Foundation, Workings, Presentation, and Control

Following on from the principles of good automotive design, **worksheets** within a **model** should be grouped within the following four functional classes:

1. **Foundation**, including sheets for inputs, timing flags, indexation factors: the model's chassis or main underpinnings. In adapting a model, re-designing elements of the foundation, particular time structure, are the most hazardous operations;
2. **Workings**, i.e. the build-ups of calculations leading to presented results: the model's 'engine';
3. **Presentation**, including financial statements, charts, primary commercial inputs, and summary results: the model's dashboard and primary showroom selling points.
4. **Control**, e.g. check sheets, control of sensitivities and scenarios, change-tracking, list of pending changes, version control, and table of contents: the model's main control devices and engine status indicators.

Each of these functional groups has a different audience (model driver vs. model mechanic) and hence a different design priority.

An issue that arises in the preceding analysis that often causes design challenge and confusion is the dual role of **inputs**: on the one hand foundation and on the other presentation and/or control. Where should they be placed? Input organization is an important design choice; the pros and cons of different approaches should be considered carefully. Should Input sheets ever have calculations? Should inputs ever be located on Workings sheets?

Design specifics for each of family of worksheet are presented in the relevant sections in Chapter 2: Worksheet Design:

- input sheets are described in section 2.04, page 23,
- presentation sheets are described in section 2.05, page 24, and
- control sheets are described in section 2.06, page 26.

FAST 1.01-02 Maintain consistent column structure across all sheets

Set-up a standard column definition and apply this across all sheets if at all possible, even if this causes a requirement for 'extra', unused columns on some sheets. For instance, the column used for labels, **constants**, units, and first column of given time series can usually be conformed across all sheets in a model.

FAST 1.01-03 Maintain a consistent **time ruler throughout the **model******FAST-1.01-03.1 except when multiple time resolutions are required**

Presuming the model can be designed with a consistent time resolution throughout (e.g. monthly, quarterly, annual), each **worksheet** in the model should have an identical time axis. This means each worksheet uses the same column for the start of the time ruler and each time ruler should run to the same length, even if this means that some worksheets have unused columns.

Inconsistent time rulers in different parts of the model cause confusion; keeping the time ruler as consistent as possible vastly improves readability and reduces possibility that serious errors are missed during the review process.

FAST 1.01-04 Ensure primary **time rulers span time frames of secondary rulers**

In some circumstances, a **model** may require different time resolutions and hence different time rulers with a different timing frequency, for example a 'secondary',



monthly resolution construction period followed by a 'primary' quarterly operations period.

In these cases, ensure that the primary time ruler encompasses the higher-resolution time period such that summarization of data from both periods can be effected more easily.

FAST 1.01-05 Proliferate [links](#) to maximize navigation efficiency

Repeated links in the [model](#) have the dual benefit of increasing formula comprehension by co-locating ingredients, more formally known as precedents, alongside the formula itself, within a single [calculation block](#). This is one of the cornerstones of the FAST Standard as it is a singularly effective means of increasing the transparency of a financial model.

Links have the additional benefit of increasing navigational efficiency within a model. The inbuilt CTRL + [keyboard shortcut will go straight to the source of a link, where there is a single link in the reference. F5, ENTER returns to the original link location. This greatly increases ease of review of the model user within a given calculation block and increases navigational efficiency throughout the model.

Note: for users of non Qwerty keyboards, CTRL + [will not work. The standard FAST Format Macros book contains a work around for those keyboards, with alternative keystrokes assigned to SHIFT + CTRL + J to following the link, and SHIFT + CTRL + K returning from a followed link.

As stated in FAST 3.06-02: Do not create daisy chains; do not link to links, page 37, all links should point back to the original source calculation and should never be [daisy chained](#). Daisy chained links impair the navigational effectiveness of links by requiring the user for following multiple steps to locate the original calculation, and by destroying the efficient 'return' operation possible with F5, ENTER.

FAST 1.01-06 Mark [exports](#) with red font and [imports](#) with blue font

While the Standard does not attach any philosophical importance to the choice of colours per se, one of the intentions of the Standard is to engender a shared language of modelling across practitioners. There is a case therefore for all users of the Standard adhering to the same colour convention for [imports](#) and [exports](#), simply to reduce the



incremental effort required to decode a model where the Standard convention has not been followed. Normally the argument for not following the Standard convention comes down to personal preference on the part of the modeler, which, as aesthetically sensitive as they individual may be, is outweighed by the industry network-effect of shared communication protocols.

FAST 1.01-07 Calculate only once

A given **calculation** should appear only once in a model. While this may sound obvious, it is often violated in practice. Even if it is simple to do otherwise, ensure that subsequent requirements to display or use a set of figures are created by a direct **link** back to the **source** calculation, not by repeating a calculation. (The rationale for this principle is similar to the rationale that an input assumption must appear only once in a model.)



FAST 1.01-08 Use normally positive convention on Workings sheets

The normally positive convention sees all figures in a model as positive and the direction of the value – whether it is coming in or going out – is suggested by the label. Positive labels such as revenues and receipts indicate that something is coming in and negative labels such as expenses and expenditure indicate that something is going out.



FAST 1.01-09 Use in-flow / out-flow convention on Presentation sheets

Flows can be of two types, either an inflow or an outflow. A clear distinction should be made between the two. In order to comply with user expectation and thereby enhance model readability, inflows should be represented as a positive value and outflows should be represented as a negative value. This is the inflow / outflow convention.

FAST 1.01-10 Do not overuse macros

Consensus position being developed for subsequent draft.

FAST 1.01-11 Never release a model with purposeful use of circularity

Circularity is Excel's in-built capacity to iterate to a solution. Test for lack of convergence, for example insufficient debt commitments, rather than setting up model to converge automatically; this often reflects commercial reality anyway. Circular

models inevitably suffer from the modeler being blinded by precision over the principle of accuracy.

1.02 Sheet Organization

FAST 1.02-01 Arrange sheets so that calculation order flows left to right

FAST-1.02-01.1 except to group Input and Results sheets

The rationale for this is to improve general readability and detection of inadvertent logical circularities, **not** calculation speed. Necessary deviations (**counter-flows**) to this 'thinking order' should be:

1. kept to an absolute minimum, and
2. clearly marked when not otherwise obvious.

However, grouping Input and Results sheets at the front of a **model** can assist readability and comprehension.

FAST 1.02-02 Do not attempt to optimize calculation layout and user interface / presentation on the same worksheet

There is almost always a trade-off between design layouts that are optimized for clarity of calculation and those that are optimized for user interface and presentation. Separate these objectives between Calculation and Presentation sheets to prevent a Model design that is poor on both fronts.

Workings sheets need not (and probably should not) look 'pretty' or be particularly printable, certainly *in toto*, particularly if this increases construction and maintenance time to sustain appearances that serve no fundamental benefit to the modeler or the user.

FAST 1.02-03 Separate flags and factors onto dedicated sheets

The foundation of any financial model is laid down by the time sheet which defines the time line of the model. Time sheets should contain all flags and partial period factors (PPFs). If timing logic is simple, then **indexation factors** may be included with this logic on 'timing and escalation' sheets, often labeled T&E sheets.

FAST 1.02-04 Separate **Workings sheets** into functional 'chapters'

Workings sheets should be functionally sub-divided, for example revenues, costs, financing, tax, accounting and so called "**one-sheet wonders**" should be avoided.

FAST 1.02-05 Minimize inter-linking between sheets

Organizing calculations across **worksheets** in a **workbook** should, in part, also be driven by an effort to minimize Exports and Imports. High density of sheet inter-linkages is a sign of poor allocation of logic to specific worksheets. To use the writing analogy, the chapters are not organized with a sufficient degree of autonomy.

1.03 Multiple Workbook Models

FAST 1.03-01 Do not split a **model** across multiple **workbooks**

FAST-1.03-01.1 except when more than one modeler must work concurrently

FAST-1.03-01.2 except when different files should be sent to different recipients

FAST-1.03-01.3 except when a single workbook would be too large and intimidating

Multiple, inter-linked workbooks are usually difficult to manage and generally a bad idea. However, the particular circumstances of a modeling project may sometimes dictate a so-called 'split model'. Where timescales necessitate parallel model development by multiple modelers, where different recipients should receive different workbooks for considerations of confidentiality or specialty, e.g. a technical recipient not being confused by financing and tax logic, or where, despite the best efforts of heeding the principle of approximation, a single file would be intimidating and unwieldy simply for its size.

FAST 1.03-02 Avoid direct (external file) **links**

FAST-1.03-02.1 except when the logic flows back and forth between **workbooks**

It is generally simpler and easier to manage the manual interchange of data through dedicated import and export areas of respective inter-linked workbooks. However, direct links should be used when workbook A passes calculated values to workbook B, which in turn uses these values to calculate dependent values passed back to

workbook A. However, such circumstances should call into question the decision to split the model.

FAST 1.03-03 Use import / export sheets for [line items](#) passed between [workbooks](#)

Data should be organized into a single 'exported data' sheet in the one file and an 'imported data' sheet in the second. Even if direct [links](#) are used, these are functionally similar to [inputs](#), albeit potentially refreshed to different values via recalculations, and hence should be separated and organized with a similar approach.

FAST 1.03-04 External file [links](#) should be Named

If a model relies on links to external files, these should be named in the source file. In the absence of a call reference in an external file being named, Excel will be unable to keep track of any changes in the location of that cell in the external file.

In most instances, the FAST Modeling Standard advises against using Names, as stated in FAST 4.03-01: Do not use Excel Names, page 42. This is a notable exception to that rule.

Chapter 2: Worksheet Design

2.01 Universal Design Layout Principles

FAST 2.01-01 Each column should have a single and consistent purpose

Constants (for example IRRs) should be clearly separated from **series line items**. Further requirements to provide section heading indenting, **display totals**, units, and an empty column to represent the period before modeling begins, should be placed in dedicated columns of appropriate width, a width that should be identical across all sheets in the model.

Exclusive use of a given column for a specific purpose not only improves clarity and structure, but can yield additional advantages. For instance, navigating through column A (say) for main section headings is facilitated with CTRL+ UP ARROW / DOWN ARROW when this column is not cluttered with other data. A separate units column causes the question of units to be begged, never a bad thing.

FAST 2.01-02 **Series worksheets** should be defined for a single **time axis** only

FAST-2.01-02.1 except series inputs sheets to avoid too many sheets

FAST-2.01-02.2 except where local exceptions warranted

Including more than one time axis on a given **sheet** must be carefully considered with reference to the four FAST principles. Making life easier on the modeler is insufficient justification. Every sheet should have a dominant time axis located within the freeze pane intersection for consistent viewability. Any other time axis used on the sheet should be clearly marked as an 'alien' time axis.

The standard formatting for 'alien' time axes will be described in Appendix A: FAST Formatting, page 43, in later version of this document.

FAST 2.01-03 Make only two columns matter

On the presumption that a series **line item** will be constructed via consistent formulas across the row, the requirement for **model** review is limited to confirming only that the

first cell in the range is logically sensible. Therefore, only the constants column and the first series column tell the story.

FAST 2.01-04 Calculation logic should generally flow from top to bottom and left to right

This helps ensure logical flow and consistency of reading / calculation order.

FAST 2.01-05 Mark intra-sheet counter-flows with gray shade

Keeping with the 'reading order equals calculation order' design approach, logic should flow top-to-bottom on a given sheet, with necessary exceptions to this (**counter-flows**) kept to a minimum and clearly marked.

FAST 2.01-06 Limit counter-flows to opening balance positions

Although it is often impossible to avoid counter-flows, having too many in a given section may be a sign that **calculation** section ordering may need to be considered.

Counter-flowing opening balance positions is generally considered benign since the opening balance is always linked to the previous period closing balance, so it is an indirect link to a previous period balance and thus in keeping with the 'left to right, top to bottom' rule (FAST 2.01-04: Calculation logic should generally flow from top to bottom and left to right, above).

Counter-flowing closing balances are more problematic and highly likely to cause a circularity in the model either immediately, or eventually. FAST 1.01-11: Never release a model with purposeful use of circularity, page 14, discusses this further.

FAST 2.01-07 Present information horizontally

FAST-2.01-07.1 except for short vertical series for scenario structuring

FAST-2.01-07.2 except where vertical layout is more clear for printing

Vertical presentation should generally only be used when schedules are required for presentation / printing or where input structures are best laid out this way to support 'single column' scenario loading or 'picking'.

FAST 2.01-08 Do not hide anything

Rows, columns, and **sheets** themselves should rarely be hidden (a prohibition which generally includes use of Excel's outline feature).

FAST-2.01-08.1 except for undefined time which should be hidden

The primary exception to the previous rule, and a strong design imperative, is to hide commercially undefined cell ranges (columns beyond the defined time axis on horizontal presentations).

Columns to the right that are beyond the **sheets'** modeling range (to assist in CTRL+RIGHT ARROW operations), to restrict the x-axis on Excel charts, and in limited circumstances when the visible range of values is commercially uninteresting (for example first 15 columns are currently all zero).

2.02 Calculation Blocks

Calculation blocks are the paragraph structure of the worksheet. Analogous to a paragraph communicating a single idea lead by a topic sentence, a prototypical calculation block contains a single **calculation** in its last row.

The other rows above this calculation contain the precedents to the calculation, each in turn a **link** directly to the source **line item**. These precedents, the 'ingredients' to the calculation, should include links to the source line item's row label, so-called **live labeling**. They are separated by blank rows above and below to visually separate them from adjacent calculation blocks.

FAST 2.02-01 Construct all **calculations in a separate **calculation block****

All ingredients must be presented as **links** immediately above the calculation with consistent calculation order and appearance in the formula.

FAST-2.02-01.1 except when the calculation block is a **balance corkscrew**

FAST-2.02-01.2 except when **cascading calculations** are warranted

FAST-2.02-01.3 except when the calculation is a **trivial formula**

FAST-2.02-01.4 except when a 2D line item is deemed the more efficient and/or readable design solution

FAST 2.02-02 Build **calculation blocks** so they can be replicated

Build calculation blocks so that they can be copied and re-used; apply minimum anchoring on formulas; row-anchor all **links** to facilitate re-using the structure.

FAST 2.02-03 List common **calculation block** components in a consistent order

Place oft-used components (e.g. **timing flags**, **indexation factors**) in a similar position each time they are used, usually placing more significant commercial components first and timing flags and factors last.

FAST 2.02-04 List precedents in the order they appear in a formula

FAST-2.02-04.1 except when this violates a 'pyramid' layout

Maintain calculation order by listing precedents in the order they are used in the formula (except for priority for pyramid structure, i.e. where constants are listed first).

FAST 2.02-05 Use **corkscrew** calculation blocks for balance accumulation

Balance accumulations should be performed by a special **calculation block** referred to as a 'corkscrew', not via semi-anchored cumulative SUMs. A corkscrew can take one of three design forms:

- a 4-line corkscrew,
- 7-line corkscrews with **flag**, and
- 7-line corkscrew with **PPF**.

FAST 2.02-06 Use **timing flag** and **factor** components routinely

Use **timing flags** (or if required, **partial period factors**, a.k.a. PPFs) and separate **indexation factors** universally. Conditional logic embedded in complex formula to test

for timing issues should never exist; separating this complexity from the primary calculation with timing flags or factors is always the preferred solution.

If there is a question of setting the time period or inflation that is not driven by flags and factors respectively, then the **calculation block** is likely poorly designed.

2.03 Header Design

FAST 2.03-01 The **time axis** is best placed on the **worksheet** only once in a freeze pane

FAST 2.03-02 Display a single end-of-period date in a freeze pane

If necessary to support this design standard, it is often sensible to sub-divide a particular area of the **model** so that all values presented adhere to a single **time axis**.

FAST 2.03-03 Display the operative period flag

FAST 2.03-04 Include a column counter for cross-reference on F11 quick charts

FAST 2.03-05 Include master error **checks** and **alert** indicators in the freeze pane

FAST 2.03-06 Include definition of **SMU** on Presentation sheets

2.04 Input Sheets

FAST 2.04-01 Organize **inputs** both by structure and commercial area

The most meaningful way of grouping inputs is first to consider their nature, e.g. separating **constant** inputs from **series** inputs, and actual values from forecasts data. These groupings can be further divided by what the inputs represent, for example, capital expenditure, financing, costs or revenue.

FAST 2.04-02 Include a dedicated instruction / comments column on Input sheets

Input sheet should be structured in descriptive style and at the same time maintaining its brevity. Add a "comments" column where any comments, notes or instructions related to a particular input can be precisely written. This information ensures that

anybody handling a model understand how to use the input. Such a column will be visible on print-outs; do not use cell comments for such information.

FAST 2.04-03 Create self-documenting Input sheets

Together with readable code, the **model** can act as its own data book (a separate document is exceedingly expensive to produce and rarely up to date to be useful on the day). Printing the input sheets, together with a software copy of the model itself, should give other modelers all the documentation they need.

2.05 Presentation Sheets

The modeler should not lose sight of a **model's** main purpose: communication. A financial model must communicate the results of numeric analysis: a model is therefore worthless if it fails to present information effectively.

The Standard differentiates between what is effective practice for the calculation and control sheets of a model, and what is effective practice for presentation sheets. Each of these model areas has a distinct function, and, per the famous architectural maxim, form follows function.

FAST 2.05-01 Use **Presentation sheets to present the model's results**

Presentation sheets form one of the basic requirement of any model and must be effective in presenting numbers, charts and tables. What sheets are placed in the model is central to its usability and fitness for purpose. Presentation sheets can be described in the form of descriptive analysis, control, report or documentation sheets.

- An analysis sheet describes the **calculation** in descriptive form,
- a Report sheet provides the output in terms of charts and tables. The difference between the two is that the analysis sheet shows every calculation required for the analysis whereas Report sheet is a crux of specific details only.
- A Control sheet presents both inputs and outputs. Sometimes, a model user wants a Control sheet from where they can control the whole model by altering few numbers and check the specific output without shuffling a sheet.
- Documentation sheets provide important information about the models, for example external inputs, exported links, and methodology.

FAST 2.05-02 A model must completely explain how it works without the need for other software applications to present the model outputs

Generally, a model can be divided into **input**, **calculation** and output. A well structured model contains sections which explain how the model is used and allows the reviewer and model user to use the model as a complete decision analysis kit.

FAST 2.05-03 Provide a description of the modeling standards and method used to build the model

The description must be precise and provided in terms of points so that the user can get the general model overview in short.

FAST 2.05-04 Provide a description of the model's flow

A simple model flow is always input → calculations → output. A complex model may have a **counter-flow** of calculations, so the flow must always be described on a sheet to give the user a macro view.

FAST 2.05-05 Provide keys to color coding, abbreviation, Named ranges, and functions

Keys are crucial to make the **model** easy to understand. Standardizing the use of abbreviations, Rangenames and functions helps the user to understand the model fast and allows for key pages to be re-used.

FAST 2.05-06 Selection of chart type should correspond to the nature of the data being presented

The FAST Standard does not provide specific guidance on the choice or design of charts in a model: there is no need to replicate the excellent work done elsewhere. In the area of effective design of charts and the visualisation of data, we recommend FAST modelers to familiarise themselves with the work of Edward Tufte, especially "*Visual Display of Quantitative Information*"¹, and Stephen Few's book "*Show Me The*

¹ Edward R. Tufte, 2001 (2nd ed.): "*The Visual Display of Quantitative Information*"; Graphics Press, USA.

*Numbers*². Being more 'applied' in nature than Tufte, Few's publications give modelers a highly systematic and practical guide to the design of effective charts and tables. We recommend that FAST modellers follow Few's recommendations in the presentational sheets in their models.

FAST 2.05-07 Charts should be formatted for ease of comprehension of the main messages being communicated

Again we refer modelers to the work of Stephen Few in this area.

2.06 Control Sheets

Control sheets allow the **model** builder to check that the model, or section of the model, works correctly. These sheets can be, for example check sheets, control of sensitivities and scenarios, change-tracking, list of pending changes, version control, and table of contents: the model's main control devices and engine status indicators.

FAST 2.06-01 Provide a table of content

The table of content should be broken down into functional areas (input, calculation, presentation) to make it easy the user to see which section is preferred for the view. For example Financial Statement sheet link goes under the heading Presentation.

FAST 2.06-02 Provide a list of **model qualifications and weaknesses**

This should be actively maintained and included in the standard short-form print-out of the model. Unless clearly documented and presented to the model customer, implicit assumptions may be construed as nothing more than 'serious model error'.

² Stephen Few, 2004: "*Show Me the Numbers: Designing Tables and Graphs to Enlighten*"; Analytics Press, Oakland, California, USA.

Chapter 3: The Line Item

3.01 Line Item Taxonomy

Borrowing on the accounting terminology, a **line item** is the lowest level of granularity that should be considered in the build-up of a **model**. Akin to considering that the atom is not divisible in chemistry (only in nuclear physics), a line item is the lowest level structure in a model and should not be corrupted.

A modeler must have a clear understanding of how a line item is classified, its taxonomy. General design principles can include:

1. Is the line item a **constant** or a **series**?
2. Is the line item cash or not-cash?
3. Is the line item a **flow** or a **balance**?
4. If the line item is a flow, is it an in-flow or an out-flow from the business or project?
5. If the line item is a balance, is it an opening (brought forward) or closing (carried forward) position?

FAST 3.01-01 Provide clear indication for constants vs series

As constants, by definition, are not time based, they require their own column separate from the time based columns.

This rule is supported by the rules FAST 2.01-03: Make only two columns matter, page 19 and FAST 2.01-01: Each column should have a single and consistent purpose, page 19.

FAST 3.01-02 Treat line items as the smallest indivisible object in a model

Treat a line item as an autonomous, incorruptible unit of information. Do not **link** to sub-parts of a line item, including displaying only part of its time range except in the rarest examples. Pass the label, units designator, and **display total** on through to any link.

FAST 3.01-03 Do not use a [series](#) structure to present [constants](#)

It is tempting to pre-build the flexibility for series constructions on values that do not vary over time, but this temptation should be avoided; adapt the [model](#) as/if such circumstance actually materializes.

This rule applies to [inputs](#) in particular. Many inputs in a model are [constants](#) and will not change over time. Updating the numbers across the timeline is a relatively tedious and error-prone job compared with updating the single cell that defines a constant.

FAST 3.01-04 Do not use row totals in [model](#) logic

A row total provides useful information and serves to highlight the [line item](#) in question being a [flow](#) (certainly not a [balance](#)). However, if a row total is required to be actively used, for example the SUM of discounted cash flows, then a separate ([constant](#)) line item should be created with its own row. Row totals should have no substantive dependents, and hence be 'display only', i.e. [display totals](#). (This rule is further supported by FAST 2.01-03: Make only two columns matter, page 19.)

Even cross-totalling via adding Display Totals from precedent line items should be avoided, though may be sensible as a check performed elsewhere. A missing Display Total, which is a non-structural element, should therefore not raise any concern on the part of the modeler.

FAST 3.01-05 Include [display totals](#) on all [flows](#)

Totals of flows are informationally important and can assist in spotting errors. Include a display total in a column dedicated for this purpose. Together with FAST 3.05-06: Include the word "balance" in labels of balances, page 35, this rule is a good way to provide clear distinction.

FAST 3.01-06 Do not include [display totals](#) on [balances](#)**FAST-3.01-06.1 except when the [line item](#) includes a single [balance](#)**

In this case a flag should be used to select the balance at that point of time and display it in the constants column.





FAST 3.01-07 Place **display totals** on the left where they are visible

FAST 3.01-08 Make numbers look like what they are with smart format

Use formatting to assist with fast and easy comprehension. Format non-monetary quantities to a resolution that is unlikely to be 'money', for example four decimals for factors, single decimal place for indices. Conversely, monetary units (other than dollars and cents) should be formatted in engineering notation: no decimals or in groups of three.

3.02 Formula Design Fundamentals

FAST 3.02-01 Formulas must be consistent

FAST-3.02-01.1 except when marked as **temporary code**

Series calculations must be constructed from consistent formulas along the axis of presentation. 2D line items should be bi-directionally consistent on both the row and column axes. This is one of only a few universally accepted principles of good modeling.

FAST 3.02-02 Mark **temporary code** clearly

Temporary code should be marked both by wrapping the label in square brackets and yellow shade, along the entire row unless the reason for the status will be clearly visible when the view is on the left-side of the row.

FAST 3.02-03 Do not use **partial range references**

Ranges used in formulas should always span the entire operative range of any series precedent. Though technically, such formula constructions are not themselves inconsistent, such an approach is prone to creating errors as circumstances change and would worry any model reviewer.

3.03 Formula Simplicity

FAST 3.03-01 Do not write a formula longer than your thumb

Also known as “the rule of your thumb”, referencing the formula in the editing pane, a formula longer than your thumb likely means that it should be broken into more than one step.

FAST 3.03-02 No formula should take more than 24 seconds to explain

Also known as “the rule of seconds”. Understanding and explaining a formula should be a short exercise; if not, break the logic into smaller calculation steps.

FAST 3.03-03 Do not write multi-line formulas

Even if “the rule of your thumb” may be at times bent or broken, under no circumstances should a formula break past a single line. Any such formula is almost certainly too complex, impractical to review, and suffers from the added annoyance (in Excel 2003 and before) that it masks the column letters on the sheet, further hampering model review. Such a formula will certainly break “the rule of seconds”.

FAST 3.03-04 Use a limited set of Excel functions

Very often, by simplifying calculations and breaking them down into calculation block based steps, complex functions are not needed. For specific rules, see Excel Functions, page 39

FAST 3.03-05 Use flags to limit use of IF function

There is nothing wrong with a (simple) use of IF function, as simple statements can generally be read intuitively as simple English. However, it shouldn't be over-used or used intensively. Circumstances where $= \text{IF}(\text{TRUE}, x, 0)$, where TRUE is evaluated on some question of time, should be replaced with $x * \text{Flag}$, except where circularity is being deliberately protected. As well $= \text{IF}(\text{FALSE}, x, 0)$ can be replaced by $= x * (1 - \text{Flag})$.

FAST 3.03-06 Use INDEX (or even CHOOSE) over IF to pick values

For more information on Excel functions, refer to section 4.01: Excel Functions, page 39.

FAST 3.03-07 Never use nested IFs

Nested IFs are a common cause of reduced transparency in **models**. They take a long time for users to decode and understand. They are prone to error as there are multiple combination of logical states that are infrequently properly tested by modelers.

Multiplication by flags can often be used to evaluate elements of the logic and breaking the logical steps into separate blocks aids comprehension later.

FAST 3.03-08 Do not use Excel Names

FAST-3.03-08.1 except for external links

FAST-3.03-08.2 except for references for macros

FAST-3.03-08.3 except were non-local precedent references are warranted

The Standard's approach to specific Excel features are explored in more depth in Chapter 4: Excel Features Used in Modeling, page 39, and Names are discussed in section 4.03: Excel Names, page 42.

Consensus position being developed for subsequent draft.

FAST 3.03-09 Do not construct array formulas

Do not use functions that require array constructions, nor form array-variants with standard functions. The resulting complexity is not warranted.



FAST-3.03-09.1 except when Excel's Data Table feature is being used

FAST-3.03-09.2 except when calculation cannot be achieved without arrays

FAST-3.03-09.3 except when the logic bloat required to avoid arrays creates a solution that is more difficult to review than the array alternative

The Standard's approach to specific Excel features are explored in more depth in Chapter 4: Excel Features Used in Modeling, page 39.

FAST 3.03-10 Do not use a space as an intersection operator

Consensus position being developed for subsequent draft.

**FAST 3.03-11 Beware circularity or #ERRORs protected on inactive branch of IF function**

Under some designs, it may be required that an IF statement be used to 'protect' circularity that would occur on the inactive branch, 'FALSE side of the IF conditional. An example of this is the circumstance where the construction = x * Flag is circular, but = IF(Flag = 1, x, 0) is not, i.e. where the time period during which Flag = 0 cause the circularities.

This feature of Excel (not found in Lotus) should not be used casually. When it is used, it should be marked and commented. It leaves the model in a position where it may become circular via a simple input change.

Excel 'hash errors', e.g. #REF, #VALUE, #DIV/0, etc., do not manifest themselves if they sit on the FALSE-side branch, even if present in the function itself. Hence, IF(Flag = 1, x, #REF) will not manifest a problem in any or all cells where Flag = 1. Model audit software will often not detect this problem either.

3.04 Formula Clarity

FAST 3.04-01 Do not write formulas with embedded constants

FAST-3.04-01.1 except when constants are universal

FAST-3.04-01.2 except when constants are deliberately embedded to avoid their manipulation

Embedding commercial information, for example an inflation rate, is never a good idea, as both clarity of model assumptions and active parameterization are lost. However, not all embedded inputs are created equal. Embedding a 24 (for 24 hours per day), 12 (12 months a year), 1000 (dollars in \$ 000s) is permissible, even sensible.

As well, certain constants may be embedded as a clear design intent, rather than presented in explicit input cells. For instance, the model's time frequency, e.g. 6 months per period, may not be able to be flexed, as the model may not have sufficient width to make this change, nor is the design ever expected to support such a change.

FAST 3.04-02 Include spaces between arguments in formulas

To the surprise of many modelers, Excel does allow the use of spaces in formulas. They make the formula clearer to read and only cause disruption in three places:

1. before the leading equal sign;
2. between a function name and the opening parenthesis; and
3. within compound logic operators such as `<=`, `>=`, and `<>`.

We note that the space itself can be used as the intersection operator. However, such usage should not be used, as it will almost always confuse the average model user.

FAST 3.04-03 Do not use parenthesis in formulas unnecessarily**FAST-3.04-03.1 except when they may improve formula clarity**

Parentheses ('brackets' to the British) are used to separate the logic in formulas. Keep their use to a minimum, though in some circumstances Excel's order of calculation is less clear than adding superfluous parentheses, for example $(\$a / 2) * b$ reads more easily for most people than the functionally identical $\$a / 2 * b$

FAST 3.04-04 Use "-1 *" coefficient for all sign switches

Sign convention is a larger topic, but when sign switches are required, make the action as apparent as possible: $-1 * a$ rather than simply $-a$. One cannot over-communicate the intention and visibility of sign switches.

**FAST 3.04-05 Do not include current sheet references in formulas**

Including a sheet label for cells referenced on the current sheet only serves to confuse formulas and the reviewer.

FAST 3.04-06 Do not use elements that appear to be non-structural in model logic

Using elements that would appear to be non-structural in model logic is risky as future users may not be aware of the importance of maintaining integrity. This would apply to using section headings, labels, or empty cells in model logic.

FAST 3.04-07 Do not over-anchor

Do not anchor beyond what is required to effect a consistent formula. Superfluous dollar signs not only clutter the formula from a reading perspective, but disrupt the ability to copy **calculation blocks** for re-use with different ingredient lines. See also FAST 2.02-02: Build calculation blocks so they can be replicated, page 22.

3.05 FAST Labeling Conventions

Labeling is seldom given the thought and emphasis it requires. We are often asked, “What is the main thing one can do to make models more readable and reviewable.” Simply stated, “More and better labels”. In fact, short, simple formulas improve readability mostly because they force the modeler to include more labels explaining and walking the reviewer through each step of what otherwise would be a complex calculation.

FAST 3.05-01 Provide a label for all **line items**

Labeling everything improves the clarity of the **model** and avoids modelers making faulty assumptions about what values represent. Labeling constants provides the safety net of a broken anchor described above.

FAST 3.05-02 Invest time in drafting a good label

Some **line items** are easy to describe, and a comprehensive and clear label comes immediately. In other cases, this is more challenging. In these cases, be clear over being brief and work to streamline the label over time. Spend at least 30 seconds developing such labels; it is worth the investment of time.

FAST 3.05-03 All **line items must have a unique label**

Inconsistent and confusing labeling should be eliminated. Each **calculation**, itself unique, should be given a unique label (of course as augmented with units and section headings as relevant). It is no better to have two calculations called the same thing, then to have the same label for two different calculations.

FAST 3.05-04 Include a units designator on all line items**FAST-3.05-04.1 except it can potentially be omitted when SMU applies**

Unit labeling starts with the reasonable command:

“Label everything with a units designator; a missing unit is something that needs attention. Absence of information to convey meaning is a fundamentally weak design”.

To this, some will reasonably argue that clarity is hampered by over-cluttering the display with unimportant units designators. One of the common, valid omissions of units is for **Standard Monetary Units** (or SMUs for short). If a units designator is omitted in these circumstances some ‘global’ indication on a sheet print-out, up in the freeze pane header indicating a statement such as, “Unless otherwise indicated, all monetary units are in \$ 000s” is warranted. (See also FAST 2.03-06: Include definition of SMU on Presentation sheets, page 23.)

A case can also be made that Line Items that are inherently dimensionless, e.g. Flags, factors, percentages of amounts (as distinct from interest rates), need not have a unit. However, to avoid any prospect of confusion under circumstances where omission of units on SMU Line Items is adopted, including simple designators such as ‘flag’, ‘index’, ‘factor’, ‘of x’ (on percentages), etc. likely will improve clarity.

FAST 3.05-05 Choose a capitalization convention and stick with it

The Standard does not take a position on capitalization in labels. The rule is that whatever standard you use, apply it consistently throughout the model. Failure to do so not only looks scrappy and gives a poor impression of the modelers attention to detail. Like all labeling inconsistency it also impairs any ability to search on specific terms and therefore increases **model** risk.

FAST 3.05-06 Include the word “balance” in labels of balances

Together with FAST 3.01-05: Include display totals on all flows, page 28, this rule is one of the clearest means to ensure the distinction between **flows** and **balances** is clear to anyone reviewing the **model**.

FAST 3.05-07 Include the word “cash” when Label is otherwise insufficiently clear

FAST 3.05-08 Unit designators must be clear and unambiguous

FAST 3.05-09 Include units in the label

Including units in the label again adds clarity. When it comes to labels, verbosity is less of a problem than miscommunication.

FAST 3.05-10 Ensure alternative sign version of **flows** are clearly labeled



position being developed for subsequent draft.

FAST 3.05-11 Ensure distinction between opening and closing **balances** clearly indicated

It is important to clearly indicate whether a balance is an opening or closing balance. The opening balance will rarely, if ever, be reported on a **Presentation sheet**. For this reason it is given the functional suffix of BEG for ‘beginning balance’. While this is not in keeping with accounting conventions, accounting conventions of ‘brought forward’ and ‘carried forward’ balances are often shortened to ‘b/f’ and ‘c/f’ which are unclear and easy to confuse. The purpose of the BEG suffix is to ensure that modelers do not link to the wrong balance.

Closing balances are given no suffix and the absence of a suffix on a balance **line item** indicates that it is the closing balance. The reason that no suffix is given is that closing balances are very often reported on presentation sheets, especially on the balance sheet itself and the lack of suffix is preferable from a presentational perspective.

Rule FAST 3.05-03: All line items must have a unique label, page 34, is related to this rule.

FAST 3.05-12 Maintain labeling consistency pedantically and precisely

Exercise discipline on standard elements to assist in global search and replace, for example, do not use “Tranche A” in one label and “Tr. A” or “TrA” in another). Do not vary the text used for standard suffixes, e.g. BEG for opening balances, POS for positive form of outflow **line items**.

FAST 3.05-13 Unit designators must be consistently applied throughout the **model**

Consistency amongst labeling components extends to units.

3.06 Links

FAST 3.06-01 Row anchor all **links**

FAST-3.06-01.1 except when setting up to replicate sections

It is preferable to remove row anchoring on **links** when setting up a **calculation block** that will be replicated a number of times. This will ensure that when the calculation block is copied, the calculation points to precedents within the new calculation block, and does not hold on to references from the **source** calculation block.



FAST 3.06-02 Do not create **daisy chains**; do not **link** to links

In general terms, a daisy chain is series of linked links. The last link does not form a direct link to the original source of the figures, an **input** or **calculation**, but instead is linked to an intermediate link, which in turn is linked to the first object, forming a series.



3.07 Timing Flags and PPFs

Consensus position being developed for subsequent draft.

FAST 3.07-01 Use **timing flags**

FAST 3.07-02 Only create a flag when it is required

FAST 3.07-03 Only use flags that are relevant to the logic they are being applied to

FAST 3.07-04 Include **display totals** on all **flags** and **PPFs**

Chapter 4: Excel Features Used in Modeling

Though many of the design considerations would apply to any spreadsheet software package, the FAST Modeling Standard has been drafted on the presumption that Microsoft Excel is the software of choice, whether the most recent version is being used or not. Much in the Standard is based on taking advantage of Excel's strengths, e.g. modeling with Links to support fast navigation with CTRL+[key, copying row-anchored links, etc.

However, Excel also has its weaknesses in a modeling context, and these must be considered carefully when considering appropriate Model design. This section is designed to provide guidance on Excel's functions and features in a modeling sense, indicating those that are:

- Generally good to apply in **models**
- Often smart to use, but should not be over-used
- Have occasional use, but rarely a good idea.
- Should fairly much be banned in modeling use

4.01 Excel Functions

FAST 4.01-01 Use the INDEX function over the CHOOSE function

INDEX and CHOOSE are used for the selection amongst the options. Both functions solve the purpose. However, in FAST methodology we would advise modelers to choose amongst options by using INDEX function over CHOOSE function.

INDEX function has more advantage in comparison to CHOOSE function because INDEX is:

1. Easy to update if additional line items are added. Simply increase the array size.
2. In accordance with the FAST methodology of block calculation.
3. Easy to write the formula as INDEX takes array whereas for CHOOSE we need to point out each of cell addresses.

4. From our experience we have found that sometimes function CHOOSE (if used excessively) makes the file heavy, crashes excel and sometimes model does not get full calculated.

The only advantage CHOOSE has over INDEX is that CHOOSE works when the options are scattered at various places. However, this advantage becomes redundant when following the FAST methodology where block calculations are promoted.

FAST 4.01-02 Do not use the NPV function – ever

We have seen modelers use NPV function quite often. However, we propose to minimize the use of NPV function in spreadsheet Financial Modeling OR use it very intelligently depending upon the type of model we have.

Generally we build financial models where the financial reporting is done on the End of Period (EoP) basis. In these type of models the NPV function should not be used because the NPV function discounts the Cash Flows for a period with the discount rate. This yields a wrong result because Cash Flow which are reported on the EoP should not be discounted in that period.

For the above scenario in particular, the XNPV function can be used instead of the NPV function. Both functions have limitations and cannot be used to cater for varying discount rates.

FAST 4.01-03 Do not use OFFSET or INDIRECT functions

Excel function selection should be 'fit for purpose', and the simplest, most direct implementation should be applied, for example using LOOKUP function variants, when INDEX or CHOOSE is fit for the task would be considered poor style.

OFFSET and INDIRECT functions should be avoided except in limited circumstances, as the logic inter-dependency is not direct when using Excel tracing arrows. (OFFSET for scenario picking in particular should be avoided, as INDEX is invariably a preferred choice.)

FAST 4.01-04 ROUND

Use of Excel rounding functions – particularly for purposes of making figures look better, ensuring tables appear to 'add up' better, or, somewhat ironically, in the interests of

precisely matching reality (for example debt draws only available in certain increments) – should generally be avoided. If necessary, find the particular point that requires adjustment, that is do not simply throw ROUND(x, 2) on all formulas.

4.02 Formatting Features

FAST 4.02-01 Use well-defined format styles

Make use of well-defined format styles, ideally merged from a standard workbook that has pre-built styles that are well-engineered and with which the modeler is familiar. Do not lazily stay with the simple defaults provided with Excel.

FAST 4.02-02 Do not merge cells

Avoid merge cell alignment setting, as it disrupts ability to select columns efficiently. (As well, it is rarely of great benefit with advent of Excel's center-across-selection setting.) Merging cells is one of those options that seems like a good idea at the time but then turns out not to be. From a first principles perspective, merging cells breaks the only element of inherent structure that Excel starts with and that doesn't have to be imposed by the modeler. That doesn't seem like it would get us off to a good start from a 'consistency of structure' perspective. Selecting columns and/or rows gets confused when models have cells merged across them and unmerging is time consuming and can cause referencing problems.

The latter is the most common problem faced by modelers in relation to merging cells. However, other points which should be noted while dealing with merge cells are:

Dealing with merge cells in macros can be very problematic.

Model review or audit software also struggles with merged cells and may sometimes simply unmerge all cells in the process of running their analysis procedures.

When a selection of cells containing multiple data values are merged into one cell, then only the upper-left most data value is kept and rest are deleted, and nevertheless to mention unmerging these cells will not bring back those initial cell values.

The only advantage which 'merge cells' options provide in a financial model is the formatting and graphical representation to the summary tables, key output and

representation sheets, etc. However, when this benefit can be achieved by using center-across-selection cell formatting, then why to at all use the merge cells in financial models.

4.03 Excel Names

FAST 4.03-01 Do not use Excel Names

FAST 4.03-02 Use Excel Names for external references

FAST 4.03-03 Use Excel Names for non-local formula precedents

The FAST Modeling Standard advocates very limited use of Names, that is adherents to the Standard are generally against Names. Adherents of the FAST Modeling Standard believe that Names positively harm flexibility and transparency; benefits they may provide are often achievable through simpler techniques and design. In fact, Names are better (or only) suited to simple spreadsheets with limited complexity, where reading a simple natural language formula such as = Price * Quantity is a real possibility.

4.04 Data Validation

Consensus position being developed for subsequent draft.

4.05 Group Outline

Consensus position being developed for subsequent draft.

4.06 Macros / VBA Considerations

Consensus position being developed for subsequent draft.

Appendix A: FAST Formatting

This section is a placeholder for recommendations that the FAST Modeling Alliance make regarding formatting text, numbers and cells to improve a model's readability.

Consensus position being developed for subsequent draft.

Appendix B: FAST Terminology

In most cases, the FAST Modeling Standard uses terms in the same way as Microsoft Excel documentation. Where the FAST Standard's definition is different or goes in to more detail than the same definition in Excel, it appears as a definition here.

Terms that financial modelers should be aware of also appear here, sometimes with references to external resources.

Alert An internal crosscheck in a **model** which indicates a point of commercial interest and/or problem with the business scenario, not necessarily a problem indicated by a logical problem. Breaches in lending covenants, cash balances below a required threshold, etc. may be classified as alerts. See also **Check**.

Balance A balance is a value measured at a particular point in time, e.g. the volume of water in a water tank. In accounting terminology, balances are the indicators of the position of a business and they are shown in the balance sheet. Also referred to as 'stocks'.

Base Case The expected case of a **model**, based on the assumptions deemed most likely to be true. The financial result for a base case should be better than those for a conservative case and worse than those for an aggressive, or upside, case.

Calculation A **line item** that has a formula with cell references, i.e. will show arrows under a trace precedent command. In FAST terminology, a formula such as $= 5 * 10 + 2$ would be consider an **input**, even has precedents and dependents

Calculation Block Autonomous paragraphs on a worksheet, separated by



at least one space, where the structure includes (usually) one **calculation**, with precedent to that calculation which are local. The traditional calculation block has a single calculation on the last row of the block and precedents above it.


Calculation Order	The sequence in which one calculation leads to another, starting from Inputs and ending at results .
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Calculation Sheet	See Workings .
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Call-up	See Link .
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Cascading Calculation	A formula design where a separate calculation block is not used to improve presentation or reduce row usage by omitting the repeat of a nearby precedent.
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Check	An internal integrity crosscheck in a model that necessarily indicates a flaw in the model logic, i.e. no matter what the business scenario, these checks should not fail. Balance sheet checks, cross-totalling, crosschecks between IRR and NPV calculations, etc. would all be considered likely integrity checks. See also Alert .
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 Code Replication	The practice of copying and pasting code. This of course saves time and effort, but more crucially provides an opportunity to indirectly review the original code, testing its suitability under different assumptions.
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Constant	A line item represented by a single value cell, i.e. with a value that does not change over time or may not even have a time specification to it, e.g. an IRR calculation. Should not be confused with an input , which is how this term may be used by other standards.
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Control Sheet	A sheet that is not central to the core model logic flowing from inputs through workings to presentation, but generally use to report issues or information about the model. Error check sheets, change control tracking, documentation sheets, etc. would all be considered Control sheets.
Corkscrew	A special form of calculation block where the opening balance is equal to the previous period's closing balance.
Counter-flow	A calculation that requires precedents that are calculated 'down stream' in the standard calculation order .
Dashboard	A dashboard is a visual, graphical display of the most important information needed to achieve one or more objectives. A good dashboard fits entirely on a single computer screen so it can be monitored at a glance.
Daisy Chain	A poor design feature where a link refers in turn to another link.
Data Range	The range of continuous cells that make up a series line item's numerical values.
Display Total	A total of the complete range of data for a series line item where the value is used for display only, i.e. not then used in model logic and hence has no dependents.
Embedded Constant	A fixed, static number included, i.e. embedded, within a formula, rather than split out separately and presented in its own labeled cell as a constant Input.
Export	A line item that is used on / referenced by another worksheet in the model . The dependents of an export is

an Import.

FAST Modeling Alliance	An informal network of companies, organizations, and governmental entities who believe financial models should be built and maintained according to the FAST Modeling Standard, the publishers of this Standard.
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Flag	See timing flag .
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Flow	A line item where the values presented are accumulated <u>over</u> a period of time, and can also be described and/or derived as the differences between two balances . In accounting terminology, flows are those line items that would appear on either the Profit & Loss (Income) Statement and/or Cash Flow Statement.
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Import	A link where the Source Line Item is on a different Worksheet. The Source of an Import is an Export.
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Indexation Factor	A factor-type line tem often used to separate the complexity of inflation into a separate modeling component, alternately referred to as escalation factors (esc factors) or simply inflation factors. Discount factors are essentially reciprocals of indexation factors.
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Input	<p>Input, generally used as short form of synonym input cells or input-type line item, is any cell that does not contain cell references and hence has no precedents, i.e. are <u>not</u> calculations.</p> <p>Inputs are most often direct numeric values entered in a spreadsheet cell, but may also contain constructed values via so-called input formulas, which are a permissible alternative, e.g. = 1500 / 12.</p> <p>Other standards alternatively refer to inputs as</p>
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assumptions or 'constants'. In the case of the latter, these should not be confused with the FAST Modeling Standard defined term **constant**, that is any cell that has a value that does not vary over time.

Line Item	A unit of information displayed on a line, row or column, of its own with its own label. Line items can contain some or all of the following components depending on their taxonomy: data range , label, units designator, and display total . As well, a time axis is an implicit attribute of a series line item.
Link	The simplest form of formula, where the only element is a simple reference to a single cell, but contains no functions or arithmetic operators. Links have a single precedent known as the source line item .
Live Labeling	Generally used only for links , where the link's label cell is a reference to the source line item's label. Hence, consistency of labeling between link and source is guaranteed, and a single change on source will refresh throughout the model upon a recalculation.
Model	A workbook , or set of inter-dependent workbooks, where data is structured along an axis of presentation; essentially a highly structured spreadsheet. In a financial model, time is usually the primary axis.
Normally Positive Convention	Leaving all figures in a model as positive and the direction of the value – whether it is coming in or going out – suggested by the label. Positive labels such as revenues and receipts indicate that something is coming in and negative labels such as expenses and expenditure indicate that something is going out.

One-sheet Wonder	An informal term, referring to a model where the vast majority of calculations are performed on a single 'workings' sheet.
Partial Period Factor	The analogue form of a timing flag , where values can range <u>between</u> 0 and 1. Generally used in simply multiplication to scale the amount of a flow applicable to a given time period when (say) operations are present in only a fraction of a given period.
Placeholder	Generic term for a temporary line item , whether entirely empty or containing temporary code . Placeholders are often used to construct formulas from local precedents in a calculation block when a given precedent does not yet exist.
Presentation Sheet	A worksheet dedicated primarily to presenting model results. For a discussion on Results sheets, see Presentation Sheets, page 24.
Results	A line item with no dependents.
Series	Short for series line item. Any line item with a range of values expressed over some sequential axis – in a financial model , usually time. Series may be inputs or calculations .
Signatory	One of the companies that have signed up to the FAST Modeling Alliance and support the FAST Modeling Standard.
SMU	See Standard Monetary Unit .
Source	The precedent line item to which a link refers. Short form for source line item.
Standard Monetary Unit	Often abbreviated SMU is the standard unit of currency in

a **model**, generally as presented in the financial statements and used most commonly in both inputs and workings, e.g. \$ 000s. Generally applies to a single currency model, unless one currency is sufficiently dominant over the other(s).

Temporary Code	Any installation in a model , typically caused by short-term expediency, which violates the design terms of the FAST Modeling Standard.
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Time Axis / Time Ruler	<p>The timeline associated with a given series line item, generally presented as a 'time ruler' in a freeze pane header when it applies to all of the Line Items on a given worksheet.</p> <p>Defining time axes is an important factor in a model's design, giving shape, structure, and size to a model.</p>
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Timing Flag	<p>Used to denote the occurrence of a particular event, that is, to place a certain value in time. Flags contain values of either 0s or 1s only and are used either in simple multiplication or often as the basis of an IF statement conditional. If a timing component contains values other than 0s and 1s it should be referred to as a partial period factor.</p> <p>In other standards, flags may be referred to as 'masks', drawn from the idea of a silk-screening process that allows ink through (when equal to 1) or not (when equal to 0).</p>
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Units Designator	The separate description of a line item's units.
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Workbook	An Excel file that collects together a number of worksheets . Synonym for 'book' and both terms will be found in this document.
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Workings

General term for intermediate **calculations**, i.e. those that have dependents, i.e. not **results**. Workings sheets and Calculation sheets are virtual synonyms and may be used interchangeably in the Standard.

Worksheet

Synonym for Excel term 'sheet' and both terms will be found in this document.

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