

How to Create Reports From TK Solver Models

There are two options for creating reports – use TK’s Report Writer or build the report yourself using TK and a word processor such as Microsoft Word or Open Office. TK’s Report Writer is fast and effective for situations involving very large models with lots of objects on various sheets, where you simply want a summary of everything without a lot of commentary. A word processor is preferred when more customization and commentary is desired. This document will focus on using a word processor to create reports.

Before going into details on the report writing process, there are several settings in TK Solver which will impact report writing that you should know about.

Font Size

The larger the font size, the less you can display horizontally on any given TK sheet. For this reason, a font size of 9 or less is recommended. The default font works fine.

Copy OLE Information

If you have this option selected, you can “Paste Link” TK objects into reports so that they dynamically update as the model changes. It’s generally a good idea to keep this option activated.

ML Single Object Paste

This option should always be active but the default is not, so be sure to check that box in the Environment tab of the Options. This setting allows you to copy and paste blocks of MathLook equations together instead of just one at a time.

The next issue is the use of Paste Special vs. Paste after copying TK objects to the clipboard. Paste uses the default format assumed by Microsoft. Unfortunately, in most cases, the default is not what is best. For this reason, we recommend that you always use Paste Special when building your TK reports. A second reason is that you must use Paste Special if you would like to dynamically link an object in the report to the source TK model. The following summarizes the best format to use for various TK objects and also gives some suggestions for preparing the objects for copying.

Variable Sheet

Use “Paste Special As TKW Document Object” to paste from the clipboard. This retains all the formatting from the TK sheet including the column headers. Be sure to adjust the column widths prior to copying to try to compress the sheet horizontally so it fits nicely in the document. Here are two versions of the same TK Variable Sheet, showing the impact of reducing some column widths before copying.

Status	Input	Name	Output	Unit	Comment
					***** SHAFT TORSION *****
	4.5	OD		in	outside diameter
		ID	2.5662332	in	inside diameter
	1	L		ft	length of shaft
		J	36	in^4	polar moment of inertia
	30000	Txy		lbf/in^2	torsional shear stress
		theta	.76394372	deg	angle of twist
	12000000	G		lbf/in^2	torsional modulus of elasticity
	40000	torque		lbf*ft	torsional moment

Notice that the image invades the right margin. But if we adjust the column widths before copying, the object can be centered nicely on the page.

Status	Input	Name	Output	Unit	Comment
					***** SHAFT TORSION *****
	4.5	OD		in	outside diameter
		ID	2.56623327	in	inside diameter
	1	L		ft	length of shaft
		J	36	in^4	polar moment of inertia
	30000	Txy		lbf/in^2	torsional shear stress
		theta	.763943727	deg	angle of twist
	12000000	G		lbf/in^2	torsional modulus of elasticity
	40000	torque		lbf*ft	torsional moment

Rule Sheet

The Rule Sheet provides a concise summary of the equations and function calls used in the model. It does not use the MathLook feature to display the equations but it can be useful in reports. Use Paste Special As TKW Document Object for best results. Be sure to reduce the column width before copying. Also, unless you need the status column in the report, just copy the rule column.

Rule
Txy = torque*OD/(2*J)
J = pi()*(OD^4-ID^4)/32
theta = torque*L/(G*J)

MathLook Equations

There are two ways of getting MathLook Equations from TK into a report. The first is to copy from the MathLook View window at the bottom of the TK screen. Simply right-click in the MathLook View area and select copy. Then use Paste Special As Picture to put it into the report.

$$T_{xy} = \frac{\text{torque} \cdot OD}{2 \cdot J}$$

If you prefer to copy blocks of equations all at once, use the MathLook Sheet in TK to convert the rules prior to pasting into the report. You may copy as many rules from the rule sheet into MathLook as you like, however, it's usually a good idea to copy them in meaningful blocks that you want grouped together in your report. Very long blocks of rules may not fit nicely on a single page of the document and you may want to insert text into your report between blocks.

When you copy the rules from the Rule Sheet (or function subsheets) into MathLook, you will see an equation block such as this one.

$$T_{xy} = \frac{\text{torque} \cdot OD}{2 \cdot J}$$

$$J = \frac{\pi \cdot [OD^4 - ID^4]}{32}$$

$$\text{theta} = \frac{\text{torque} \cdot L}{G \cdot J}$$

You then copy that block and use Paste Special As Picture to place it into the report.

$$T_{xy} = \frac{\text{torque} \cdot OD}{2 \cdot J}$$

$$J = \frac{\pi \cdot [OD^4 - ID^4]}{32}$$

$$\text{theta} = \frac{\text{torque} \cdot L}{G \cdot J}$$

In some cases, it's a good idea to stretch the bottom border of equation block down slightly prior to copying to avoid cutting off a portion of a bracket or parenthesis when pasting the block later.

If you do not activate the ML Single Object Paste setting, the MathLook block will appear like this...

$$T_{xy} = \frac{\text{torque} \cdot OD}{2 \cdot J}$$

$$J = \frac{\pi \cdot [OD^4 - ID^4]}{32}$$

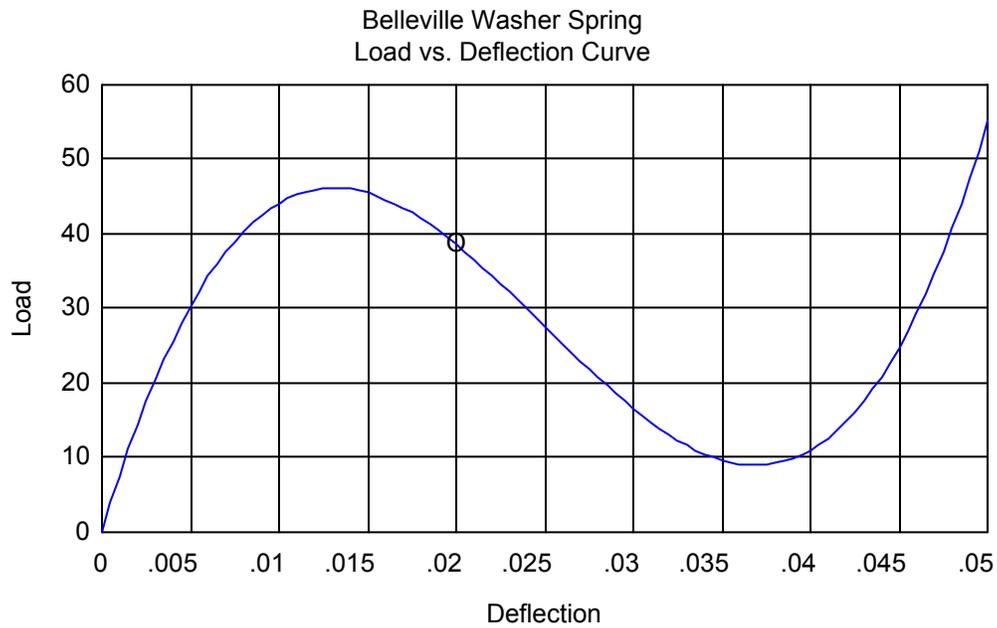
$$\text{theta} = \frac{\text{torque} \cdot L}{G \cdot J}$$

In this form, only one equation can be copied at a time.

MathLook equations cannot be linked to the source TK model. They are static pictures.

Plots

TK Plots can be linked dynamically to reports using Paste Special As TKW Document Object. It is important to note that the plot can and should be sized in TK prior to copying. It is generally a good idea to keep the size smaller than the report margins so they fit nicely.



Tables

Tables are the trickiest object to deal with in making reports due to potential size issues. If the length and width easily fit on a single page, simply copy and Paste Special As TKW Document Object. If the table is longer than a single page, it is usually best to click and drag to copy blocks of elements that each fit on a single page. The number of elements will vary depending upon the top and bottom page margins and the font used in TK.

Here is a table that easily fits on a single page.

Element	No.	Material	G, psi	E, psi	nu	Gamma,1/df
1			Shear	Young's	Poisson	Thermal
2			Modulus	Modulus	Ratio	Coeff.
3		METALS				
4	1	Aluminum - cast, pure	3.7E6	9E6	0.36	1.3E-5
5	2	Aluminum - cast, 220 T4	3.55E6	9.5E6	0.33	1.36E-5
6	3	Aluminum - wrought, 2014 T6	4E6	1.06E7	0.33	1.28E-5
7	4	Aluminum - wrought, 6061 T6	3.75E6	1E7	0.3	1.3E-5
8	5	Beryllium copper	7E6	1.9E7	3.55E-1	9.3E-6
9	6	Brass - naval	5.5E6	1.5E7	3.57E-1	1.18E-5
10	7	Bronze - Phosphor, A.S.T.M. B159	6.5E6	1.5E7	0.35	9.9E-6
11	8	Cast iron, gray, no. 20	6.7E6	1.4E7	0.25	6E-6
12	9	Cast iron, gray, no. 30	6.7E6	1.52E7	0.25	6E-6
13	10	Cast iron, gray, no. 40	6.7E6	1.83E7	0.25	6E-6
14	11	Cast iron, gray, no. 60	6.7E6	1.9E7	0.25	6E-6
15	12	Cast iron - malleable	8.8E6	2.6E7	0.25	7.5E-6
16	13	Cast iron - nodular	6.7E6	2.35E7	0.25	6.6E-6
17	14	Magnesium, AZ80A T5	2.4E6	6.5E6	2.81E-1	1.6E-5
18	15	Titanium - pure	5.8E6	1.55E7	0.34	5.3E-6
19	16	Titanium, alloy, 5 Al, 2.5 Sn	6.2E6	1.7E7	0.33	5.7E-6
20	17	Steel - A.S.T.M. A7-61T	1.15E7	2.9E7	0.27	6.5E-6
21	18	Hi-str, lo-alloy steel, A.S.T.M. A242-63T	1.15E7	2.9E7	0.27	6.5E-6
22	19	Hi-str steel casings A.S.T.M. A148-60	1.15E7	2.9E7	0.27	8.3E-6
23	20	Steel - spring, carbon, S.A.E. 1095	1.15E7	3E7	2.85E-1	No data
24	21	Steel - spring, alloy, S.A.E. 4068	1.15E7	3E7	2.85E-1	No data
25	22	Steel - ball bearings, S.A.E. 52100	1.15E7	3E7	2.85E-1	No data
26	23	Steel - stainless, 1/4 hard	1.25E7	2.8E7	3.05E-1	9.6E-6
27	24	Steel - stainless, full hard	1.2E7	2.66E7	3.05E-1	9.6E-6
28		TIMBER (12% moisture content)				
29	25	Ash (white)	1.05E5	1.68E6	No data	5.3E-6
30	26	Birch (sweet, yellow)	1.29E5	2.07E6	No data	1.1E-6
31	27	Elm (American)	8.38E4	1.34E6	No data	No data
32	28	Hickory (true)	1.36E5	2.18E6	No data	No data
33	29	Maple (sugar)	1.14E5	1.83E6	No data	1.2E-6
34	30	Oak (red)	1.13E5	1.81E6	No data	1.9E-6
35	31	Oak (white)	1.01E5	1.62E6	No data	2.7E-6
36	32	Fir (Douglas)	1.2E5	1.92E6	No data	No data
37	33	Hemlock (Eastern)	7.5E4	1.2E6	No data	No data
38	34	Spruce (Sitka)	9.81E4	1.57E6	No data	No data
39	35	Cypress (Southern)	9E4	1.44E6	No data	No data
40	36	Pine (Southern long-leaf)	1.24E5	1.99E6	No data	3E-6
41		CONCRETE AND MASONRY				
42	37	Concrete (1: 1.5: 3, 6.5 gal/sack)	No data	3.5E6	0.15	6E-6
43	38	Concrete (1: 2.5: 3.5, 7.5 gal/sack)	No data	3E6	0.13	6E-6
44	39	Concrete (1: 3: 5, 9.0 gal/sack)	No data	2.5E6	0.1	6E-6
45	40	Brick (soft)	No data	1.5E6	No data	3E-6
46	41	Brick (hard)	No data	3.5E6	No data	3E-6
47	42	Granite	No data	7E6	0.28	3.6E-6
48	43	Limestone	No data	6E6	0.21	2.8E-6
49	44	Marble	No data	8E6	0.26	3.8E-6
50	45	Sandstone	No data	2.5E6	0.28	5.2E-6

If a table is wider than a single page, there are several options. If the table is the key element of the report, it may be best to orient the entire the entire document in landscape mode instead of portrait mode if that would provide the necessary width. If the table is even wider than that, it is probably best to create two or more tables, each with as many columns as will fit in the report.

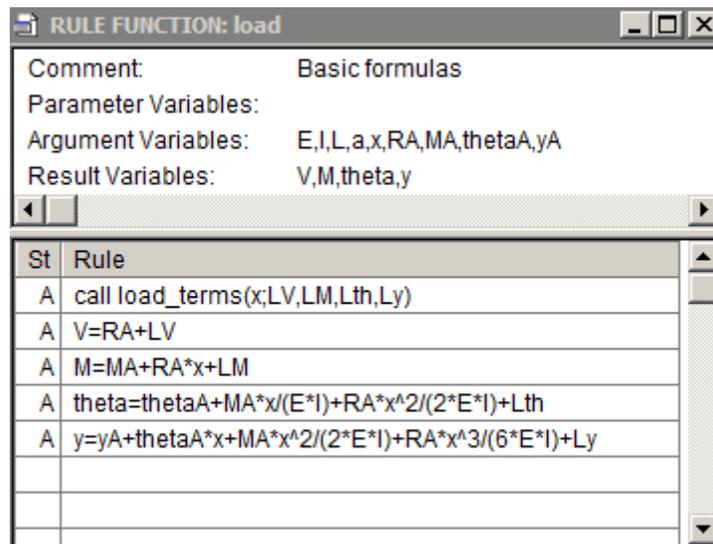
Tables can be displayed vertically or horizontally in TK, so in some cases, when a large number of variables are included in the table, each with only a few elements, it may be better to use the horizontal option. This will not work well if there are more data points for each variable than can be displayed in TK without scrolling.

Units Sheet

The Units Sheet, and most other TK Sheets, can be included in reports using Paste Special As TKW Document Object after adjusting the column widths. As with tables, copy only the number of rows that will fit on a single page.

Function Subsheets

If you use user-defined functions in your models, they will probably be important components of your reports. Function subsheets are split into two windows with the top containing the summary comment and variables being passed in and out of the function. The windows are separated by a scroll bar. Here is a rule function.



We used the Windows Vista Snipping Tool to snip and copy this function from TK into this document. That technique works nicely as long as there aren't too many equations or statements in the function.

This technique also does not format the equations using MathLook. It is often preferable to copy the upper window first and then copy blocks from the lower window after converting them to MathLook.

Click and drag to copy the upper portion of the subsheet and Paste Special As Picture for best results. If you Paste Special as TKW Document Object, the image is wider and doesn't fit on the page as nicely. Note that in either case, the name of the function is not included in the image so you have to insert that manually.

RULE FUNCTION: load

Comment:	Basic formulas
Parameter Variables:	
Argument Variables:	E,I,L,a,x,RA,MA,thetaA,yA
Result Variables:	V,M,theta,y

call load_terms (x; LV , LM , Lth , Ly)

$$V = RA + LV$$

$$M = MA + RA \cdot x + LM$$

$$\theta = \theta A + \frac{MA \cdot x}{E \cdot I} + \frac{RA \cdot x^2}{2 \cdot E \cdot I} + Lth$$

$$y = yA + \theta A \cdot x + \frac{MA \cdot x^2}{2 \cdot E \cdot I} + \frac{RA \cdot x^3}{6 \cdot E \cdot I} + Ly$$

List function subsheets are similar to tables, so you should try to copy blocks of elements that will fit on a single page. Use Paste As TKW Document Object for best results.

LIST FUNCTION: Dt

Comment:	Diameter Tolerances
Domain List:	ODtd
Mapping:	Step
Range List:	ODtr

Element	Domain	Range
1	0	0.008
2	0.197	0.01
3	0.394	0.012
4	0.984	0.016
5	1.969	0.02
6	3.937	Too Large
7	1000	