

STOP! WAIT! GO!**See What Traffic-Lighting Can Do For You**

Louise Hadden, Abt Associates Inc., Cambridge, MA

ABSTRACT

The Output Delivery System in conjunction with three SAS® procedures that have procedure level styles make "traffic lighting" or the highlighting of various output items easy to accomplish. Traffic lighting can allow you to make your tables and reporting really stand out in the crowd! This paper will demonstrate various forms of traffic lighting in PROC TABULATE, PROC REPORT, and PROC PRINT to add interest to YOUR SAS® output!

DECISIONS, DECISIONS

There are three primary procedures that allow you to control styles within the procedure via style commands: PROC PRINT, PROC REPORT and PROC TABULATE. Each procedure has its own particular syntax for adding styles to output, and this syntax may vary by output destination, or tagset. Styles, whether provided by SAS® or user-defined with PROC TEMPLATE, also influence the appearance of output. While styles and tagsets, particularly when user-defined, may offer the potential for traffic lighting, the ability to control row by row or column by column output is best accomplished by manipulating one of the big three of reporting.

TRAFFIC LIGHTING TOOLKIT

Although not strictly a reporting procedure, one of the most important procedures in the would-be traffic lighter's toolkit is PROC FORMAT. User defined formats allow the SAS® programmer to define foreground (font) color, background color, and other aspects of the appearance of the output such as special "picture" formats. Examples of the creation and application of some user-defined formats using the same input data set and PROC PRINT follow below output to the MSOFFICE2K tagset (Excel).

**FOREGROUND FORMAT**

```
Proc format;
  Value sigf      low-<0.0011='Green'
                  0.0011-<0.0501='Red'
                  0.0501-<0.1001='Blue'
                  other='Black';
run;

Ods msoffice2k file='significance_foreground.xls' path=odsout style=styles.minimal;
Proc print data=yourlib.yourdata label uniform;
  Var var2 chisq;
  Var chisqp / style={foreground=sigf.};
  Var chisqdf;
  Id var1;
Title1 'Foreground Traffic Lighting';
Run;
Ods msoffice2k close;
```

Microsoft Excel - significance_foreground.xls

File Edit View Insert Format Tools Data Window Help

Arial 8 B I U \$ % , .00 .00 100% ?

	D	E	F	G	H	I	J
21	2.0%	16	1.4%	18	3.0%	0.1933	
22	0.2%	2	0.2%	1	0.2%	0.1933	
23	57.6%	950	60.7%	364	51.5%	0.0005	
24	25.0%	297	24.0%	169	26.9%	0.0005	
25	12.8%	158	11.9%	89	14.6%	0.0005	
26	4.6%	46	3.5%	43	6.9%	0.0005	
27	5.0%	345	5.8%	98	3.3%	0.0000	
28	20.2%	255	19.7%	132	21.2%	0.0000	
29	45.5%	544	46.1%	263	44.4%	0.0000	
30	29.3%	335	28.4%	184	31.2%	0.0000	
31	23.0%	303	21.9%	167	25.2%	0.1184	
32	77.0%	1,176	78.1%	510	74.8%	0.1184	
33	96.2%	1,438	97.3%	636	94.0%	0.0019	
34	3.8%	41	2.7%	41	6.0%	0.0019	
35	81.9%	1,221	82.3%	549	80.9%	0.8775	
36	3.6%	57	3.5%	28	3.6%	0.8775	
37	5.3%	78	5.3%	36	5.4%	0.8775	
38	0.7%	9	0.7%	4	0.6%	0.8775	
39	8.5%	107	8.1%	59	9.5%	0.8775	
40	7.9%	125	8.1%	50	7.4%	0.0000	
41	23.2%	387	24.9%	137	19.9%	0.0000	
42	35.5%	546	37.8%	215	30.9%	0.0000	
43	24.8%	333	23.3%	183	27.7%	0.0000	
44	8.7%	85	6.0%	90	14.1%	0.0000	

significance_foreground

Ready NUM

BACKGROUND FORMAT

```
Proc format;
  Value sigb      low-<0.0011='Red'
                  0.0011-<0.0501='Yellow'
                  other='Green';

run;

Ods msoffice2k file='significance_background.xls' path=odsout style=styles.minimal;

Proc print data=yourlib.yourdata noobs label uniform;
  var xlab xval totaln totper nsumn colpern
      nsumno colperno;
  var chisqp / style={background=sigb.};
  title1 'Significance Background Traffic Lighting';
run;

Ods msoffice2k close;
```

Microsoft Excel - significance_background.xls

File Edit View Insert Format Tools Data Window Help

Arial 8 B I U \$ % , 100%

	D	E	F	G	H	I	J
1	Background Traffic Lighting						
2							
3	Tot Percent	Unweighted N of Rs in Home Health Longitudinal File	Column Percent of Rs in Home Health Longitudinal File	Unweighted N of NRs in Home Health Longitudinal File	Column Percent of NRs in Home Health Longitudinal File	P-Value	
4							
5							
6							
7	18.1%	338	20.2%	104	14.0%	0.0000	
8	23.9%	410	25.4%	157	20.8%	0.0000	
9	10.4%	176	11.2%	61	8.8%	0.0000	
10	9.4%	132	9.3%	63	9.7%	0.0000	
11	15.8%	205	15.7%	103	15.9%	0.0000	
12	6.8%	82	6.9%	42	6.8%	0.0000	
13	15.1%	131	11.0%	139	23.5%	0.0000	
14	0.4%	4	0.3%	3	0.5%	0.0000	
15	0.3%	5	0.3%	5	0.3%	0.1933	
16	6.1%	144	6.8%	46	4.8%	0.1933	
17	21.5%	365	22.0%	150	20.5%	0.1933	
18	37.9%	539	37.6%	255	38.5%	0.1933	
19	24.8%	328	25.2%	147	24.1%	0.1933	
20	7.3%	79	6.6%	53	8.6%	0.1933	
21	2.0%	16	1.4%	18	3.0%	0.1933	
22	0.2%	2	0.2%	1	0.2%	0.1933	
23	57.6%	950	60.7%	364	51.5%	0.0005	

significance_background/ NUM

STARRING FORMAT

```
Proc format;
picture sigstar low-<0.0010='9.9999***'
              0.0011-<0.0501='9.9999**'
              0.0501-<0.1001='9.9999*'
              other='9.9999';

Ods msoffice2k file='significance_stars.xls' path=odsout style=styles.minimal;

Proc print data=yourlib.yourdata noobs label uniform;
  var xlab xval totaln totper nsumn colpern
      nsumno colperno chisqp;
  format chisqp sigstar.;
  title1 'Significance Stars Traffic Lighting';
  Title1 'Background Traffic Lighting';
Run;

Ods msoffice2k close;
```

Microsoft Excel - significance_stars.xls

File Edit View Insert Format Tools Data Window Help

Arial 8 B I U \$ % , +.0 -.00 +.0

J6 =

ance Stars Traffic Lighting

Tot Percent	Unweighted N of Rs in Home Health Longitudinal File	Column Percent of Rs in Home Health Longitudinal File	Unweighted N of NRs in Home Health Longitudinal File	Column Percent of NRs in Home Health Longitudinal File	P-Value
18.1%	338	20.2%	104	14.0%	0.0000***
23.9%	410	25.4%	157	20.8%	0.0000***
10.4%	176	11.2%	61	8.8%	0.0000***
9.4%	132	9.3%	63	9.7%	0.0000***
15.8%	205	15.7%	103	15.9%	0.0000***
6.8%	82	6.9%	42	6.8%	0.0000***
15.1%	131	11.0%	139	23.5%	0.0000***
0.4%	4	0.3%	3	0.5%	0.0000***
0.3%	5	0.3%	5	0.3%	0.1933
6.1%	144	6.8%	46	4.8%	0.1933
21.5%	365	22.0%	150	20.5%	0.1933
37.9%	539	37.6%	255	38.5%	0.1933
24.8%	328	25.2%	147	24.1%	0.1933
7.3%	79	6.6%	53	8.6%	0.1933
2.0%	16	1.4%	18	3.0%	0.1933
0.2%	2	0.2%	1	0.2%	0.1933
57.6%	950	60.7%	364	51.5%	0.0005***

significance_stars/

Ready NUM

DETAILS, DETAILS

Now that you have a taste of how you can enhance your SAS® output with the simplest of reporting procedures, we can go on to some of the finer points of traffic-lighting within the three procedures. While PROC PRINT primarily allows you to traffic light at the column or variable level, both PROC REPORT and PROC TABULATE offer significant, and different, enhancements. For all three procedures, however, the key is the use of user-defined formats in PROC FORMAT and the STYLE statement. Where and how the style statement is used is what differs.

You saw above the statements in PROC PRINT:

```
var chisqp / style={foreground=sigf.};
var chisqp / style={background=sigb.};
```

Wait – weren't there three examples above? Yes, I cheated. The last example was really applying a user-defined "picture" to a variable. It's a form of traffic lighting, but not quite the same as most of what will be discussed in this paper.

The style statement can be shortened by using s= instead of style=. The style attribute (and there are many more than just background and foreground!) is enclosed in curly brackets. The entire style statement follows a variable or variables after a forward slash. The syntax differs somewhat from procedure to procedure, but the concepts are constants in the traffic lighter's toolkit.

PROC PRINT

Several PROC PRINT traffic lighting examples were presented above that showed different ways to highlight significance statistics. The three examples presented showed traffic lighting using the foreground (font color), background (enclosed by a cell border), and using a picture format. The background and foreground examples have something in common: the use of a separate var statement so that we could apply the user-defined format to a selected variable (or variables). While this application is specific to PROC PRINT, the concept is similar in PROC REPORT and PROC TABULATE, and will be discussed below, along with some neat additions that each PROCEDURE features. The full color implementation of the syntax for various items will be displayed on the poster, while specific selected items will be demonstrated in the paper to save space.

PROC TABULATE

In PROC TABULATE, background and foreground colors via a user-defined format can be applied in the various style statements (for example, the PROC statement, the VAR statement(s), CLASS statement(s), the CLASSLEV statements(s), the TABLES statement(s), and the BOX statement.) They can also be applied in a user-defined style template. Colors can be assigned directly in the style statement, or with a user-defined format.

STYLE ON THE PROC STATEMENT:

In general, you would not use style on the PROC TABULATE statement for the purposes of traffic lighting, as it applies an overall style to the table rather than highlights particular values. Nonetheless, it's fun to play with while formatting your reports.

Syntax:

```
Proc tabulate data=yourdataset style={background=lightblue};
```

This would create a light blue background for your table regardless of what overall style you use.

STYLE ON THE CLASS AND CLASSLEV STATEMENTS:

EXAMPLE OF HIGHLIGHTING ROWS IN PROC TABULATE USING THE CLASS STATEMENT:

Syntax:

```
class region srvlevel loc_cat enr_cat2 /
      s={background=lightblue
        font=("Times New Roman",8pt,Bold)};
run;
```

EXAMPLE OF HIGHLIGHTING ROWS IN PROC TABULATE USING THE CLASSLEV STATEMENT:

Syntax:

```
proc format;
value regcol          1='Light Blue'
                      2='Pink'
                      3='Light Green'
                      4='Yellow';

run;
...
classlev region /
      s={background=regcol.
        font=("Times New Roman 8pt")};
run;
```

Note the difference between using the CLASS statement and the CLASSLEV statement to highlight rows. The CLASS statement affects the variable heading, while the CLASSLEV statement affects the actual values. Note also that the cells are not colored, only the headers. I will discuss how to implement highlighting in cells using PROC TABULATE below.

Percentage of Schools Collecting Various Types of Problems Presented to Students
By Selected School Characteristics: 2002-2003

	Has Access to Data		Types of Problems Presented to Students
TOTAL	40,803	100.0%	6
Region			
Northeast	8,226	20.1%	6
South	10,516	25.7%	6
Midwest	13,865	33.9%	6
West	8,196	20.0%	6
Level			
Elementary	24,663	60.4%	6

	Has Access to Data		Types of Problems Presented to Students
TOTAL	40,803	100.0%	
Region			
Northeast	8,226	20.1%	
South	10,516	25.7%	
Midwest	13,865	33.9%	
West	8,196	20.0%	
Level			
Elementary	24,663	60.4%	
Middle	7,861	19.2%	

STYLE ON VAR STATEMENTS:

As with PROC PRINT, you can use multiple VAR statements in PROC TABULATE to highlight columns in different ways. Note that the syntax below will only highlight the headings on the columns.

EXAMPLE OF HIGHLIGHTING COLUMN HEADERS IN PROC TABULATE USING THE VAR STATEMENT:

Syntax:

```
var region /s={background=lightblue font=("Times New Roman",8pt,Bold)};
```

STYLE ON TABLE STATEMENTS:

The table statement is where it's at with traffic lighting in PROC TABULATE. You can add styles to table cells by putting the style code in table crossings. It follows that you can "traffic light" values in specific columns by using a user-defined color format rather than a simple color statement. There are, however, complications with PROC TABULATE which have to do with style inheritance. The hierarchy of "parenting" is discussed in detail in the documentation for PROC TABULATE and will not be covered here.

Syntax:

```
Tables region, urban*{style={background=lightblue}};
```

The code above will provide a light blue background for the entire column “urban”. To color code or traffic light particular cells, use a user defined format as shown above on the example of a CLASSLEV statement in conjunction with the table statement.

Syntax:

```
Tables region, urban*{style={background=$userfmt.}};
```

THINKING INSIDE THE BOX:
EXAMPLE OF A PREIMAGE FILE IN THE BOX:

PROC TABULATE and PROC REPORT both allow the use of “preimage” graphics files. In PROC TABULATE, a logo can be easily inserted in the “box” in the top left corner of the output. The type of graphics file used is dependent on the SAS® output destination: for the RTF destination and PROC TABULATE I used a JPEG file.

Syntax:

```
tables all region srvlevel ...,
    schc_ns*(mean*f=comma9.4)
    schc_any*(pctsum<counter>='%'*f=pctpic.)
...
/ box={s={bordercolor=black borderwidth=2
    preimage='abtlogo.jpg'}};
```

Table 13A.
Type of School Staff Providing Mental Health Serv
by Selected School Characteristics: 2002-2003

	School Counselors	Any Co
	Mean	
TOTAL	1.8532	
Region		
Northeast	2.2455	
South	1.6451	
---	-----	

A clipped snapshot of the RTF file is displayed to the right.

As you have seen in the PROC TABULATE code snippets above, familiarity with the procedure itself is very helpful with implementing traffic lighting. Understanding how PROC TABULATE summarizes and nests is key to your success in using PROC TABULATE to traffic light your reports. While the same concepts carry through PROC PRINT, PROC TABULATE and PROC REPORT, the complexity and syntax to implement traffic lighting vary considerably.

PROC REPORT

PROC REPORT, like PROC PRINT and PROC TABULATE, allow the SAS® programmer to customize output with procedure level styles. The syntax varies somewhat from what we have seen above. For example, to add an the Abt logo shown above to PROC REPORT output:

```
Proc report data=tempdata nowd split='' style=[preimage='abtlogo.gif'];
```

Note that in this case I am using a GIF file rather than a JPEG file, as my destination in this case was HTML output rather than RTF. It is also possible to insert postimage files in the same manner.

To apply images to specific cells using proc report:

```
Compute sales;
  If lastsale ne . then do;
    If sales.sum gt lastsale
      then call define(_col_, 'style', 'style=[foreground=green preimage='smiley.gif']');
    Else if sales.sum lt lastsale
      then call define(_col_, 'style', 'style=[foreground=red preimage='frown.gif']');
  End;
```

Note that the style option in PROC REPORT can be used in the PROC REPORT statement, a DEFINE statement, a CALL DEFINE statement, a BREAK/RBREAK statement, or COMPUTE statement. As with PROC TABULATE, traffic lighting is generally desired on a table cell level. For the most part, this will happen in a CALL DEFINE or DEFINE statement. To apply a user-defined format to cells in PROC REPORT:

```
Define sales / analysis 'Sales' sum right style(column)=[background=saleslev.];
```

This will produce a different background color as specified by the format saleslev for the sum of sales.

As with PROC TABULATE, the greater your familiarity with the REPORT procedure, the greater your ability to manipulate styles to “traffic light” your output. There are many opportunities in this powerful procedure to explore and enhance your presentations with.

PROC FORMAT

It is important to note that you can use standard SAS® formats within your user-defined formats. You could, for example, use SAS® date ranges in your formats. This might be useful, for example, in tracking late credit card payments in a very visible way. Don't let the words “user-defined” intimidate you! There are numerous excellent papers written on the power of PROC FORMAT which are worth a second, and third look. Nested formats, embedded HTML references, etc. can all be utilized in your efforts to enhance your presentations with traffic lighting.

TRAFFIC LIGHTING IN THE BIG PICTURE

Traffic lighting is a single component of the overall reporting picture, and must be considered in context. SAS® provided styles and tagsets are also integral to the “look and feel” of a report, and can sometimes conflict with procedure level styles defined by the SAS® programmer. While it is not necessary to produce custom tagsets or styles in order to use the traffic-lighting examples shown above (indeed, I took pains to use some standard SAS® provided tagsets and styles), the interaction between the various components must be considered to achieve the goal of effective traffic-lighting. For example, using a background to traffic light might have unexpected results in a style with a colored background that either clashes or coincides with one or more of the colors used in the high-lighting! The bottom line (green light) is to experiment, have fun, and see what traffic lighting can do for YOUR reports.

REFERENCES

SAS® Online Documentation (PC SAS V8.2, AIX UNIX SAS V8.2, PC SAS V9.1)

SAS® Institute Inc., *The Complete Guide to the SAS® Output Delivery System*, Version 8, Cary, NC: SAS® Institute Inc., 1999. 310 pp.

<http://support.sas.com/rnd/base/index-ods-resources.html>

ACKNOWLEDGMENTS

Lauren Haworth, author of the definitive books "PROC TABULATE By Example" and ODS By Example.

Ray Pass, Dan Bruns and Sandy McNeill, tireless promoters of "doing it in style" with both PROC REPORT and PROC TABULATE

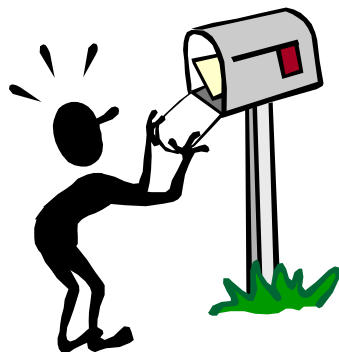
Lois Levin and Bruce Gilsen, authors of very useful papers on PROC FORMAT

SAS® and all other SAS® Institute Inc. product or service names are registered trademarks or trademarks of SAS® Institute Inc. in the USA and other countries. ® indicates USA registration. Other brand and product names are registered trademarks or trademarks of their respective companies.



CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:



Louise Hadden
Abt Associates Inc.
55 Wheeler St.
Cambridge, MA 02138

Work Phone: 617-349-2385
Fax: 617-349-2675

Email: louise_hadden@abtassoc.com

KEYWORDS

SAS®; ODS; PROC TABULATE; PROC REPORT; PROC PRINT; STYLE; TAGSET; TRAF-
FIC LIGHTING

