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**Creating Reports that Comply with Section 508 Using SAS® 9.4:
Planning Is the Most Important Step**

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ABSTRACT

When reports need to meet Section 508 and other accessibility compliance requirements, those needs are often only addressed in the last stages of creating and designing reports. At that point in the process, decisions have already been made that either limit the ability to make reports accessible or require significant revisions to output that has already been designed and generated. The result is a report that either does not fully meet accessibility requirements or that requires a significant investment in additional resources to fix the problem. This session details the issues report authors need to consider before they write their first line of code when planning for how they will create and deliver their report. This includes the technologies they choose to use (for example, HTML vs. PDF vs. Microsoft Excel), the way data is presented in both tabular and graph form, and what technologies and techniques are available in the SAS® 9.4M6 Output Delivery System (ODS) to achieve these goals. The end result is that the often tedious act of remediating for accessibility turns into an easy task that emerges naturally as you create reports.

INTRODUCTION

What are the issues that SAS report authors need to consider when creating electronic content in order to meet accessibility requirements? Many times, we create reports and then at the last stage ask, "What do I have to do to make it meet accessibility requirements?" All too often decisions that had already been made in creating the report generate additional challenges in making the content accessible. This paper will detail some of the most common decisions that have a significant impact on the ability to make electronic content accessible.

FILE FORMATS

The file format you choose is the single most important decision you will make in terms of how accessible a particular report is. File formats vary in two main aspects in regard to accessibility.

1. What accessibility features does a file format support?
2. How easily can a particular file format be made accessible?

Another way to think about this is that almost any file format can be accessible. However, the more complex you make a report, the less particular formats are going to be able to present your report in accessible ways.

What makes a report complex? Here are the items that are found in most reports, from the most basic to the more complex.

1. Plain unformatted text (prose, not tabular data)
2. Formatted text (headings, bulleted lists, etc.)
3. Simple tabular data (single column and/or row of headers)
4. Complex tabular data (multiple headers, spanned headers, and so on)

5. Images (non-graphs)
6. Graphs

Reports will include most if not all of these components, especially the most complex content type – graphs. Because of this the ideal formats become quickly limited. For accessibility purposes, you can classify the ODS destination types into two groups: general formats and specialized formats.

GENERAL FORMATS

These file formats are used for most reports that contain multiple types of content, such as tables, graphs, and prose. This list is ranked from the formats with the most accessibility support to the least, although any of these formats can be made fairly accessible.

1. HTML5
2. EPUB
3. PDF
4. Microsoft Word

SPECIALIZED FORMATS

ODS also enables you to create more specialized formats as well, usually for specific purposes.

- Excel
- PowerPoint

Both of these formats can be made accessible, but they have limitations in the types of content that they can present accessibly. These limitations are detailed in a later section.

FORMATS TO AVOID

There are some formats that are so limited in their accessibility features that for the purpose of meeting Section 508 or other accessibility requirements they should be avoided.

- RTF
- Listing

ODS DESTINATIONS

HTML5

HTML5 provides the most accessible and flexible file format for supporting accessibility. HTML5 content works well with all assistive technologies. If you want to create a very complex report beyond the basics, because SAS lets you define the HTML that is output along with including any CSS and JavaScript you want, you have complete control over making even the most advanced report accessible.

One huge accessibility advantage HTML5 has over all of the other formats is its ability to integrate with SAS Graphics Accelerator. This is a Chrome extension that provides alternative presentations of data visualizations to people with visual impairments. **HTML5 is the only file format that supports integration with SAS Graphics Accelerator.**

EPUB

If you have never heard of EPUB, it is an ebook format that uses HTML5 behind the scenes to display each page of content. Since it uses HTML5, EPUB also gains all of the accessibility

benefits of HTML5. However, SAS Graphics Accelerator will not work with EPUB readers. It might also be harder to edit EPUB content after SAS produces it.

PDF

PDF files can be made very accessible. The biggest downside to PDF files is that you can create your report in such a way that SAS cannot automatically make it accessible. In those cases, you have to add extra accessibility information to the document with Adobe Acrobat. That process is tedious and requires a specialized skill set. To get the most accessible PDF possible from SAS, you need to use SAS 9.4, Maintenance Release 6 (9.4M6).

Word

ODS 9.4M6 enables you to create Microsoft Word documents as a preproduction feature. For the most part the level of accessibility between Microsoft Word and PDF formats are equivalent. The biggest difference is in what accessibility information you are able to add into the document after SAS creates it if additional work is needed. Many of the post-processing features available in PDF documents are not available in Microsoft Word. However, the post-processing changes that can be made in Word are significantly easier to make than they are in PDF.

Excel

Excel files can be very accessible, but only under tight constraints. When presenting tabular data, there should only be one row and/or column of headers. There should also not be any merged cells. Only one data table can be presented per sheet. Free text, like headings and prose generally should not be used in Excel sheets. If you include graphs, they should be on their own sheet and have alternative text. In short, an Excel file can be very accessible if it is used for sharing raw data or presenting simple layouts of tabular data, one table per sheet.

PowerPoint

PowerPoint files generated from SAS can be very accessible, but just as with Excel, there are some constraints. Tables on slides should contain only one row and/or column of headers. Due to the physical size of the slide, tables are pretty limited in how large they can be. There should also not be any merged cells. Additionally, graphs and images must have alternative text.

RTF

RTF files do not support headings, table headers, or alternative text for images. There are essential components to accessibility that it cannot support.

Listing

The plain text produced in the Listing destination does not actually define tables but uses spaces to make items visually look like a table. This is not a suitable destination to support accessibility.

THE LAYOUT OF THE REPORT

A primary concern in designing a report is how to divide the sections of the report, and what elements you use to denote those separations. You can use PROC ODSTEXT and the HEADING statements to define a logical structure of heading levels, much like an outline. A problem occurs when other types of text elements get used to serve the purpose of visual headings, but they don't actually convey semantic heading information to the user. Text is simply styled to be bigger, bolder, and use more whitespace. The most common occurrence of this problem is the use of the TITLE statement. The TITLE statement does make text that

appears, to sighted readers, to serve as a heading for a section of content. However, TITLE statements do not get converted to heading levels within any of the destinations. In those cases, you need to use PROC ODSTEXT and the HEADING statement to ensure the text serving as the beginning of a section is conveyed to screen reader users as a sectional heading.

PRESENTING TABULAR DATA

Most SAS tabular output can be made accessible fairly easily if it is not already accessible. PROC PRINT, PROC TABULATE, PROC REPORT, and the Report Writing Interface in the DATA step all provide methods for creating accessible tables. However, even with all of the accessibility capabilities of these procedures, there are still aspects to table design that you must properly plan for.

Do not add non-data elements to a table

There are a multitude of ways you can make a SAS table inaccessible due to presenting non-tabular information inside of the table structure. The commonality among all of these techniques is usually freeform text or blank lines that are placed in table cells for formatting reasons. Sometimes this is done to provide more visual separation between subsets of data. Sometimes it is done to provide contextual notes for a set of data.

Team at the End of 1986	Player's Name	Home Runs in 1986	Hits in 1986
Atlanta	Thomas, Andres	6	81
	Horner, Bob	27	141
	Sample, Billy	6	57
	Murphy, Dale	29	163
	Hubbard, Glenn	4	94
	Oberkfell, Ken	5	136
	Moreno, Omar	4	84
	Virgil, Ozzie	15	80
	Ramirez, Rafael	8	119
	Harper, Terry	8	68
Simmons, Ted	4	32	
Baltimore	Wiggins, Alan	0	60
	Ripken, Cal	25	177
	Murray, Eddie	17	151
	Lynn, Fred	23	114
	Rayford, Floyd	8	37
	Beniquez, Juan	6	103
	Bonilla, Juan	1	69
	Dwyer, Jim	8	39
	Shelby, John	11	92
	Traber, Jim	13	54
	Lacy, Lee	11	141
	Sheets, Larry	18	92
	Young, Mike	9	93
	Dempsey, Rick	13	68
O'Malley, Tom	1	46	
Boston	Buckner, Bill	18	168
	Baylor, Don	31	139

Figure 1. Table with Blank Rows between Sections of Data

Make	Model	Type	MSRP	Invoice	Horsepower
Honda	Civic Hybrid 4dr manual (gas/electric)	Hybrid	\$20,140	\$18,451	93
	Insight 2dr (gas/electric)	Hybrid	\$19,110	\$17,911	73
	CR-V LX	SUV	\$19,860	\$18,419	160
	Element LX	SUV	\$18,690	\$17,334	160
	Civic DX 2dr	Sedan	\$13,270	\$12,175	115
	Civic HX 2dr	Sedan	\$14,170	\$12,996	117
	Civic LX 4dr	Sedan	\$15,850	\$14,531	115
	Accord LX 2dr	Sedan	\$19,860	\$17,924	160
	Civic EX 4dr	Sedan	\$17,750	\$16,265	127
	Civic Si 2dr hatch	Sedan	\$19,490	\$17,849	160
Note: These totals only reflect United States sales					

Figure 2. Table with Non-Data Rows at the Bottom

Do not create "multiple tables" within a single table

Sometimes when we have data that we want to present in different subsets we often present these different sections within the same table. A common occurrence of this is providing summary information (a subtotal) between each of these sections, but the summary information breaks the pattern of how each cell relates to already defined column headers.

Make	Model	Type	MSRP
Chevrolet	Tracker	SUV	\$20,255
	Cavalier LS 2dr	Sedan	\$16,385
	Malibu 4dr	Sedan	\$18,995
	Malibu LS 4dr	Sedan	\$20,370
	Colorado Z85	Truck	\$18,760
	Silverado 1500 Regular Cab	Truck	\$20,310
		Subtotal	\$115,075
Chrysler	PT Cruiser 4dr	Sedan	\$17,985
	Sebring 4dr	Sedan	\$19,090
		Subtotal	\$37,075
Dodge	Stratus SXT 4dr	Sedan	\$18,820
	Stratus SE 4dr	Sedan	\$20,220
	Dakota Regular Cab	Truck	\$17,630
	Dakota Club Cab	Truck	\$20,300
	Ram 1500 Regular Cab ST	Truck	\$20,215
		Subtotal	\$97,185
Ford	Focus SVT 2dr	Sedan	\$19,135

Figure 3. Table with Multiple Sections, but Heading Structure is Broken

In this case there are two potential solutions:

1. Make each section its own table.
2. Remove the blank lines and move the "Subtotal" label to the left-most column where the headers are defined.

The following guidelines will help ensure that your tables are accessible:

- There should be no blank lines or other lines inserted into the table for formatting reasons.

- If non-tabular data is inserted into the table, such as a summary statistic line (sub-total), ensure that the header for that row is defined properly.
- General notes about the table are stored outside of the table, not within the rows of data.

Do not use color as the only means of conveying information

This problem most often occurs when traffic lighting data. Certain values in cells or rows will force the color of the item to change to indicate additional information about the item, such as one row being a "high value" and another row being a "low value". Because this additional information is only conveyed through color, people who cannot perceive color cannot understand this information. When traffic lighting data, the simple technique for making it accessible is to provide text or an image along with the color to also indicate this information.

Middle East	Boot	45	\$171,282	\$3,648
	Men's Casual	64	\$2,058,254	\$30,783
	Men's Dress	71	\$839,571	\$11,489

Figure 4. Traffic Lighting with Color Alone

Middle East	Boot	45	\$171,282	\$3,648	\$
	Men's Casual	64	\$2,058,254	\$30,783	\$\$\$
	Men's Dress	71	\$839,571	\$11,489	\$\$

Figure 5. Traffic Lighting with Color and Icons

For detailed techniques for creating accessible tables you can refer to the online documentation at "Creating Accessible SAS® 9.4 Output Using ODS and ODS Graphics" or the SAS Global Forum paper "The Incredible, Accessible Report: Creating PDF Reports that Meet Compliance Standards in SAS® 9.4M6", both of which are referenced in the Appendix. Note, even though the Global Forum paper is about creating PDF files, the table output techniques apply equally to the HTML5 destination.

PRESENTING GRAPHS

Graphs contain a lot of information, and describing all of that information in plain text adequately to people who cannot see the graph can be challenging. To provide access to these graphs for users with visual impairments, SAS has developed SAS Graphics Accelerator. SAS Graphics Accelerator enables users with visual impairments or blindness to create, explore, and share data visualizations. It supports alternative presentations of data visualizations that include enhanced visual rendering, text descriptions, tabular data, and interactive sonification. Sonification uses non-speech audio to convey important information about the graph. All of these modes of interaction provide a very rich environment for exploring data. **SAS Graphics Accelerator works only with the HTML5 destination with the ACCESSIBLE_GRAPH option specified, and graphs must be generated from the ODS Graphics procedures.**

When choosing a file format to use, the only way to provide this level of accessibility for graphs is to use the HTML5 destination. You can still provide plain text descriptions of graphs as alternative text in destinations like PDF, Excel, PowerPoint, and Word using the

DESCRIPTION option on PROC SGPLOT. This can often be sufficient to meet the letter of the law in terms of accessibility, but in terms of truly providing an equitable experience to all users, SAS Graphics Accelerator with the HTML5 destination is unparalleled in terms of what it provides.

CONCLUSION

By planning how data will be presented before writing any code, you can more easily design your reports to be accessible.

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