

ANALYSIS OF U.S. SENATE WEB SITES FOR DISABILITY ACCESSIBILITY

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ABSTRACT

U.S. federal government web sites have increased significantly the level of services and information offered to various internal and external stakeholders. The Workforce Investment Act of 1998 amended Section 508 of the Rehabilitation Act of 1973, which complemented the intent and aims of the 1990 Americans with Disabilities Act (ADA). As a result, federal agencies and departments were mandated to provide disabled stakeholders with access to key information from federal web sites. However, since this enactment, some federal web sites still do not meet fully the legal requirements to accommodate users with disabilities. Additionally, web sites of members of the U.S. Congress technically do not fall under regulation. Without regulation, non-adherence to accessibility standards by congressional web sites may result in poor or ineffective utilization by citizen consumers or other stakeholders with disabilities. The purpose of this study is to examine the accessibility statistics for a pseudo-random sample of 50 web sites of U.S. Senators. The main web page of each site was evaluated with an online web site analysis software tool – Truwex. Three factors were used to gauge the level of accessibility: criteria based on Section 508, WCAG 1.0 standards, and WCAG 2.0 standards. Results suggest that the vast majority of the U.S. Senate web sites do not meet the federal legal guidelines that otherwise are imposed on other U.S. governmental agencies and departments. Many of the sites contain consistent patterns of non-compliance, and some minor changes could result in increased accessibility for disabled stakeholders.

Keywords: *Web Content Accessibility Guidelines (WCAG), U.S. Senate, W3C, Truwex, e-government, Human Computer Interaction (HCI), Workforce Investment Act, Section 508, Rehabilitation Act, Americans with Disabilities Act (ADA)*

1. INTRODUCTION

Individuals with disabilities are experiencing increased opportunities for access to online information and online commerce. Although web site designers have given increased access to disabled web patrons, practical usability of many web sites remains problematic. Several initiatives have increased internet accessibility for disabled Internet users. For example, international standards groups such as the World Wide Web Consortium (W3C) have created standards for developers when building web sites to improve web accessibility for disabled web users. A multitude of U.S. laws requires that Internet web sites of federal agencies and departments be accessible to disabled individuals. However, even with enactment of laws and adoption of industry standards, uniform compliance among the three branches of the U.S. government has not been assured.

This lack of uniform compliance becomes noticeable when U.S. citizens suffering from disability regularly access the Internet. According to the U.S. Census Bureau, more than 41.3 million Americans live with some form of disability. Of these, 29% access the Internet (Americans with Disabilities, 2008). Thus, a significant number of the disabled U.S. population might require assistive technology when accessing Internet web sites, and specifically, U.S. governmental web sites. Additionally, the U.S. government, through the E-government Act of 2002 (P.L. 107-347), has increased utilization of the Internet as a primary means of distribution of key information for U.S. citizens. Through a variety of sources, Jaeger (2004) shows that Internet users not only seek information from e-government web sites, but they also expect to find the information for which they are seeking.

2. LITERATURE REVIEW

The modern requirement that government-maintained Internet sites should be adequately accessible by disabled persons has a long and winding history. Its legal origin can be found in the Rehabilitation Act of 1973, which predates considerably the creation of today's World Wide Web. Section 504 of The Rehabilitation Act specifically forbade a "qualified handicapped individual in the United States... be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance" (Rehabilitation Act of 1973). Due to the increase in electronic access to government data, Congress amended the Rehabilitation Act by adding Section 508, titled "Electronic Equipment Accessibility" (U.S. Department of Justice, 2000). This amendment effected the development of "guidelines for the Federal Government's procurement of accessible electronic equipment" (U.S. Department of Justice, 2000).

The American with Disabilities Act of 1990 and further advancements in electronic access to data caused Congress to significantly update Section 508 of the Rehabilitation Act, resulting with the passage of the Workforce Investment Act of 1998, which President Bill Clinton signed into law. The Workforce Investment Act updated the Rehabilitation Act of 1973, focusing particularly on Section 508 of the Rehabilitation Act. The updated law requires Executive agencies and departments of the U.S. government to procure "electronic and information technology" to make federal web sites accessible to individuals with disabilities comparable to the access and use of the same information and data enjoyed by those who are not disabled (Atwater, 2003). These requirements, however, apply to all Executive agencies and departments only, thus explicitly excluding the Congress and Judiciary from Section 508 coverage (Rehabilitation Act of 1973, as amended).

Subsequently in 2001, federal regulations were finalized and promulgated by the Access Board, a regulatory body established through the Architectural Barriers Act of 1968 (42 U.S.C.A. § 4151 et seq.). These set forth standards for the procurement of accessible electronic and information technology. These governmental regulations and guidelines, along with private standards created by the World Wide Web Consortium (W3C), have created the framework of various standards for accessibility (Thatcher, 2008). A comprehensive review of the variety of federal laws and regulations also can be found in Jaeger (2004). He concludes that "the discussions of the accessibility of e-government, thus far, attempt neither to explore the requirements of and relationships between these laws in detail nor to assess Web sites in relation to the entire spectrum of accessibility requirements" (Jaeger, 2004, p. 521).

In May 1999, the Web Content Accessibility Guidelines (WCAG) version 1.0 was approved as a recommended accessibility standard for web design. "Recommended" status by the W3C is considered equivalent to "standards" adopted by other similar organizations (W3C (a), 2009). This standard is comprised of a series of 14 guidelines, each having one or more checkpoints as a basis for conformance to the standard. Each checkpoint is assigned a priority to determine the impact on accessibility (W3.org, 2008). There are three priority checkpoint levels in WCAG 1.0 (W3C (b), 1999): 1) Priority 1 checkpoints must be satisfied; these are the minimum acceptable requirements; 2) Priority 2 checkpoints, where web developers should satisfy these requirements; and 3) Priority 3 checkpoints, where web developers may address these requirements.

The World Wide Web Consortium (W3G) recently completed an updated standard, WCAG 2.0. This version applies more generally to various web technologies and is written broadly to incorporate future changes in technology. WCAG 2.0 is organized around guidelines with criteria similar to WCAG 1.0; most web sites that already conform to WCAG 1.0 should not require significant changes to conform to WCAG 2.0 (W3.org, 2008). The recommended version (W3G's final status, similar to "standards" in other organizations) was finalized and published on December 11, 2008 (W3C (a), 2009).

Although awareness of accessibility issues is critical to meet the needs of disabled users, there appears to be a lack of understanding in: 1) the reasons for applying specific accessibility elements and 2) knowledge of how developers should implement them effectively (Brophy & Craven, 2007, p. 968). This lack of knowledge and understanding has resulted in few government web sites that fully comply with laws or the WCAG standards. For example, Sligar & Zeng (2008) evaluated 80 U.S. state government vocational sites and found a much higher compliance (91%) with "Priority 1" test checkpoints, although they only tested each home page and not all logical linked pages for each web site. The authors

suggested that this result could have occurred due to agencies' sensitivity to their primary web stakeholders, while the audience for federal congressional sites typically is more diverse. Hackett, Parmanto and Zeng (2005) performed a longitudinal study between 1997 and 2002 showing that as web sites and technology became more complex, the level of accessibility typically decreased.

Ellison (2004) analyzed 50 U.S. government web sites' home pages using two different software accessibility tools: "Bobby" and "Cynthia Says." Results from the "Bobby" tool demonstrated only 22% compliance with Section 508 requirements. Analysis results on the same web sites by applying the "Cynthia Says" tool demonstrated a higher level of Section 508 compliance at 42%. Findings from Ellison (2004) suggest that the internal testing criteria for different web accessibility tools can produce different results, so care should be taken when analyzing and interpolating results from any single web accessibility tool. A similar application of the "Bobby" accessibility tool to Fortune 500 companies found that only 24% of home web pages passed initial accessibility tests on "Priority 1" issues (Guitierrez & Windsor, 2005).

Jaeger (2008) researched a variety of government web sites for accessibility and found that there exists a variety of user-centered evaluation methods that government site developers could use in universal design. Jaeger recommended that web designers create sites that are accessible to all users from the outset, rather than attempting to make them accessible after implementation.

Kuzma and Price (2009 in press) provide evidence of similar challenges in the United Kingdom and demonstrated how software tools could be utilized to evaluate web site compliance with both governmental regulations and the WCAG web accessibility standards. They analyzed 130 web sites of members of the U.K. House of Commons with the Truwex software package. Results indicated that only 7 out of 130 web sites passed the Truwex WCAG 2.0 standards with no failures, and only 30 web sites passed the Truwex WCAG 1.0 standards with no failures. Detailed results from those analyses promoted creating specific recommendations for improvement (Kuzma & Price, 2009).

3. METHODOLOGY

Fifty web sites of members of the U.S. Senate were analyzed to determine their adherence to federal regulations. First, the Truwex web site analysis tool was reviewed to determine its applicability to measure web site accessibility and meet the objectives of this research. In the second phase, the web homepages of 50 U.S. Senators were pseudo-randomly selected and analyzed with the Truwex online accessibility software tool to determine if the sites met WCAG and Section 508 standards.

The Truwex web site compliance tool is one of several web accessibility testing tools that web designers utilize to test web pages against industry standards and legal requirements. It is capable of a wide variety of analyses including: 1) U.S. Section 508, 2) WCAG 1.0 and 2.0, 3) web analytics validation, and 4) Childrens Online Privacy Protection Act (COPPA) (Erigami (a), 2008). Detailed compliance reports are generated by Truwex including analyses on single or multiple compliance standards, pass/fail status of specific criteria, and counts on the frequency of errors or warnings per page. (Erigami (a), 2008).

Researchers should be aware of key limitations of the online Truwex analysis software. Truwex is robust in analyzing various accessibility issues against standards, but the color/background combinations are not a perfect fit for the WCAG 2.0 Luminosity Contrast Formula (Website QA & Tools, 2008). Additionally, although Truwex supports a variety of web browsers including Firefox and MS Internet Explorer, utilization of other browsers, such as Opera, might not be possible (Popov, 2008). Information at the Truwex web site recommends MS Internet Explorer version 6 or 7 (Erigami (c), 2009).

During the summer of 2008, prior to changes in the composition of Congress from the November 2008 elections, 50 U.S. Senators' web sites (homepages only) were chosen pseudo-randomly from a list of the 100 members of the U.S. Senate, as found at <http://www.senate.gov>. Since each U.S. state has two Senators, one Senate member from each state was chosen randomly for evaluation. U.S. Senators' web sites were chosen for evaluation because they often are considered to be federal web sites, despite not technically falling under the auspices of Section 508 of the updated Rehabilitation Act of 1973. To

suggest an important point, U.S. Senators' web sites were evaluated to determine if the content owners of those web sites adhere to the laws under which other U.S. departments and agencies must abide.

The Truwex web accessibility tool was applied using web-based functions. The Uniform Resource Locator (URL) for each Senator's primary web page was entered directly into a text box on the Truwex web site. After entering the web site's homepage URL, several web quality standards were selected to evaluate each web site: 1) Section 508, 2) WCAG 1.0, and 3) WCAG 2.0 (Erigami (b), 2008). Other criteria were available to analyze each web site, but only these three evaluation sets were utilized for this study. For this study, Truwex was used to analyze only the homepage of each site, and it generated a diagnostic report including the number of detected issues and warnings where each site was not in compliance with specific accessibility standards. "Issues" were defined by Truwex as serious non-compliance problems that should be fixed to meet compliance with the standards. "Warnings" were informational messages about potential problems (Erigami (d), 2008).

Two of the randomly selected web sites could not be evaluated using the online version of Truwex. The software could not process the URL for Senator Isakson (Georgia), so the site for Senator Chambliss (Georgia) was substituted. Also, Truwex gave several timeout processing error messages for the URL entry for Senator Menendez (New Jersey), so the web homepage for Senator Lautenberg (New Jersey) was analyzed instead.

4. RESULTS

Table 1 shows a summary of the accessibility tests that were applied to 50 U.S Senators' homepage web sites on September 1, 2008. The table's first two columns show which state each U.S. Senator represents, followed by the specific web site URL that was tested. The remainder of the data table is divided into three parts: 1) Section 508 result statistics, 2) WCAG 1.0 results, and 3) WCAG 2.0 results. Beneath each of these three main sections includes subset results for: 1) overall criteria fail/pass for the web page, 2) the number of "Issues" on the web page, and 3) the number of "Warnings" on the web page. For each combination of test criteria and page, results show if the site failed ("F") or passed ("O") the accessibility analysis. Additionally, the number of serious "Issues" and less critical "Warnings" are also shown for the combination of each type of accessibility test applied to each web site homepage.

Of the 50 web pages evaluated with the Truwex software, only two, Harkin (Iowa) and Tester (Montana), fully passed the Section 508 and WCAG 1.0 accessibility criteria with no major "Issues". All other sites had some number of Issues with either Section 508 criteria or WCAG 1.0 criteria. The average web homepage produced 2.88 standards "Issues", and 5.58 "Warnings" from the Section 508 analysis.

Based on Truwex results from testing the WCAG 1.0 standards, six of the 50 web sites met the standard with no major "Issues": a) Harkin (Iowa), b) Tester (Montana), c) Reed (Rhode Island), d) Bennett (Utah), e) Webb (Virginia) and f) Murray (Washington). The average web site had 2.28 "Issues", and 8.38 "Warnings". WCAG 2.0 standards produced the poorest compliance based on the Truwex analysis tool. All 50 web sites failed this check with averages of 5.08 Issues per web site and 11.8 warnings per web site.

The detailed reports for the 50 Senators' web pages produced a large variety of errors and warnings associated with each of the three standards. However, the most common errors consistently were related to the same challenges: 1) Missing alternative (alt) tags, 2) Clickable images without alt tags, 3) Low contrast text, and 4) Device-dependent event handlers.

TABLE 1. ACCESSIBILITY RESULTS FOR FEDERAL SENATE WEB SITES

St	Site	Section 508			WCAG1			WCAG2		
		F/O	Iss	Warn	F/O	Iss	Warn	F/O	Iss	Warn
AL	http://sessions.senate.gov/public/	F	5	6	F	5	10	F	6	14
AK	http://murkowski.senate.gov/public/	F	3	7	F	3	10	F	5	12
AZ	http://kyl.senate.gov/	F	1	6	F	1	4	F	5	9

AR	http://lincoln.senate.gov/	F	3	6	F	1	8	F	7	12
CA	http://boxer.senate.gov/	F	5	5	F	4	8	F	5	13
CO	http://allard.senate.gov/public/	F	5	5	F	4	8	F	5	11
CT	http://dodd.senate.gov/	F	3	5	F	3	8	F	4	12
DE	http://biden.senate.gov/	F	2	6	F	2	10	F	3	12
FL	http://billnelson.senate.gov	F	4	5	F	3	8	F	5	12
GA	http://chambliss.senate.gov/public/	F	5	7	F	4	10	F	7	15
HI	http://inouye.senate.gov/	F	4	4	F	4	7	F	4	14
ID	http://crapo.senate.gov/	F	4	6	F	4	8	F	9	10
IL	http://durbin.senate.gov/	F	5	6	F	4	10	F	6	13
IN	http://bayh.senate.gov/	F	2	6	F	2	10	F	5	13
IA	http://harkin.senate.gov/	O	0	5	O	0	8	F	4	9
KS	http://brownback.senate.gov/	F	4	6	F	3	8	F	4	12
KY	http://mcconnell.senate.gov/	F	1	5	F	1	8	F	1	11
LA	http://vitter.senate.gov/	F	2	5	F	2	8	F	8	11
ME	http://snowe.senate.gov/public/	F	4	5	F	3	8	F	9	11
MD	http://cardin.senate.gov/	F	3	6	F	2	10	F	4	13
MA	http://kerry.senate.gov/	F	2	6	F	1	8	F	7	11
MI	http://levin.senate.gov/	F	2	5	F	1	8	F	3	10
MN	http://klobuchar.senate.gov/	F	3	6	F	2	9	F	4	12
MS	http://cochran.senate.gov/	F	4	5	F	3	8	F	5	12
MO	http://mccaskill.senate.gov/	F	2	6	F	2	10	F	6	14
MT	http://tester.senate.gov/	O	0	6	O	0	10	F	3	12
NE	http://bennelson.senate.gov/	F	5	6	F	3	7	F	6	11
NV	http://ensign.senate.gov/	F	4	6	F	4	10	F	6	14
NH	http://sununu.senate.gov/	F	1	5	F	1	4	F	2	10
NJ	http://lautenberg.senate.gov/	F	1	6	F	1	8	F	3	11
NM	http://bingaman.senate.gov/	F	3	5	F	2	8	F	5	12
NY	http://schumer.senate.gov/	F	3	6	F	2	4	F	6	10
NC	http://dole.senate.gov/public/	F	2	5	F	2	8	F	6	12
ND	http://conrad.senate.gov/	F	2	6	F	1	8	F	5	12
OH	http://brown.senate.gov/	F	2	6	F	2	10	F	2	12
OK	http://coburn.senate.gov/public/	F	3	6	F	2	10	F	6	14
OR	http://wyden.senate.gov/	F	2	5	F	2	8	F	7	12
PA	http://casey.senate.gov/	F	3	6	F	3	10	F	3	13
RI	http://reed.senate.gov/	F	1	3	O	0	8	F	2	11
SC	http://lgraham.senate.gov/public/	F	3	5	F	3	8	F	7	9
SD	http://thune.senate.gov/public/	F	4	6	F	4	10	F	5	12
TN	http://corker.senate.gov/public/	F	6	6	F	4	10	F	4	13
TX	http://hutchison.senate.gov/	F	3	5	F	2	8	F	4	11
UT	http://bennett.senate.gov/	F	1	6	O	0	8	F	7	12
VT	http://leahy.senate.gov/	F	5	5	F	4	7	F	6	10
VA	http://webb.senate.gov/	F	1	6	O	0	8	F	6	13
WA	http://murray.senate.gov/	F	1	4	O	0	7	F	5	11
WV	http://byrd.senate.gov/	F	2	7	F	2	10	F	6	12
WI	http://kohl.senate.gov/	F	3	6	F	2	8	F	6	10
WY	http://enzi.senate.gov/public/	F	5	6	F	4	10	F	5	13

Additionally, data was collected on the tenure of each member in the U.S. Senate whose homepage web site was tested. Results from simple correlation analyses found no statistically significant relationships between the Senators lengths of tenure and number of "Issues" or "Warnings" for any of the three sets of accessibility criteria.

5. IMPLICATIONS AND RECOMMENDATIONS FOR WEB DESIGNERS

Results from this research demonstrated that the vast majority of these U.S. Senators' web sites do not meet either Section 508 federal law on accessibility requirements or WCAG 1.0 or 2.0 standards. Although the number of Issues and Warnings was overwhelming, several of the errors were consistent

across most of the sites. The two Issues that appeared in most of the analysis reports were: 1) missing alternative (alt) tags, and 2) clickable images without alt tags. In web site development and implementation, alt tags are used to enhance the content of a digital image or picture. Alt tags allow visually impaired web users to understand the meaning of images via screen-reading assistive devices that decode the imbedded alt tag information. Additionally, a non-impaired web site user can benefit from alt tags by positioning the computer's cursor over the image and reading additional information about the posted image or picture.

Low contrast text warnings and issues impact web users having sight impairment. Typical examples might include: 1) blue text font positioned on a black colored background or 2) red text font positioned on a green colored background. The second example color combination, in addition to being low contrast, can be problematic for users who are colorblind. According to the Howard Hughes Medical Institute, approximately some 10 million American men (approximately 7% of the population) have some form of colorblindness (Montgomery, n.d.). Even though a colorblind user might be considered not visually impaired by traditional standards, adherence to the color contrast standards would greatly improve his ability to attain and process information presented on a web site.

A significant number of the Senators' web sites also had formal standards "Issues" with device-dependent event handlers such as "onmouseover", or "ondblclick". For a specific result to occur (such as the appearance of key information) the use of this imbedded code such as "onmouseover" would require that: 1) the web site user is capable of moving the mouse/cursor over a specific target area on the computer screen, 2) the user recognizes that the action is necessary, and 3) the web user has a mouse or similar computer input device. Disabled web users could possibly fail to recognize that the action is required, might not be able to utilize the necessary input device (mouse), or might not have a mouse device installed on her/his computer.

Developers of federal web sites can ensure greater accessibility by disabled individuals by using access compliance testing tools during web site development, before site implementation. Developers should use caution when utilizing automated software tools because some results can be misinterpreted and may not provide an entire view of web accessibility compliance (Brophy & Craven, 2007, p. 963). Specific recommendations follow a mixture of W3C guidelines and development methods including: 1) using semi-automatic testing tools for validation, 2) manual evaluation with standards for checkpoints and priority levels, and 3) user-testing of specific features using a group of individuals with a mixture of disabilities and abilities (Brophy & Craven, 2007, p. 964).

Like Brophy and Craven (2007), Jaeger (2008) recommends sites be tested by persons with disabilities during development rather than after implementation. Although researchers and good design practices both suggest that Internet web sites should be developed and tested prior to implementation, developers of the current U.S. Senate web sites could still improve accessibility to disabled patrons without negatively impacting ongoing usability of those web sites. First, web sites could be modified quickly and easily to include alt tags for images. These changes could be accomplished opportunistically when specific web site pages require routine updates. Periodically, developers could apply accessibility tests on their sites to determine other modifications that should be implemented to improve overall site usability.

Developers of these web sites should create plans to monitor their sites for accessibility compliance and develop processes for future web site development. Individual members of Congress and their staffs should review federal web accessibility laws and recommended standards, and recognize that web accessibility compliance benefits not only individuals with disabilities, but also the larger range of their constituents. This systematic continuous improvement approach would allow web site designers to create project plans that prioritize suggested improvements to their web sites.

6. CONCLUSIONS

This research has shown that a significant number of U.S. Senators' web sites do not meet the needs of disabled constituents and stakeholders as defined by Section 508, and standards WCAG 1.0 and WCAG 2.0. Additionally, members of the U.S. Senate have been responsible for the creation and passage of

Section 508 of the amended Rehabilitation Act of 1973. Section 508 requires that federal departments and agencies should meet minimum standards of accessibility to governmental web sites for individuals with disabilities, so that these individuals have access that is comparable to individuals without disabilities. Although Congress created and passed Section 508, Congress is not bound by it. Despite this, the web developers responsible for these U.S. Senators' web homepages could implement relatively simple changes to vastly improve web accessibility compliance when measured against Section 508 and web accessibility standards WCAG 1.0 and WCAG 2.0.

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