

**UNITED STATES ARCHITECTURAL & TRANSPORTATION
BARRIERS COMPLIANCE BOARD**

**ELECTRONIC AND INFORMATION TECHNOLOGY
ACCESSIBILITY STANDARDS**

ECONOMIC ASSESSMENT

**Prepared by the EOP Foundation
Washington, D.C.**

November 2000

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EXECUTIVE SUMMARY

Introduction

The purpose of this economic assessment is to discuss and, where possible, quantify the costs and benefits of the electronic and information technology accessibility standards issued by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board) under the authority of section 508 of the Rehabilitation Act Amendments of 1998. The standards are intended to improve the accessibility of electronic and information technology used by the Federal government. The standards will benefit Federal employees with disabilities, as well as members of the public with disabilities who seek to use Federal electronic and information technology to access information and services. The standards will be incorporated into the Federal Acquisition Regulations (FAR). Federal agencies, including the United States Postal Service, must comply with the standards when they develop, procure, maintain, and use electronic and information technology, unless an undue burden would be imposed on the agency. There is an exemption for national security systems. Failure of a Federal agency to comply with the standards when procuring electronic and information technology may result in an administrative complaint or a civil action seeking to enforce compliance with the standards.

The analysis for the final rule is, for all intents and purposes, identical to the analysis prepared in support of the proposed rule. The original analysis was a very broad estimate of the costs and benefits of the standards. None of the substantive changes made in the final rule were of sufficient magnitude to effect these estimates.

Need for Standards

The improvements in accessibility expected to result from the standards are intended to address three issues that may persist in the absence of the standards.

- Potential market failure that can arise because transaction costs of organizing persons with disabilities to send appropriate market signals to manufacturers of electronic and information technology for accessible products are too costly.
- Failure of the Federal government procurement system to place a value on accessible features when purchasing electronic and information technology.
- Civil rights issues that may call for a solution that goes beyond maximization of market efficiency.

By incorporating the standards into the FAR, the Federal government will be placing a very high value - limited only by the undue burden provision - on accessibility. By doing so, the potential exists that the government may purchase more accessibility than necessary to maximize economic efficiency. However, the civil rights benefits are difficult to capture using traditional economic techniques, as they represent improvements in equity considerations rather than improvements in efficiency.

Baseline of Federal Spending on Electronic and Information Technology

According to Office of Management and Budget (OMB), the Federal government spent \$37.6 billion on information technology in fiscal year 1999. The defense agencies appear to have the highest information technology budgets, while civilian agency information technology budgets are expected to increase rapidly. However, it is not possible to disaggregate this data in a manner that it is useful for purposes of this assessment. Instead, annual sales data collected from the General Services Administration (GSA) Federal Supply Service (FSS) for fiscal year 1999 were used to estimate Federal spending on electronic and information technology affected by the standards.

Using the GSA data, this assessment estimates that the Federal government spends approximately \$12.4 billion annually on electronic and information technology affected by the standards. This estimate likely understates the actual spending by the Federal government because agencies do not always make purchases through the GSA FSS. Thus any items that are purchased directly from suppliers are not accounted for in the GSA data. As a result, Federal expenditures for electronic and information technology affected by the standards may actually be higher than the GSA data would indicate. The degree to which the potential understatement of baseline spending leads to an understatement of the costs of the standards is unclear. Some components of the estimated costs of the standards rely heavily on Federal spending levels, while others do not. On the other hand, some portion of this \$12.4 billion is likely to reflect spending on electronic and information technology that will not be affected by the standards. For example, the GSA sales data include expenditures for wiring and file servers. Neither of these items will be affected by the standards. Thus, their inclusion may have the effect of overstating Federal expenditures on electronic and information technology affected by the rule.

The exact relationship between the OMB data and the GSA data is unclear because the products and services reflected in the two estimates are likely to be significantly different. OMB data on information technology obligations from fiscal years 1994 through 1998 were examined. Two scenarios were used to develop an upper and lower bound representing the proportion expected to be potentially affected by the standards. The average proportion of the total obligations for information technology potentially affected by the standards ranged between 25 percent and 50 percent. The \$12.4 billion estimate based on the GSA data falls within this range, representing 33 percent of the total fiscal year 1999 information technology obligations of \$37.6 billion. One

limitation of these ranges is that they are based on gross classifications of information technology obligations and do not provide the level of disaggregation necessary to parallel the GSA data. As a result, the two scenarios likely include expenditures on products and services that would not be affected by the standards to a higher degree than the GSA data.

Estimated Costs of Standards

Accessible versions of some electronic and information technology products, particularly computers and software, are available to satisfy the requirements of the standards. However, there are many products that will require modifications to meet the standards. The standards are to be applied prospectively and do not require agencies to retrofit existing electronic and information technology. The analysis includes discussions of both direct and opportunity costs associated with the standards. Major sources of cost include:

- Costs of modifying electronic and information technology to meet the standards.
- Training of staff, both Federal and manufacturers, to market, support, and use accessible products.
- Translation of documentation and instructions into alternative formats.

The direct costs that were quantified for this assessment based on fiscal year 1999 data are shown in Table ES-1. The total estimated costs to society range from \$177 million to \$1,068 million annually. The Federal proportion of these costs is estimated to range between \$85 million and \$691 million. The ability of manufacturers, especially software manufacturers, to distribute these costs over the general consumer population will determine the actual proportion shared by the Federal government. Assuming that the addition of accessible features adds value to the products outside the Federal government, we expect these costs to be distributed across society thereby setting a lower bound cost to the Federal government of \$85 million. If manufacturers do not distribute these costs across society, the upper bound of the Federal cost will increase to an estimated \$1,068 million.

These costs must be placed in appropriate context by comparing them with the total Federal budget. In fiscal year 1999, the Federal government spent \$1.703 trillion, of which \$37.6 billion was spent on information technology. By comparison, the lower and upper bound of the costs of the standards represent 0.01 percent to 0.06 percent of the total Federal budget, 0.23 percent to 2.8 percent of the amount spent on information technology.

Table ES-1 Estimated Costs

Electronic & Information Technology	Lower Bound Cost Estimates (millions)	Upper Bound Cost Estimates (millions)
General Office Software	\$ 110	\$ 456
Mission Specific Software	\$ 10	\$ 52
Compatible Hardware Products	\$ -	\$ 337
Document Management Products	\$ 56	\$ 222
Microphotographic Products	\$ 0.1	\$ 0.4
Other Misc. Products	\$ 0.2	\$ 1
Total Social Cost	\$ 177	\$ 1,068
Estimated Federal Proportion	\$ 85	\$ 691¹

Estimated Benefits of Standards

The benefits associated with the standards result from increased access to electronic and information technology for Federal employees with disabilities and members of the public with disabilities who seek to use Federal electronic and information technology to access information and services. This increased access reduces barriers to employment in the Federal government for persons with disabilities, reduces the probability that Federal workers with disabilities will be underemployed, and increases the productivity of Federal work teams. The standards may also have benefits for people outside the Federal workforce - both with and without disabilities - as a result of spillover of technology from the Federal government to the rest of society.

Two methods are presented for evaluating the quantifiable benefits of the standards. The first is a wage gap analysis that attempts to measure the difference in wages between the general Federal workforce and Federal workers with targeted and reportable disabilities. While this analysis is limited to white collar Federal workers due to data constraints, the potential change in productivity is measured by the difference between the weighted average salary for all white collar Federal workers and Federal workers with targeted and reportable disabilities. This assumes that an increase in accessibility will help diminish this wage gap by increasing worker productivity.

The alternative is a team based approach for measuring the productivity of Federal workers. This approach is based on the assumption that a Federal worker's wage rate reflects their productivity and the scarcity of their skills in the labor market. However, this may not apply to Federal wage rates, thus the average productivity of a Federal

¹ If manufacturers do not distribute the costs across society, the upper bound of the Federal cost will increase to an estimated \$1,068 million.

team is assumed to be equivalent to the average Federal wage rate. Based on this rate, it is assumed that the standards will produce an increase in productivity ranging between 5 percent and 10 percent. Since no data have been identified to support the increase in productivity in the team based approach, we have retained the wage gap analysis to represent the benefits generated by the standards.

The quantified benefits of the standards represent the value added by the standards in closing the wage gap between the general Federal workforce and Federal workers with targeted and reportable disabilities. Keeping in mind certain data limitations with this analysis that are explained further in Chapter 5, it is estimated that the benefits of the standards will produce a maximum upper bound benefit of \$466 million to Federal workers with disabilities. This figure does not account for benefits that may be accrued by the general public or other Federal workers due to spillover effects of the standards.

Table ES-2 Estimated Benefits

Productivity Increase	Aggregate Benefits Range (millions)
Lower Bound	\$ -
Upper Bound	\$ 466

Given the uncertainties associated with the estimates of the quantifiable costs and benefits in this analysis, it is not possible to conclude that the benefits are greater than the costs. However, there is significant overlap in the estimates of the quantified costs and benefits in the analysis, suggesting that there is a non-zero probability of such a state of affairs. All the civil rights benefits of the standards are not quantifiable. These nonquantifiable civil rights benefits are considerable and weighed heavily in Congress's initial enactment and strengthening of section 508, which require the standards to be issued.

CHAPTER 1

BACKGROUND

1.1 Overview

Section 508 of the Rehabilitation Act Amendments of 1998 requires the Architectural and Transportation Barriers Compliance Board (Access Board) to issue standards setting forth a definition of electronic and information technology, and the technical and functional performance criteria necessary to make such technology accessible to individuals with disabilities. The standards apply to each Federal agency, including the United States Postal Service, unless compliance would impose an undue burden on the agency. There is an exception for national security systems.

The purpose of the standards are to ensure that:

- Federal employees with disabilities have access to electronic and information technology used by the Federal government that is comparable to that of Federal employees without disabilities.
- Members of the public with disabilities have access to information and services provided to members of the public without disabilities through the use of Federal electronic and information technology.

For many types of electronic and information technology the standards focus on compatibility with existing and future assistive technology, such as screen readers. The standards do not require that assistive technology be provided universally. Provision of assistive technology is still governed by the reasonable accommodation requirements of sections 501 and 504 of the Rehabilitation Act. In other words, section 508 does not require that assistive technology be purchased, but it does require that electronic and information technology be capable of having assistive technology added at some later time as necessary. Other types of electronic and information technology do not lend themselves to the modular addition of assistive technology (e.g., copiers) and are likely to require changes in design that incorporate accessible features into each product.

This economic assessment was prepared to meet the requirements of Executive Order 12866 and other requirements, and to better inform the public about the implications of the standards. The analysis for the final rule is, for all intents and purposes, identical to the analysis submitted in support of the proposed rule. The original analysis was a very broad estimate of the costs and benefits of the standards. None of the substantive changes made in the final rule were of sufficient magnitude to effect these estimates. The changes made in the final rule are largely in the format and organization of the standards. The standards have been reorganized to be clearer and more user friendly.

There have been two changes made in the final rule that could have some effect on the actual costs of the standards.

- Self-contained closed products (e.g., copiers) must have alternative controls where touch screen technology is used. While this may increase the average product costs, the upper bound incremental cost estimate for this category of equipment was 20 percent and cost for alternative controls continues to fall within the range of the original estimate.
- The requirement that all products be equipped with standard ports is removed. This could reduce the cost of the standards slightly. The magnitude of this change is not likely to be great enough to have any effect on the estimates of costs or benefits.

In addition to these changes, a letter to the President dated September 21, 2000 from the heads of over 40 technology companies and other recent evidence indicate that the software industry is already moving to add accessible features faster than was originally anticipated. This suggests that the costs of doing so is, in fact, quite low and that the original cost estimates for software modification is overstated. We have no means of assessing the magnitude of this overestimate.

We have also added a response to comments in chapter 6 to address the comments submitted on the analysis for the proposed rule.

1.2 Statutory and Regulatory History

Congress originally added section 508 to Title V of the Rehabilitation Act in 1986. Title V of the Rehabilitation Act contains civil rights provisions requiring affirmative action in employment towards individuals with disabilities by the Federal government (29 U.S.C. §791) and by Federal government contractors(29 U.S.C. §793); and prohibiting discrimination on the basis of disability in federally assisted and federally conducted programs and activities (29 U.S.C. §794). In the 1980's Federal agencies significantly increased their dependency on electronic office technology. Section 508 was added to Title V to ensure that such technology would be accessible to individuals with disabilities.

Efforts to ensure access to Federal electronic and information technology actually began a few years earlier. In 1984, the National Institute on Disability and Rehabilitation Research (NIDRR), in conjunction with the Department of Education's Office of Special Education and Rehabilitative Services and the White House, established a Government-Industry Task Force on computer access that brought together representatives from the computer industry and individuals with disabilities. That same year, the General Services Administration (GSA) established the Interagency Committee for Computer Support of Handicapped Employees and the Clearinghouse on Computer Accommodation. Both groups were designed to promote

the use of electronic and information technology in a manner that would enhance the productivity of Federal workers with disabilities.

Section 508 originally directed the Secretary of Education to work with NIDRR and GSA on the development of guidelines for accessible electronic office equipment. In October 1987, after consultation with an advisory committee, the Department of Education and GSA issued guidelines that addressed management responsibilities and functional performance specifications for input, output, and documentation access to electronic office equipment. In January 1991, after receiving further comments from Federal agencies, industry, and individuals with disabilities, GSA published Bulletin C-8 containing the amended guidelines in the Federal Information Resources Management Regulations (FIRMR).² Section 508 directed Federal agencies to comply with the guidelines issued by GSA. Although several Federal agencies initiated efforts to comply with the guidelines, consistent application across agencies did not occur over the subsequent decade. The lack of an enforcement mechanism in the original legislation contributed to the inconsistent application.

The lack of progress toward fulfilling section 508's objectives prompted the introduction of new legislation designed to strengthen section 508. The Federal Electronic and Information Technology Accessibility Compliance Act was introduced in 1997. With some revision, the language contained in this proposed legislation was ultimately enacted in the Workforce Investment Act of 1998, which included the Rehabilitation Act Amendments of 1998. Pub. L. 105-220, Title IV, §408(b), codified at 29 U.S.C. §794d. The amended section 508 requires Federal agencies to ensure that electronic and information technology they develop, procure, maintain, or use are accessible to both Federal employees with disabilities and members of the public with disabilities, unless doing so would impose an undue burden. Where the procurement of accessible products results in an undue burden, agencies are directed to document why compliance will create an undue burden, and provide the information through an alternative means of access. There is an exception for national security systems.

² In a related matter, in April 1987, GSA published Bulletin 48 in FIRMR which set forth requirements for Federal agencies to provide accommodations to meet the needs of employees with disabilities when replacing computer systems.

As amended, section 508 directs the Access Board to issue standards setting forth a definition of electronic and information technology, and technical and functional performance criteria necessary to achieve access to such technology.³ The amended section 508 directs the Access Board to consult with Federal agencies, the electronic and information technology industry, and organizations representing individuals with disabilities in the course of developing the new section 508 standards. The Access Board has fulfilled this obligation through the Electronic and Information Technology Access Advisory Committee (EITAAC). Within six months after the Access Board publishes the section 508 standards, the Federal Acquisition Regulatory Council must revise the Federal Acquisition Regulations (FAR) to incorporate the standards. Each Federal agency must also revise its procurement policies and directives to incorporate the new section 508 standards. The Access Board and GSA are directed to provide technical assistance on the standards.

The amended section 508 contains a number of new provisions to ensure compliance. First, Federal agencies are required to evaluate and to submit a report to the Attorney General on the extent to which their electronic and information technology is accessible. Based on information provided by the agencies, the Attorney General is directed to prepare biennial reports to the President on the extent to which electronic and information technology used by Federal agencies is accessible. The Attorney General issued the first report in April 2000. Second, individuals can file administrative complaints and civil actions against Federal agencies alleging noncompliance with section 508 when procuring new electronic and information technology. The Military Construction Appropriations Act for Fiscal Year 2001 amended section 508 to provide for the enforcement provisions to take effect six months after the Access Board publishes its final section 508 standards. Pub. L. 106-246. Each Federal agency will process administrative complaints filed under section 508 using the procedures developed under section 504 of the Rehabilitation Act for resolving allegations of discrimination in a federally conducted program or activity. The procedures, remedies, and rights set forth in section 505(a)(2) and 505(b) of the Rehabilitation Act apply to civil actions to enforce section 508.

³ The definition of electronic and information technology established by the Access Board must be consistent with the definition of information technology contained in the Clinger-Cohen Act (40 U.S.C. §1401(3)). Congress enacted the Clinger-Cohen Act in 1996 for the purpose of creating consistency across Federal agencies in the acquisition, use, and disposal of information technology. The Clinger-Cohen Act defines information technology as:

“any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the executive agency.”

Among other things, Clinger-Cohen states that information technology includes computers, ancillary equipment, software, firmware, support services, and related resources.

1.3 Statement of Need

The standards promulgated under section 508 are necessary to:

- Correct a potential market failure that can arise because the transaction costs associated with organizing persons with disabilities to send the appropriate market signals to manufacturers of electronic and information technology for accessible products are too costly.
- Resolve the failure of the Federal government procurement system to place a value on accessible features when purchasing electronic and information technology.
- Ensure the civil rights of individuals with disabilities by reducing barriers to Federal employment and providing public access to information and services available through Federal electronic and information technology.

Market Failure

Manufacturers of electronic and information technology have an economic incentive to sell accessible products to buyers with disabilities. However, there are costs for sellers and buyers to identify and to negotiate with one another. If these transactions cost are too high, manufacturers will not know the accessible products buyers with disabilities would like to purchase. Mutually-beneficial trades among buyers and sellers will not occur, resulting in a market failure.

The Federal government can correct this potential market failure. The Federal government can invest resources to identify the needs of individuals with disabilities for accessible products and communicate those needs to manufacturers. Manufacturers then can produce accessible products. In section 508, Congress required the Access Board to identify the needs of individuals with disabilities and required Federal agencies to procure accessible products that meet those needs.

Procurement System Failure

Procurement regulations give Federal purchasers different incentives than private purchasers. Unless accessible features are included in product specifications, they do not have value and may not be paid for. If purchasing a product with accessible features costs more, procurement regulations would direct purchasing officials to purchase the less expensive product. Incorporating accessibility standards in the FAR corrects an existing regulatory disincentive to procure accessible products.

Civil Rights

Not all government policies are based on maximizing economic efficiency. Even when the market is operating efficiently, there may be groups or individuals who remain “under-served.” In these instances it may be socially desirable to provide for more equitable distributions of social welfare to those populations that receive less than their “fair” share of goods and services at the market equilibrium. Congress has decided that making Federal electronic information and technology accessible is a socially preferred choice and is an essential component of civil rights for individuals with disabilities. Traditional economic analysis is ill equipped to make judgements about fairness or equity. Instead, we tend to rely on political processes to make decisions about redistribution of wealth based on equity considerations. While benefit-cost analysis is not dispositive in making equity-based decisions, it can inform the policy makers as they make redistribution decisions.

CHAPTER 2

DESCRIPTION OF STANDARDS

2.1 Final Standards

The section 508 standards are to be used by Federal agencies when they develop, procure, maintain, and use electronic and information technology. The standards are to be applied prospectively and do not require Federal agencies to retrofit existing electronic and information technology. As agencies upgrade and change their electronic and information technology, they must comply with the standards. Table 2-1 summarizes the final standards.

Table 2-1 Final Standards

Section	Standard
§ 1194.21 Software Applications and Operating Systems	
(a) Keyboard	(a) Execute product functions from a keyboard, when software is designed to run on a system with a keyboard and the function or the result of performing the function can be discerned textually.
(b) Compatibility	(b) Do not disrupt or disable activated accessibility features of other products, where those features developed and documented according to industry standards. Do not disrupt or disable activated accessibility features of any operating system, where application programming interface for those features has been documented by the operating system manufacturer and is available to the product developer.
(c) Visual focus indicators	(c) Provide well-defined and programmatically exposed visual focus indicator for interactive interface elements as input focus changes so assistive technology can track focus and focus changes.
(d) User interface element	(d) Provide information to enable assistive technology to understand the identify, operation, and state of the element. When an image represents a program element, information conveyed by the image must also be available in text.
(e) Bitmap images	(e) Must be assigned consistent meaning throughout application's performance when used to identify controls, status indicators, or other programmatic elements.
(f) Textual information	(f) Provide textual information through operating system functions for displaying text, including text content, text input caret location, and text attributes.
(g) Display attributes	(g) Do not override user selected contrast and color selections and other individual display attributes.
(h) Animation	(h) Display information in at least one non-animated presentation mode at option of user when animation displayed.

<ul style="list-style-type: none"> (i) Color coding (j) Color and contrast settings (k) Flashing or blinking text (l) Electronic forms 	<ul style="list-style-type: none"> (i) Do not use color coding as only means of conveying information, indicating an action, prompting a response, or distinguishing a visual element. (j) Provide variety of color selections capable of producing a range of contrast levels when a product permits a user to adjust color and contrast settings. (k) Do not use flashing or blinking text, objects, or other elements having a flash or blink frequency greater than 2 HZ and lower than 55 Hz. (l) Provide a format that allows access via assistive technology to information, field elements, and functionality required for completion and submission of the form, including directions and cues.
<p>§ 1194.22 Web-Based Intranet and Internet Information Applications</p> <ul style="list-style-type: none"> (a) Text equivalent (b) Multimedia presentation (c) Color (d) Organization (e) Server-side image maps (f) Client-side image maps (g) Data tables (h) Multi-logic row or column headers (i) Frames (j) Flicker (k) Text-only equivalent pages (l) Scripting languages (m) Applets and plug-ins 	<ul style="list-style-type: none"> (a) Provide text equivalent for every non-text element (e.g., via "alt," "longdesc," or in element content). (b) Synchronize equivalent alternatives for multimedia presentation with presentation. (c) Design web pages so that all information conveyed with color is also available without color (e.g., from contrast or markup). (d) Organize documents to be readable without requiring an associated style sheet. (e) Provide redundant text links for each active region of server-side image maps. (f) Provide client-side image maps instead of server side image maps, except where regions cannot be defined with available geometric shape. (g) Identify row and column headers for data tables. (h) Use markup to associate data cells and header cells for data tables with two or more logical levels of row or column headers. (i) Title frames with text that facilitates identification and navigation. (j) Design pages to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz. (k) Provide text-only page, with equivalent information or functionality, to comply with standards when compliance cannot be accomplished in any other way. Update content of text-only page whenever primary page changes. (l) Identify information provided by the script with functional text readable by assistive technology when pages utilize scripting languages to display content or to create interface elements. (m) Provide a link to a plug-in or applet that complies with § 1194.21 (Software Applications and Operating Systems) when web page requires applet, plug-in, or other application to be present on the client system to interpret page content.

<p>(n) Electronic forms</p> <p>(o) Content tracking</p> <p>(p) Timed response</p>	<p>(n) Provide a form that allows access via assistive technology to information, field elements, and functionality required for completion and submission of the form, including directions and cues.</p> <p>(o) Provide method that permits users to skip repetitive navigation links.</p> <p>(p) Alert user when timed response is required and give sufficient time to indicate more time is required.</p>
<p>§ 1194.23 Telecommunications Products</p> <p>(a) Non-acoustic connection point for TTYs</p> <p>(b) TTY signals</p> <p>(c) TTY compatibility with voice response systems</p> <p>(d) Timed response</p> <p>(e) Caller identification</p> <p>(f) Volume control</p> <p>(g) Default volume level reset</p> <p>(h) Audio transducer</p> <p>(i) Interference reduction</p> <p>(j) Pass through standard codes</p> <p>(k) Mechanically operated controls</p>	<p>(a) Provide standard non-acoustic connection point for TTYs for telecommunications products or systems that allow voice communication and do not have a TTY functionality. Microphones must be capable of being turned on and off to allow user to intermix speech with TTY use.</p> <p>(b) Support all commonly used cross-manufacturer non-proprietary standard TTY signal protocols when telecommunication products include voice communication functionality.</p> <p>(c) Make voice mail, auto-attendant, and interactive voice response telecommunications systems usable with TTYs.</p> <p>(d) Give an alert that time interval is about to run out when voice mail, messaging, auto-attendant, and interactive voice response telecommunications systems require a response from user within a time interval, and provide sufficient time for user to indicate that more time is required.</p> <p>(e) Make caller identification and similar functions available for TTY users and users who cannot see displays where caller identification is provided.</p> <p>(f) Provide a gain adjustable up to a minimum of 20 dB for transmitted voice signals, and at least one intermediate step of 12 dB of gain for incremental volume control.</p> <p>(g) Provide a function to automatically reset the volume to the default level after every use if the telecommunications product allows user to adjust the receive volume.</p> <p>(h) Provide a means for effective magnetic wireless coupling to hearing technologies where telecommunications product delivers output by audio transducer normally held up to the ear.</p> <p>(i) Reduce interference to hearing technologies (e.g., hearing aids, cochlear implants, assistive listening systems) to the lowest possible level that allows user of hearing technologies to utilize the telecommunications product.</p> <p>(j) Pass through cross-manufacturer, non-proprietary, industry-standard codes, translation protocols, formats, or other information necessary to provide information in usable format in products that transmit or conduct information or communication. Do not remove information needed for access or restore it upon delivery when technologies use encoding, signal compression, format transformation, or similar techniques.</p> <p>(k) Provide controls and keys that are tactilely discernable without activating the controls or keys, and that are operable with one hand and do not require tight grasping,</p>

	<p>pinching, or twisting of the wrist. Force to activate controls or keys must be 5 lbs. (22.2 N) maximum. If key repeat is supported, delay before repeat must be adjustable to at least 2 seconds and key repeat rate must be adjustable to 2 seconds per character. Status of all locking or toggle controls or keys must be visually discernable, and discernable through touch or sound.</p>
<p>§ 1194.24 Video and Multimedia Products</p> <p>(a) Television displays</p> <p>(b) Television tuners</p> <p>(c) Captioning</p> <p>(d) Audio description</p> <p>(e) User control</p>	<p>(a) Equip analog television displays 13 inches and larger, and computer equipment that includes analog television receiver or display circuitry, with caption decoder circuitry which appropriately receives, decodes, and displays closed captions from broadcast, cable, videotape, and DVD signals. As soon as practicable, but not later than July 1, 2002, widescreen digital television (DTV) displays measuring at least 7.8 inches vertically, DTV sets with conventional displays measuring at least 13 inches vertically, and stand alone DTV tuners, whether or not they are marketed with display screens, and computer equipment that includes DTV receiver or display circuitry must be equipped with caption decoder circuitry which appropriately receives, decodes, and displays closed captions from broadcast, cable, videotape, and DVD signals.</p> <p>(b) Equip television tuners, including tuner cards for use in computers, with secondary audio program playback circuitry.</p> <p>(c) Provide open or closed captions on all training and informational video and multimedia productions which support the agency's mission, regardless of format, that contain speech or other audio necessary for comprehension of content</p> <p>(d) Provide audio description for all training and informational video and multimedia productions which support the agency's mission, regardless of format, that contain visual information necessary for comprehension of content.</p> <p>(e) Make display or presentation of alternate text presentation or audio descriptions user-selectable unless permanent.</p>
<p>§ 1194.25 Self-Contained, Closed Products</p> <p>(a) Usability</p> <p>(b) Timed response</p> <p>(c) Voice output</p> <p>(d) Biometric identification</p> <p>(e) Auditory output</p>	<p>(a) Make self-contained products usable by people with disabilities without attaching assistive technology. Personal headsets for private listening are not assistive technology.</p> <p>(b) Alert user when timed response is required and give sufficient time to indicate more time is required.</p> <p>(c) Provide input method that complies with § 1194.23 (k)(1) through (4) where product utilizes touch screens or contact-sensitive controls.</p> <p>(d) Provide alternative form of identification or activation which does not require user to possess particular biological characteristics when biometric forms of user identification or control are used.</p> <p>(e) Provide audio signal at a standard signal level through an industry standard connector that will allow for private listening when products provide auditory output. Provide</p>

<p>(f) Volume control</p> <p>(g) Color coding</p> <p>(h) Color and contrast</p> <p>(i) Flicker</p> <p>(j) Reach ranges</p>	<p>ability to interrupt, pause, and restart audio at any time.</p> <p>(f) Provide incremental volume control with output amplification up to a level of 65 dB when products deliver voice output in a public area. Where ambient noise level is above 45 dB, volume gain of at least 20 dB above the ambient level must be user selectable. Provide function to automatically reset volume to default level after every use.</p> <p>(g) Do not use color coding as only means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.</p> <p>(h) Provide a range of color selections capable of producing a variety of contrast levels when a product permits user to adjust color and contrast settings.</p> <p>(i) Design products to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz.</p> <p>(j) Make operable controls comply with reach ranges in § 1194.25 (j) (1) through (4) when products have operable controls and are free-standing, non-portable, and intended to be used in one location.</p>
<p>§ 1194.26 Desktop and Portable Computers</p> <p>(a) Mechanically operated controls</p> <p>(b) Touch screens</p> <p>(c) Biometric identification</p> <p>(d) Expansion slots</p>	<p>(a) Provide mechanically operated controls and keys that comply with § 1194.23 (k) (1) through (4).</p> <p>(b) Provide input method that complies with § 1194.23 (k) (1) through (4) if product utilizes touch screens or touch operated controls.</p> <p>(c) Provide alternative form of identification or activation which does not require user to possess particular biological characteristics when biometric forms of user identification or control are used.</p> <p>(d) Make at least one of each type of expansion slots, ports and connectors provided comply with publically available industry standards.</p>
<p>§ 1194.31 Functional Performance Criteria</p> <p>(a) Vision</p> <p>(b) Visual acuity</p> <p>(c) Hearing</p> <p>(d) Audio information</p> <p>(e) Speech</p> <p>(f) Motor skills/coordination</p>	<p>(a) Provide at least one mode of operation and information retrieval that does not require user vision, or support for assistive technology.</p> <p>(b) Provide audio output and enlarged print output working together or independently at least one mode of operation and information retrieval that does not require visual acuity above 20/70, or support for assistive technology.</p> <p>(c) Provide at least one mode of operation and information retrieval that does not require hearing, or support for assistive technology.</p> <p>(d) Provide at least one mode of operation and information retrieval in enhanced auditory fashion where audio information is important for use of a product, or support for assistive technology</p> <p>(e) Provide at least one mode of operation and information retrieval that does not require speech, or support for assistive technology.</p> <p>(f) Provide at least one mode of operation and information retrieval that does not require fine motor control or</p>

	simultaneous actions and that is operable with limited reach and strength.
§ 1194.41 Information, Documentation, and Support	
(a) Product support documentation	(a) Make product support documentation provided to end-users available in alternate formats upon request for no additional charge.
(b) Accessibility and compatibility features	(b) Provide end-users access to a description of accessibility and compatibility features of products in alternate formats or alternate modes upon request at no additional charge.
(c) Support services	(c) Accommodate communication needs of end users with disabilities when providing support services for products.

2.2 Baseline of Technology

The section 508 standards will affect a wide variety of electronic and information technology. The state of each technology fluctuates relative to the level of research and development invested in the product. Investment in some products has remained relatively static since their first introduction to the market. However, many more have changed in leaps and bounds in the small period of time that they have been in the market. The best example of this dynamic environment is the evolution of the Internet and the number of applications it has today versus five years ago. Table 2-2 provides a general overview of the state of the baseline technology.

Table 2-2 Baseline of Technology

Standard	Baseline
§1194.21 Software applications and operating systems	Programming capability exists to meet standards. Compliant products available. Some products may require modifications to satisfy standards.
§1194.22 Web-based intranet and internet information and applications	Programming capability exists to meet standards.
§1194.23 Telecommunications products	Compliant products available or are under development.
§1194.24 Video and multimedia products	Compliant products available or are under development. Technology exists to provide captioning and audio description.
§1194.25 Self-contained closed products	Technical capability exists to meet standards. Products may require modifications to meet standards.
§1194.26 Desktop and portable computers	Technical capability exists to meet standards. Compliant products available. Some products may require modifications to meet standards.
§1194.31 Functional performance criteria	Programming and technical capability exists to meet standards. Some products may require modifications to meet standards.
§1194.41 Information, documentation, and support	Alternate formats exist, extent of availability may be limited. Materials need to be developed for new products describing accessibility and compatibility features. Additional support services may be required.

CHAPTER 3

DATA ON PERSONS WITH DISABILITIES

3.1 Target Population

The section 508 standards will improve accessibility to electronic and information technology for persons with disabilities who are currently employed by the Federal government. These standards will also improve accessibility to Federal electronic and information technology for members of the public with disabilities. Based on Bureau of Census statistics from 1994⁴, 20.6 percent or 54 million persons in the United States have some level of disability. By increasing the accessibility of electronic and information technology used by the Federal government, the standards may also improve future employment opportunities in the Federal government for persons with disabilities currently employed by the Federal government, and for persons with disabilities who are working in the private sector or are classified as not being active in the labor force. Increasing the accessibility of electronic and information technology increases the productivity and mobility of persons with disabilities who, under existing conditions, may face barriers to their employment and advancement within the Federal workforce.

3.2 Federal Workers with Disabilities

The Equal Employment Opportunity Commission (EEOC) tracks the number of Federal workers with disabilities. In fiscal year 1997, the Federal government employed 167,902 persons with reportable disabilities, of which 28,672 persons had targeted disabilities. The EEOC defines persons with “targeted” disabilities based on the applicable codes on Standard Form 256. Form 256 is a voluntary self-identification system developed by the Office of Personnel Management (OPM) to track the number of persons with disabilities and the types of disabilities represented in the Federal workforce. Nine categories of severe disabilities are classified as targeted disabilities by the EEOC: deafness, blindness, missing extremities, partial paralysis, complete paralysis, convulsive disorders, mental retardation, mental illness, and distortion of limbs and/or spine. Other categories of disabilities may benefit from the section 508 standards such as unable to hear normal conversation or have speech understood. In fact, many of the provisions in the standards are designed to assist persons whose disabilities do not cause them to be classified as having a targeted disability. For example, the standards include provisions to assist persons with limited hearing who are not deaf.

⁴ U.S. Department of Commerce, Economics and Statistics Administration, *Americans with Disabilities: 1994-95* (P70-61), August 1997.

Relying on self-reported data may create a downward bias in the number of Federal workers who are likely to benefit from the standards. This downward bias has two potential sources:

- Some workers may perceive some sort of stigma or career limiting consequence from reporting a disability; and,
- Some workers will experience reduction in vision, hearing, or other function as a natural consequence of aging or as a temporary condition from an illness or accident. These workers are unlikely to report themselves as having a disability.

These sources of reporting bias are less likely to affect the number of targeted disabilities reported than the reporting of less severe disabilities.

The Survey of Income and Participation (SIPP)⁵ conducted by the Bureau of Census provides periodic data on the number and characteristics of persons with disabilities who are active in the workforce. The SIPP data used in this assessment is for the period from September 1994 to December 1994. Table 3-1 compares the distribution of persons with disabilities in the national labor pool and the Federal workforce. This data does not differentiate between persons working for the private sector and the Federal government. No attempt was made to disaggregate the SIPP to provide such information. In addition, the SIPP data only covers persons between the ages of 20 and 64, the age group most representative of the employed population, including the Federal workforce. Workers with targeted disabilities represent 1.2 percent of the total Federal workforce. An additional 5.6 percent of the Federal workforce reports other non-targeted disabilities.

Table 3-1 Workforce Distribution of Persons with Disabilities

Characteristic	1994 SIPP Age 20-64 (Numbers)	FY 1997 Federal Workforce (Numbers)	SIPP Age 20 -64 (%)	FY 1997 Federal Workforce (%)
All Persons	123,042,000	2,478,700	100.00	100.00
Any Disability (incl. severe)	29,919,000	167,902	24.3	6.8
Severe or Targeted Disability	14,350,000	28,672	11.7	1.2

Source: *Monthly Labor Review*, September 1998; and OPM for Federal workforce data.

⁵ The SIPP is a longitudinal survey of adults in households obtained from a multi-stage stratified sample of the noninstitutional resident population of the United States. It is a multi-panel survey with a new sample (panel) introduced at the beginning of each calendar year. The initial selection of households into the survey is done according to a sample selection methodology similar to that used for the Current Population Survey (CPS). The primary focus of SIPP is adults, i.e., persons 15 years old or older in the initial household sample.

Federal agencies have the responsibility under sections 501 and 504 of the Rehabilitation Act to provide reasonable accommodations for Federal workers with disabilities. These accommodations may address accessibility only at the individual's work station, not necessarily to the entire office or agency. Several agencies, including the Department of Education and the Department of Defense, have created model accommodation programs. One component of the Department of Education's program evaluates the level of accessibility of the software packages used by the agency. The Department of Defense, Office of the Assistant Secretary of Defense Health Affairs, has created the Computer/Electronic Accommodations Program (CAP) to provide assistive technology to employees and beneficiaries with disabilities who require accommodation to access computer or telecommunication systems. The CAP program is a model for accommodating individual needs, completing more than 477 accommodation requests during fiscal years 1997 to 1999. Based on the experience from this program, the CAP has identified electronic and information technology systems with the highest incidence of accessibility or compatibility issues which parallel those addressed by the section 508 standards. This micro-evaluation confirms the need for the section 508 standards.

3.3 Persons with Disabilities Who Remain Unemployed

Table 3-2 shows the labor force activity for persons without disabilities and persons with severe disabilities.

Table 3-2 Activity in Labor Force, persons age 20 to 64

Characteristic	No Disability	Severe Disability
Total	123,042,000	14,350,000
Percent		
With labor force activity	84.5	29.5
With no labor force activity	15.5	70.5

Source: *Monthly Labor Review*, September 1998.

The SIPP data do not allow for the construction of unemployment rates similar to the official rates produced by the Bureau of Labor Statistics using the Current Population Survey (CPS). The labor force estimates from the SIPP cannot be compared to the CPS because the questions used to determine labor force status in each survey are significantly different, including the reference periods used for the two surveys. Employment status is determined in the SIPP through questions asking the respondent if they had a job or business, full time or part time, even if it was for just a few days during the reference period of the survey. If they report that they did not work, the subsequent questions ask whether they looked for work or were on layoff. Thus, labor force activity corresponded to those persons indicating that they have spent some time working, seeking work, or being laid off in the previous month. In addition, while the SIPP counts those in the military as employed, they are not included in the universe of the CPS. The SIPP data may actually overestimate the number of persons employed at the time of the survey due to the scope of the survey definition of labor force activity.

Over 70 percent of working age persons with severe disabilities have minimal or no employment. While some of these persons may be unable to work due to the severity of their disability, this 70 percent of the population of persons of working age with disabilities represents the labor pool for whom increased accessibility to electronic and information technology could enhance their employment opportunities. Increased accessibility reduces barriers to employment, and provides employers with a greater number of persons from whom they can search for qualified personnel.

CHAPTER 4

ESTIMATED COSTS OF STANDARDS

4.1 Overview

The social costs of the section 508 standards include both direct and opportunity costs. Direct costs are the value of the resources society spends to produce accessible electronic and information technology and to deliver these products to the end users. Committing resources to provide accessible electronic and information technology to the Federal government necessitates doing without these resources to produce some other good or service for society's benefit. The value of these foregone goods and services is the opportunity cost of the standards. This chapter quantifies some of the direct costs of the standards and gives a qualitative discussion of the potential opportunity costs.

4.2 Who Is Likely to Experience Increased Costs Due to Standards?

The section 508 standards apply only to Federal agencies. Other Federal agencies may apply the standards to entities that they have relationships with through funding, contracting, or other mechanisms. The costs and benefits associated with other agency decisions to apply the standards to other entities must be justified by those agencies and are, therefore, not included in this economic assessment.

The standards do not directly impose any requirements on businesses selling or leasing electronic and information technology, because they are not required to sell or lease their products to the Federal government. Businesses that choose to market their products to the Federal government must ensure that their products comply with the standards. For many businesses, this may simply involve a review of the product *vis a vis* the standards to confirm compliance. For others, this could require redesign of a product to add accessible features before it can be sold to the Federal government. Presumably these costs can be passed on to the Federal government (and other consumers) in the form of higher prices. An increase in the price of electronic and information technology can result in a decrease in demand for these products.

Federal agencies may experience increases in their costs for electronic and information technology to cover the costs of redesigning products to comply with the standards. There may also be some incidental cost born by Federal agencies as a result of the standards such as the cost of training employees on new features or evaluating compliance before making a purchase. Due to methodological and data constraints, the magnitude of these incidental costs has not been computed, however they are described in more detail later in this chapter.

4.3 Direct Compliance Costs

Direct costs include the costs to produce accessible electronic and information technology, including software, hardware, and documentation that explains how to use the products. In addition, Federal agencies and manufacturers will have to spend resources to market the accessible products and to train workers to operate them. The sections below discuss the methodology, the data sources, and where possible the quantitative estimates of the costs to provide compliant software, hardware, documentation, and training. The sections also discuss the limitations of the direct cost estimates.

4.3.1 Methodology

4.3.1.1 Software

Software manufacturers have a choice to make their software accessible to all consumers, to make an accessible version for sale to the Federal government, or to not modify their product and cease marketing to the Federal government. This analysis assumes software companies choose the first option. They modify and sell one accessible version to both Federal and non-Federal customers. This assumption is supported by the cost structures of software development. Software manufacturers pay millions of dollars to produce their first working product for sale and then can cheaply produce the next copy for only a few dollars. In other words, companies pay relatively high fixed costs to acquire, design, test, and market innovative intellectual property. The material and equipment costs to manufacture products that are sold – floppy discs and CD-ROMs – are inconsequential. Therefore, software firms profit the more they can spread the fixed costs over as many identical units as possible.

This incentive is reinforced by software's brief shelf life and by consumer demand. Software firms must recoup their fixed cost investment in just a few years before competitors introduce superior products. The resulting high depreciation rate of the product increases the value of the underlying human capital. Further, consumers are not likely to demand separate versions of software since they are likely to be unaffected or unaware of the accessible features. Consumers that do not want the accessible features can turn them off and still get the same value from the product. For most software features, it is not efficient for companies to divert their most valuable resource – human capital – to produce separate versions if consumers do not value the difference. In other words, a software company is not likely to market an accessible word processor to the Federal government and also market a "non-accessible" word processor to the general public.

Given this cost structure of the software market, the analysis estimates that software manufacturers will incorporate accessible features into their products and market them to all of their customers. The major manufacturing cost is the specialized labor that designs and programs the software features. The additional lines of software code

impose virtually no material costs. The analysis also assumes that these development costs occur annually and are not tied to a particular software product release. Once each manufacturer invests in obtaining in-house experts on accessible features, the manufacturer will maintain this staff permanently to work on later product upgrades.

The analysis measures the accessibility resources devoted to development costs based on discussions with several industry sources and access engineering experts. The analysis also assumes that the ratio of development costs is the same across all manufacturers and across all software products. Therefore, the proportion of labor resources needed to upgrade one word processing program is the same for all other word processing programs and for all other general office software such as spreadsheets, presentation software, and database management.

4.3.1.2 Hardware

Hardware manufacturers also face the same choice as software manufacturers: make their hardware accessible to all consumers, make an accessible version for sale to the Federal government, or not modify their product and cease marketing to the Federal government. This analysis assumes that hardware manufacturers will in general choose the second option and manufacture accessible versions of their products for the Federal government. Hardware manufacturers have different cost structures than software manufacturers. Extra equipment, such as a handset to privately communicate audio information, raises the unit cost of production. In addition, consumer demand is more likely to be affected by incorporating accessible features in hardware than in software. Consumers that do not need accessible features may not be willing to pay for the extra cost. In addition, complying with the standards may require a redesign or reconfiguration of certain equipment. Certain consumers may notice the accessible design changes and may not want them. Therefore, if consumers will value different designs and if there are significant manufacturing costs, the manufacturer is likely to respond with different hardware products for Federal agencies and for other consumers. If the hardware changes are hidden and inexpensive, hardware manufacturers may simply make one version for all consumers. In addition, non-Federal market signals from institutions such as universities, libraries, and others may welcome accessible hardware systems, thus allowing the costs to be dispersed over a larger sector of the market, similar to software producers.

The analysis puts forth a range to estimate the estimate the increased manufacturing and design costs for hardware to comply with the standards.

4.3.1.3 Training

There are five major categories of training costs that will be incurred as a result of the standards:

- *Training of staff selling products to Federal government.* Manufacturers must change their marketing and inform their sales staff to promote their compliance with the new standards. The analysis assumes that this cost is bundled into the price charged to Federal purchasers.
- *Training of Federal procurement officials.* This cost is not a direct result of this rule, but a result of revisions to the FAR and other agency procurement regulations.
- *Training of Federal workers on how to use accessible features.* When compliant products are provided, Federal workers will have to invest the time and resources to learn how to operate the accessible features. The same workers will benefit from this effort with increased productivity. Therefore, rather than calculate the direct cost of Federal worker training and the total productivity gained, the analysis computes the productivity gains net of training costs in the benefit estimate of the standards. (See Chapter 5.)
- *Training of industry customer service representatives on accessible features.* End users may need assistance operating accessible features. Manufacturers either offer technical assistance free or charge separately for the service. In either case, manufacturers will bear direct costs training their customer service staff on the new accessible features. As a simplifying assumption, the analysis assumes this cost is bundled into the purchase price.
- *Training of government support staff on accessible features.* In addition to commercial customer support, Federal agencies hire staff to answer workers' questions with Federally-owned or licensed software and hardware. This staff will also have to understand the new accessible features to perform their assigned tasks.

We do not have sufficient information to provide estimates of the training costs associated with the standards. From our discussions with industry, we believe the assumption that the cost of training sales and support staff are included in the price increase of the product to be defensible. We have not attempted to estimate the cost of training Federal support staff. We do not expect these costs to be significant relative to other costs of the standards.

4.3.1.4 Documentation

There are two types of documentation costs that will be incurred as a result of the standards:

- The standards require that documentation provided with electronic and information technology products (e.g., manuals or other type of instruction) be available in an alternative format upon request. The costs of producing and distributing product documentation in alternative formats may be born exclusively by Federal agencies if they elect to translate any documentation they receives into alternative formats. The more likely scenario is that manufacturers will be called upon to provide documentation in alternative formats along with the product or at a later time. This analysis assumes that the cost of providing this type of documentation is included in the price of the product sold to Federal purchasers. Many software and hardware manufacturers now supply detailed system documentation on some type of electronic format such as disk or CD-ROM rather than the traditional paper manuals. Documentation provided in this format is presumed to be accessible.
- Federal agencies that claim the undue burden exception must maintain documentation supporting the claim. This analysis assumes that no agencies will claim this exemption, therefore no costs associated with documenting the claims were estimated. This assumption is not intended to imply that the undue burden provision will never be applied, only that an insufficient amount of data is available to derive any useful assumption of the degree to which it would be applied and for which products.

4.3.2 Data Sources

To estimate the costs of the standards data is needed on the quantity of different types of electronic and information purchased by the Federal government that is affected by the standards, and the incremental cost for each product to comply with the standards. The General Services Administration (GSA) Federal Supply Service (FSS) data is used to estimate the quantity of electronic and information technology procured by the Federal government. The FSS organizes products into schedules based on a product classification system. The products assigned to each schedule are further defined by schedule identification numbers (SINs), which are specific to a particular product type (e.g., term software licenses). However, the classification by SINs does not eliminate products and services that would not be affected by the standards. For instance, the SIN for information technology services is very broad in its coverage and may include materials used to build computer network systems such as cables and routers that would not be affected by the standards. Aside from this limitation, the GSA data provide the most detailed level of information on the types of electronic and information technology purchased by the Federal government.

The GSA data provides a bottom-up approach for estimating Federal spending on electronic and information technology. Based on the GSA data, it is estimated that Federal spending on electronic and information technology affected by the standards was \$12.4 billion in fiscal year 1999. This figure represents an estimated 33 percent of

fiscal year 1999 information technology budget of \$37.6 billion. The greatest limitation of this method, however, is that not all purchases of electronic and information technology by Federal agencies are accounted for by the GSA data. Some agencies make purchases directly with product suppliers and therefore the sales will not be represented in the GSA data. This limitation has the effect of underestimating the potential increase in costs due to the standards. As procurement regulations have been reformed in recent years, more and more purchases are being made without using the GSA FSS. However, this downward bias in the overall cost estimate is partially counteracted by the potential overestimation of some projected product cost increases and the inclusion of products such as routers, cables, etc. that will not experience increases in cost as a result of the standards. Overestimation may occur due to the inability to disaggregate products within each SIN that may be exempt under the Clinger-Cohen definitions for national security use, or for which the standards are not applicable.

The effect of using the GSA data is either an overestimation or underestimation of the actual cost of electronic and information technology products affected by the standards. The uncertainty arises from the inability to disaggregate specific brand names from the gross sales figures reported to GSA. Different brands within a category, like word processing software, may have different incremental costs to bring the brands into compliance. Based on the information available, the analysis cannot distinguish and account for these differences.

Recognizing the limitations of the GSA data, the analysis also examined OMB data on the total obligations for information technology in the federal budget for the fiscal years 1994 through 1998, as an alternative top-down approach. OMB ceased collecting this data in the format and categories noted below after fiscal year 1998, thus data for fiscal year 1999 could not be included. The analysis applies two scenarios for estimating the average percentage of the total information technology budget spent on products affected by the standards.

The first scenario includes four primary information technology budget categories to estimate the amount affected by the standards: equipment and capital purchases; other purchases/leases; software capital purchases; and other purchases/leases. During a five year period (fiscal years 1994 through 1998), the expenditures in these four categories represented an average of approximately 25 percent of the total information technology budget. This estimate excludes the following categories based on the assumption that they were unlikely to include any significant expenditures on items affected by the standards: services; support services; supplies; personnel; other (DOD); and intra-government payments and collections. Therefore, scenario one represents the lower bound of Federal spending on information technology affected by the standards.

**Scenario 1: Lower Bound of Federal Spending on Information Technology
Affected by the Standards
(millions of dollars)**

Fiscal Year	Equipment & Capital Purchases 1.A	Other Purchases or Leases 1.B	Software Capital Purchases 2.A	Other Purchases or Leases 2.B	Total Estimate for E&IT	Total Obligations	E&IT in Total Obligation
1998	3,733	1,533	1,327	479	7,072	28,973	24%
1997	3,645	1,717	1,212	452	7,027	28,623	25%
1996	3,582	1,864	1,053	482	6,980	27,245	26%
1995	3,226	1,485	1,045	501	6,256	25,730	24%
1994	3,774	1,082	879	260	5,996	23,457	26%
Average							25%

The second scenario is the same except two categories, services and support services, are added to the analysis. These categories were added to capture other areas potentially affected by the standards. However, only 50 percent of each category is carried forward in the analysis since not all of the expenditures in these categories will be affected by the standards. During the same five year period (fiscal years 1994 through 1998), the expenditures in these six areas represented an average of approximately 52 percent of the total information technology budget. Scenario two represents the upper bound of Federal spending on information technology affected by the standards. This upper bound may be significantly overstated since it is not possible to determine from this data what proportion of each category would be affected.

**Scenario 2: Upper Bound of Federal Spending on Information Technology
Affected by the Standards
(millions of dollars)**

Fiscal Year	Equipment & Capital Purchases	Other Purchases or Leases	Software Capital Purchases	Other Purchases or Leases	Services (50%)	Support Services (50%)	Total Estimate for E&IT	Total Obligations	E&IT in Total Obligation
1998	3,733	1,533	1,327	479	2,413	6,150	15,635	28,973	54%
1997	3,645	1,717	1,212	452	2,398	5,630	15,055	28,623	53%
1996	3,582	1,864	1,053	482	2,382	4,847	14,209	27,245	52%
1995	3,226	1,485	1,045	501	2,170	4,235	12,661	25,730	49%
1994	3,774	1,082	879	260	1,778	3,883	11,657	23,457	50%
Average									52%

The top-down approach is limited by the inability to determine what portion of each category under both scenarios would be affected by the standards. This results in a gross overestimation of the total information technology budget that will be affected by the standards. However, the analysis generates a range that includes the analysis based on the GSA data and allows for other purchases of information technology outside the GSA FSS. Due to the limitations of the top-down approach in disaggregating the expenditures for information technology in greater detail, we have chosen to retain the GSA data for computing the estimated costs of the standards. The

GSA data provides the assessment with a consistent measurement tool that allows for aggregation of the total expected cost of the standards.

The electronic and information technology products affected by the standards are discussed below.

4.3.3. Software Cost Estimates

Federal government purchases of software can be divided into three major categories: general office software, mission-specific software, and information technology and electronic commerce services. General office software packages that the Federal government typically procures for personnel computer work stations (principally IBM compatible) are programs such as operating systems, word processors, and spreadsheets. Mission-specific software is software that has been commissioned for government purposes such as air traffic control, Federal budget and accounting systems, and environmental policy modeling. The SIN for this software also may include the actual hardware components required to operate the software. For purposes of this assessment, the accessibility costs are included in the software section and not the hardware section based on the assumption that the hardware components will not require a significant modification. This approach potentially underestimates the cost of satisfying the standards if the hardware components require extensive modification. Information technology and electronic commerce services have been classified as software in this assessment because of their software-related component.

Table 4-1 lists the SINs for general office software, mission-specific software, and information technology and electronic commerce services. Operating systems, word processors, spreadsheets, and database programs are included in the “term software license” and “perpetual software license” SINs. Mission-specific software is also included in these SINs. The difference between the SINs is associated with the license agreement that the government chooses to purchase. When software is procured, the buyer is only purchasing the right to use or to operate the software for a predetermined period of time. Thus, for some short term projects that require high expense software licenses, the government opts to purchase the product through a term license agreement. Less expensive license agreements, such as those associated with word processors and spreadsheet programs, are often procured as perpetual licenses where the full life of the license is purchased. This analysis includes software used by the Federal government under all of these categories.

Table 4-1

Software & Related Systems			GSA Sales FY 1999 (millions)
Schedule	SIN #	Description	
70 IV - Info Tech	132 32	Term Software License	\$ 22.4
70 IV - Info Tech	132 33	Perpetual Software License	\$ 1,309.1
36 IV - Doc Mgt	51 407	Optical Imaging Sys. & Mission Software	\$ 0.053
36 IV - Doc Mgt	51 408	CD-ROM Info. Ret. Sys. & Mission Software	\$ -
36 IV - Doc Mgt	51 409	Network Optical Imaging Sys & Mission Software	\$ 0.14
70 IV - Info Tech	132 51	Information Tech. Services	\$ 3,863.1
70 IV - Info Tech	132 52	Elec. Commerce Services	\$ 3.8
Total Expenditures			\$ 5,198.7

For much of the standard software packages procured by the Federal government for personnel computer work stations (principally IBM compatible), there are compliant software packages available that meet the standards. Based on discussions with the GSA, the majority of the personnel computer work stations are loaded with Microsoft Windows (currently Windows 98™) as the operating system. Three major, comparably priced software packages provide the same basic task oriented programs noted above: Microsoft Office, Lotus Notes, and Corel Office Suite. Based on reviews from the EITAAC and industry, many of these products, and products like them, satisfy most of the provisions in the standards.

The software category is split into two major subcategories representing (1) general office software, and (2) mission specific software. For purposes of this analysis, it is assumed that software associated with various internet applications is included in each subcategory. It is further assumed that the general office software category represents approximately 80 percent of all the software purchased by the Federal government, and that the remaining 20 percent represents mission-specific applications. An analysis of each of these subcategories follows, including discussion of the cost assumptions for each.

4.3.3.1 General Office Software

For the purposes of this analysis, it is assumed that 30 percent of general office software procured by the Federal government will satisfy the standards or that accessible alternatives are available. The middle 40 percent of the software will require minor to medium modifications as accessible alternatives may not exist. The remaining 30 percent of the software is likely to require significant modifications to ensure that the standards are satisfied. These assumptions are based on discussions with several EITAAC and industry representatives.

The first 30 percent of the software will not involve any increased costs and therefore are not considered further in this assessment. The cost of modifying the middle 40 percent of the software is estimated to be in the range of 0.4 percent to 1 percent based on discussions with industry experts. This assumption is based on an evaluation

of several software companies and the number of employees dedicated to accessibility issues. The methodology uses employee classification as a proxy for cost or expense of accessibility research and development, labor, and design that are all factored into the final product cost. The companies studied have dedicated divisions or groups of employees that specifically address accessibility issues. These employees make up about 0.2 percent to 0.5 percent of these companies total workforce. Typically the accessibility employees act as consultants to others throughout the firm to help identify and address accessibility concerns with each product line. A lower and upper bound cost estimate for the middle 40 percent of general office software is derived by assuming that each employee in the accessibility division leverages their effort with an additional work-year of effort from others in the company. This results in an estimated cost range for modifying and supporting the accessible features of general office software between 0.4 percent and 1 percent.

The remaining 30 percent of the software in this category is expected to require significant modifications to comply with the standards. The cost increase for this category of software is assumed to range from 1 percent to 5 percent based on discussions with industry experts.

The cost of modifying general office software is not limited to the software purchased by the Federal government. Because it is assumed that software manufacturers will elect to sell the same product in the private marketplace as they sell to the Federal government, the cost increases will be incurred in the entire \$24 billion general office software market. Using the range of the costs for modifying the general office software products discussed above, Table 4-2 shows that the cost of modifying general office software to range from \$110 to \$456 million per year.

Table 4-2

U.S. Personal Computer Software Market	Revenue in 1997 (millions)	General Office Applications 80 %				
		30 %	40 %		30 %	
Compliance Assumption		30 %	40 %		30 %	
Cost Increase Assumption		0 %	0.4 %	1 %	1 %	5 %
Total Direct Cost	\$ 24,000 *	\$ -	\$ 38	\$ 96	\$ 72	\$360

* Software & Information Industry Association

Assuming that manufacturers distribute these costs across the Federal government and the private marketplace, the Federal government's share of this cost is shown in Table 4-3 and is estimated to range from \$19 to \$79 million per year.

Table 4-3

Software & Related Services			GSA Sales FY 1999 (millions)	General Office Software 80 %				
Sched.	SIN#	Description		30 % 0 %	40 % 0.4 %	1 %	1 %	30 % 5 %
70 IV	132 32	Term Software License	\$ 22.4	\$ -	\$ 0.029	\$ 0.072	\$ 0.054	\$ 0.27
70 IV	132 33	Perpetual Software License	\$ 1,309.1	\$ -	\$ 1.676	\$ 4.189	\$ 3.142	\$ 15.71
36 IV	51 407	Optical Imaging Sys. & Mission Software	\$ 0.053	\$ -	\$ -	\$ -	\$ -	\$ -
36 IV	51 408	CD-ROM Info. Ret. Sys. & Mission Software	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
36 IV	51 409	Network Optical Imaging Sys & Mission Software	\$ 0.14	\$ -	\$ -	\$ -	\$ -	\$ -
70 IV	132 51	Information Tech. Services	\$ 3,863.1	\$ -	\$ 4.945	\$ 12.362	\$ 9.271	\$ 46.355
70 IV	132 52	Elec. Commerce Services	\$ 3.8	\$ -	\$ 0.005	\$ 0.012	\$ 0.009	\$ 0.045
Total Government Cost			\$ 5,198.7	\$ -	\$ 6.65	\$ 16.63	\$ 12.48	\$ 62.38

4.3.3.2 Mission Specific Software

The cost to modify mission-specific software is assumed to be higher than for general office software and ranges from 1 percent to 5 percent. Table 4-4 shows the increased cost to the Federal government of procuring mission-specific software to range from \$10.4 million per year to \$51.9 million per year. Mission-specific software developed for the Federal agencies has limited distribution outside the government and manufacturers have a diminished opportunity to disperse the increased cost over a larger market.

Table 4-4

Software & Related Services			GSA Sales FY 1999 (millions)	Mission Specific Software 20%	
Sched.	SIN #	Description		1 %	5 %
70 IV	132 32	Term Software License	\$ 22.4	\$ 0.044	\$ 0.22
70 IV	132 33	Perpetual Software License	\$ 1,309.1	\$ 2.6	\$ 13.09
36 IV	51 407	Optical Imaging Sys. & Mission Software	\$ 0.053	\$ -	\$ -
36 IV	51 408	CD_ROM Info. Ret. Sys. & Mission Software	\$ -	\$ -	\$ -
36 IV	51 409	Network Optical Imaging Sys. & Mission Software	\$ 0.14	\$ -	\$ 0.0013
70 IV	132 51	Information Tech. Services	\$ 3,863.1	\$ 7.73	\$ 38.6
70 IV	132 52	Elec. Commerce Services	\$ 3.8	\$ 0.0076	\$ 0.038
Total Government Cost			\$ 5,198.7	\$ 10.4	\$ 51.9

4.3.4 Hardware Cost Estimates

This analysis divides hardware into two categories: compatible and self-contained. Compatible hardware includes products such as desktop and portable computers to which assistive technology can be easily attached or installed (via USB, parallel, or serial ports). Self-contained hardware includes products such as information kiosks, copiers, and printers to which assistive technology cannot be easily attached or installed.

4.3.4.1 Compatible Hardware Products

This assessment assumes that compatible hardware purchased by the Federal government meets the standards or that alternatives are available to meet the standards. Because a sufficient number of alternatives exist, the Federal government will not pay any incremental cost to buy compatible products in most Federal workplace environments. However, as a sensitivity analysis, the assessment places an upper bound incremental cost increase of 5 percent on the purchase price of compatible products to account for additional accessibility costs. Table 4-6 presents the results of this sensitivity analysis.

Table 4-6

Compatible Hardware Products			GSA Sales	Estimated Cost Range	
Sched.	SIN #	Description	FY 1999 (millions)	0 %	5 %
70 IV	132 3	Leasing	\$ 89.9	\$ -	\$ 4.5
70 IV	132 8	Purchase of Equipment	\$ 6,644.9	\$ -	\$ 332.3
Total Government Cost			\$ 6,739.7	\$ -	\$ 337

It is unclear whether the Federal government would continue to avoid incremental costs associated with procuring compatible hardware in the future. While the unit cost of compatible hardware is expected to decrease over time as the industry adopts more standardized approaches, hardware may change radically in the foreseeable future. Accessible features may not be incorporated into the first versions of new hardware. If Federal purchasers wait until accessible components become standardized, they may temporarily forgo the productivity improvements that come with the new technologies (see opportunity cost discussion in section 4.7). For the direct cost estimates, the analysis assumes that Federal agencies only purchase hardware that has been in the market for a sufficient period of time so that its components are standardized and made routinely accessible.

4.3.4.2 Self-Contained Hardware

This assessment examines three major categories of self-contained products from the GSA data: document management products, microphotographic equipment, and miscellaneous products. Copiers make up the majority of self-contained hardware purchased by the Federal government, totaling in excess of \$1 billion per year. Since

self-contained products do not lend themselves to the addition of assistive technology, these products have to be designed to be accessible. The cost range for making self-contained products accessible is based on discussions with accessibility experts and industry. These discussions suggest that a range of 5 percent to 20 percent is a reasonable assumption for estimating the increase in costs associated with making self-contained products accessible. There is a copier currently on the market that claims to be fully accessible, and the cost increase associated with this product is 73 percent. However, this product appears to exceed the standards and was not considered in establishing the upper bound cost of this assessment. Tables 4-7, 4-8, and 4-9 show the results of this analysis. We estimate the cost of modifying self-contained products to range from \$56 million per year to \$223 million per year.

Table 4-7

Document Management Products			GSA Sales FY 1999 (millions)	Estimated Cost Range	
Sched.	SIN #	Description		5 %	20 %
36 IV	51 B362a	Copiers	\$ 5.51	\$ 0.28	\$ 1.10
36 IV	51 B74a	Offset Duplicating Machines	\$ 0.004	\$ -	\$ -
36 IV	51 55	Rental Plans (Copying & Duplicating)	\$ 148.51	\$ 7.43	\$ 29.70
36 IV	51 58	Lease-to-ownership Plans	\$ 512.60	\$ 25.63	\$ 102.52
36 IV	51 100	Photocopying Equipment	\$ 386.69	\$ 19.33	\$ 77.34
36 IV	51 100c	Cost-per-copy Plans (Photocopying)	\$ 23.48	\$ 1.17	\$ 4.70
36 IV	51 100f	Flat-rate Monthly Fee Copying Plans	\$ 13.76	\$ 0.69	\$ 2.75
36 IV	51 101 9	Copy-control Devices & Systems	\$ -	\$ -	\$ -
36 IV	51 103	Special-application Copying Equip.	\$ 20.02	\$ 1.00	\$ 4.00
36 IV	51 200	Offset Process Presses	\$ 0.15	\$ 0.007	\$ 0.03
36 IV	51 229	Duplicator-Digital Scan-stencil Process	\$ 0.19	\$ 0.009	\$ 0.04
Total Government Cost			\$ 1,111	\$ 55.55	\$ 222.18

Table 4-8

Microphotographic Products			GSA Sales FY 1999 (millions)	Estimated Cost Range	
Sched.	SIN #	Description		5 %	20 %
36 IV.	51 402	Aperture Card Microfilm Readers & Reader-printers	\$ 1.30	\$ 0.064	\$ 0.26
36 IV	51 403	Microfilm Readers & Reader-printers	\$ 0.34	\$ 0.02	\$ 0.067
36 IV	51 405	Portable Microfiche Readers	\$ 0.002	\$ -	\$ -
36 IV	51 406	Microfilm Reader-printers & Reader-printer Projectors	\$ -	\$ -	\$ -
36 IV	51 410	Electronic Reader-scanner Systems	\$ 0.30	\$ 0.015	\$ 0.06
36 IV	51 413	Microphotographic Duplicating Equipment	\$ 0.036	\$ 0.002	\$ 0.007
36 IV	51 429	Rental of Equipment (Microphotographic)	\$ 0.064	\$ 0.003	\$ 0.013
Total Government Cost			\$ 2.04	\$ 0.10	\$ 0.41

Table 4-9

Sched.	SIN #	Miscellaneous Products Description	GSA Sales FY 1999 (millions)	Estimated Cost Range	
				5 %	20 %
75 IV	47 145	Electronic Typewriters	\$ 3.09	\$ 0.15	\$ 0.62
75 IV	47 3451	Dictation Systems	\$ 0.35	\$ 0.017	\$ 0.070
75 IV	47 355	Dictating/Transcribing Machine	\$ 0.80	\$ 0.04	\$ 0.16
75 IV	50 281	Electronic Calculators	\$ 0.56	\$ 0.028	\$ 0.11
Total Government Cost			\$ 4.8	\$ 0.24	\$ 0.96

While not included as an assumption in this analysis, we expect to see the costs for copiers to decrease over time as more digital copying technologies are purchased. The interface between digital copying equipment is the office computer network, making this class of products accessible from any desktop work station. The costs for microphotographic and miscellaneous products may be slightly overstated because many of these products will be exempt from certain provisions of the standards if it results in a fundamental alteration of the nature of a product or its components. For example, cameras not required to be accessible to blind persons.

4.4 Web-Based Information Systems

While Federal web-based information systems are likely to require a minimum amount of accessibility modifications, the fixed labor costs are expected to decrease significantly over the short term. Federal agencies are incorporating accessibility into their web-based information systems programming criteria. The section 508 standards are based on the World Wide Web Consortium's guidelines on internet accessibility. The additional programming steps necessary to comply with the standards are not expected to create significant changes in the overall cost of developing web sites and other internet resources. However, any costs associated with World Wide Web accessibility are reflected in the software category of this assessment.

4.5 Telecommunications

This assessment assumes that any costs associated with telecommunications products will be covered by accessibility guidelines developed under section 255 of the Telecommunications Act of 1996. Excluding the costs attributed to section 255 avoids overestimating the standards' social cost and double-counting the aggregate impact of accessibility standards. However, in some instances, the cost associated with accessibility may be inseparable due to the products' development or design (e.g., certain software applications that may rely on telecommunication features). In such instances, the incremental costs associated are included in the software category of this assessment.

4.6 Video and Multimedia

This assessment assumes that any costs associated with equipping television displays with caption decoder circuitry will be covered by the Federal Communications Commission (FCC) rules, which require the same. The standards also require training and informational video and multimedia that support the agency's mission to be captioned and audio described. The costs of these services incurred by the Federal government have not been evaluated in this assessment because there is an insufficient amount of data to support this analysis. The GSA has recently added these types of services to the FSS and data will be available in the future. Currently, only unit cost estimates are available from industry experts that provide these services as shown in Table 4-10.

Table 4-10

Video Services	Estimated Unit Cost
Captioning Services * Prerecorded programming	\$ 800~\$2,500/1 hr.
Live programming	\$150~1,200/1 hr.
Audio Description Services ** Full-length programs	\$4,000/hr.
Short Pieces (i.e., training tapes or museum video)	5 min \$1,460
	10 min \$1,620
	15 min \$1,920
	20 min \$2,080

Source: * Federal Communication Commission, *Video Programming Accessibility Report*, FCC 96-318, July 29, 1996; and ** WGBH Educational Foundation.

4.7 Opportunity Costs

The opportunity costs of the standards include:

- *Delay in procuring new products.* It is possible that for some types of electronic and information technology fully compliant products will not be commercially available when the standards are incorporated into the FAR. Confusion over which products comply with the standards may delay decisions to procure new products. Federal agencies may experience a loss of productivity if procurement of new products is unduly delayed.
- *Permanent lag in procuring innovative technology.* The standards may lead to a permanent lag in use of innovative technology by Federal agencies. If the first version of a product does not include accessible features, Federal agencies may not procure the product. Federal workers will not benefit from the productivity enhancements of these products until the accessibility features are added into later versions.

- *Delay in the increase of productivity of Federal workers if technology replacement is delayed due to price increases.* In this instance, although compliant products are available, price increases due to the standards delay Federal purchasing. The price increases lengthen the software and hardware upgrade cycle, lowering productivity of Federal workers during the incremental period. If a software package's price rises 5 percent due to the standards and an agency therefore delays upgrading for a year, the inability to use the new upgraded features and any software incompatibility during that year is the opportunity cost.
- *Consequences of allowing accessibility to override functionality in procurement process.* Accessibility is only one feature of a product. Products have many other attributes which make them valuable for Federal work. The standards elevate accessibility as a necessary component of any Federal product, regardless of how valuable the other attributes of a product are.

4.8 Limitations

This analysis has several important limitations:

- It assumes no monopolistic pricing practices and that manufacturers will resist the temptation to raise the price to just below the "undue burden" level, knowing that the FAR places a very high value on accessibility features.
- It does not consider or assume any level of reduction in the aggregate costs or benefits of the standards based on the exception for undue burden. Therefore, this assessment may to some degree overstate the costs and benefits since the value of potential undue burden exception could not be realistically estimated for this assessment.
- It does not consider the timing of expenditures or the potential for reductions in accessibility costs over time.
- It may ignore classes of electronic and information technology products that are located in unexpected places on the GSA schedule.

CHAPTER 5

ESTIMATED BENEFITS OF STANDARDS

5.1. Overview

This chapter estimates the social benefits of the section 508 standards. While it is not possible to quantify all categories of potential benefits, the analysis provides a range of estimates to illustrate the magnitude of the benefits.

5.2 Who is Likely to Experience Benefits From Standards?

The primary beneficiaries of the standards are Federal employees with disabilities who will have an increased ability to use the same electronic and information technology available to other Federal employees. The universality of accessible features also makes it easier for employees with disabilities to change between jobs in the Federal government, and may make it possible to work more flexibly in existing positions. The standards also require that Federal agencies provide members of the public with disabilities access to information and services that is comparable to the access provided to other members of the public.

Other individuals and entities are also likely to benefit from these standards:

- Federal agencies will experience gains in productivity as workers with disabilities are more able to take advantage of the productivity enhancing benefits of electronic and information technology.
- The perceived transaction costs associated with hiring persons with disabilities will be reduced for Federal agencies, benefitting both persons with disabilities seeking Federal employment, and the Federal government by expanding the quantity and quality of available employees.
- Federal employees who are not disabled, or do not consider themselves to have a disability, may benefit from increased usability of electronic and information technology associated with accessibility. For example, the ability to increase the size of text on a computer screen may be necessary to make the technology accessible to an individual with limited vision, but it can also provide benefits to an employee who is moderately farsighted or simply prefers larger text.
- Improvements made to products to comply with the standards are likely to carry over into the non-Federal market improving access and productivity for workers with and without disabilities in the non-Federal workforce. The

result is a potential standardization and mainstreaming of products that improve the productivity of all employees as opposed to being limited to individuals in the Federal workforce.

5.3 Specific Categories of Benefits

5.3.1 Net Increase in Productivity of Federal Workforce

Two methods for measuring the increase in productivity of the Federal workforce were considered to estimate the benefits of the standards. The first method examines the existing wage gap between Federal workers with and without disabilities to estimate the effect of the standards on diminishing this wage gap. The second method estimates the increase in a Federal worker's productivity as a member of workgroup or team to determine the benefit derived from the standards. Each method assumes that a net gain in the productivity of Federal workers will be generated by the increased accessibility of electronic and information technology.

Wage Gap Analysis

This analysis examines the wage gap between the general Federal workforce and Federal employees with reportable and targeted disabilities. The upper bound assumes the benefits gained from the standards are equivalent to the complete elimination of the wage gap. The lower bound assumes a worst case scenario where no measurable benefits are generated by the standards (i.e., the wage gap is not diminished).

The EEOC data used for this analysis is limited to the white collar Federal workforce that earn wages on the general schedule, senior pay grades and other white collar wages.⁶ The EEOC data does not permit the inclusion of blue collar wages in this assessment. The wage gap in the blue collar Federal workforce is likely to be smaller in absolute terms because the gap is driven by distribution among employee grades. There is a narrower distribution overall among civilian Federal workers not covered by the general schedule. The data used by the EEOC is from the Central Personnel Data File (CPDF)⁷ and is organized according to the Federal white collar occupational series. White collar positions are defined by five employment categories by which Federal

⁶ EEOC, "Annual Report on the Employment of Minorities, Women and People with Disabilities in the Federal Government: For the Fiscal Year Ending 1998." See Table II-6.

⁷ CPDF is an automated file created by OPM. The file is based on personnel action information submitted directly to the OPM by Federal agency appointing offices. The Standard Form 50, "Notification of Personnel Action," is the basic source of input to the CPDF. The CPDF does not include data for the Tennessee Valley Authority, United States Postal Service, Army and Air Force Exchange Service, Central Intelligence Agency, Defense Intelligence Agency, the National Imagery and Mapping Agency, or the National Security Agency. These agencies make up approximately 30 percent of the Federal workforce.

agencies can group occupational services: Professional, Administrative, Technical, Clerical, and Other.

Federal employees with disabilities are classified as having reportable and targeted disabilities. The disability status is determined by the Standard Form 256, Self-Identification of Reportable Handicap, which is a voluntary form developed by OPM and used to identify employees with disabilities in the Federal workforce. This data may understate the number of Federal employees with disabilities since many employees elect not to complete this form. Employees with targeted disabilities represent a subset of the reportable disabilities group and include nine major categories: deafness, blindness, missing extremities, partial paralysis, complete paralysis, convulsive disorders, mental retardation, mental illness, and distortion of limbs and/or spine. Employees with targeted disabilities are excluded from the group with reportable disabilities to avoid double counting.

The EEOC data provides the number of Federal white collar employees with targeted and reportable disabilities in each pay grade. A weighted average salary was developed for each group (i.e., reportable and targeted disabilities). Within each grade the pay rate for employees on the general schedule are distributed over 10 steps.⁸ The EEOC data do not provide this level of detail, thus the mean rate for each pay grade is used. A weighted average salary was calculated based on the number of employees in each disability group. The wage gap between the general white collar workforce and the reportable and targeted disabilities workforce is simply the difference between the weighted average salary for all white collar employees and averaged within the two disability groups. Based on the wage gap, the aggregate value of the wage gap is calculated using the total number of employees in the disability group. When summed this figure represents the complete elimination of the existing wage gap and thus the upper bound of the benefits expected to be derived from the standards. The results are shown in Table 5-1.

⁸ OPM, Federal Civilian Workforce Statistics: Pay Structure of the Federal Civil Service as of March 31, 1998. Data from the tables on page 51 are used to derive the average rate in each pay grade. The range for senior pay is derived from the subtables for Senior Executive Service (ES), Executive Schedule (EX), and Senior Level (SL & ST). The average rate for the other category is based on data from Figure 3 for all areas.

Table 5-1

Disability by Type	Number	Weighted Ave. Salary	Wage Gap	Aggregate Value of Wage Gap
All White Collar	1,409,306	\$ 44,664	\$ -	\$ -
White Collar Reportable Disability (w/o Targeted)	79,779	\$ 40,735	\$ 3,929	\$ 313,459,432
White Collar Targeted Disability	16,235	\$ 35,288	\$ 9,376	\$ 152,253,902
Upper Bound				\$ 465,713,333

This analysis is limited by the fact that only 70 percent of the Federal workforce is represented in the CPDF and the exclusion of blue collar employees. Therefore this upper bound estimate understates the maximum potential benefits of the standards. This analysis does not suggest that the actual wage gap will actually be closed, especially in the short-term. Federal wages are influenced by a number of factors other than productivity and can be expected to respond slower to change in productivity than wages in the private sector.

Limitations to the wage gap approach include:

- Magnitude of the wage gap is driven by distribution of workers among grades. This distribution is affected by more than just the accessibility of technology. The actual wage gap is unlikely to change unless other factors, such as education, change as well.
- Because so many factors effect wage distribution, the choice of any specific productivity increase between zero and the upper-bound estimate is arbitrary.
- The assumption that an individual Federal worker’s wage reflects their productivity because the worker could find employment elsewhere at a similar rate is called into question if the technology that makes them productive is only available in the Federal workplace.

Team Based Analysis

An alternative to using wages as a proxy for productivity is to view the Federal workforce as a series of teams. Government employees tend to work in teams with the productivity of each worker affecting the productivity of their teammates. The Federal workforce is more productive because the individual worker with a disability and their team’s productivity should increase due to the improved accessibility of electronic and information technology.

Because it is difficult to estimate the productivity of any individual Federal worker or team, it is also difficult to quantify the value of the change in this productivity. There are

two methodological issues: determining the value of Federal government outputs, and how to apportion this output among individual Federal workers. In the private sector, an individual's wage rate is one of the best measures of productivity. The wage rate not only captures individual performance, but also the relative scarcity of those skills in the labor market. The Federal wage rate, however, does not capture either of these measures of economic productivity very well. Federal workers are mostly paid the same regardless of the scarcity of their skills in the labor market. Agencies cannot rapidly raise wages to attract scarce skills. Because agencies can only raise offering salaries with significant administrative effort, Federal wages are an imperfect reflection of the value of scarce skills.

Within the Federal workforce, wages are only a rough estimate of relative productivity of workers. Through the merit system, promotions and yearly bonuses tend to go to the most valuable workers within a given Federal organization. However, since there are statutory and other administrative constraints, the Federal wage rate is only a rough measure of an individual worker's productivity. In the absence of direct measures of individual productivity, it will be assumed in this analysis that the average productivity of a Federal team is equal to the average Federal wage rate of that team. Since workers with disabilities and their teams work throughout the Federal government, the average wage rate of all the teams that benefit is equivalent to the average Federal wage rate. Recognizing the limitations listed above, this assumption is consistent with economic theory.

Improved access to electronic and technology increases the productivity of the Federal worker with a disability, modeled as a percentage increase of the average Federal wage for that worker. Although Federal workers with disabilities typically have an average Federal wage lower than the average wage of all Federal workers, this analysis uses the average wage of all Federal workers on the general schedule which is \$44,824 according to 1998 OPM data.⁹ This assumption is chosen to recognize that greater productivity by one member of a Federal team (the worker with a disability]) leads to greater productivity for the entire team. The analyses models this spillover effect by applying the percentage increase in productivity to the higher, average Federal wage rate. The dollar value of this increase in productivity is calculated by multiplying the average Federal wage by the estimated increase in productivity and then by the number of workers with disabilities in the Federal workforce. The analysis uses two estimates of the number of workers with disabilities to provide a range of the potential benefits. The lower bound is the number of workers with targeted disabilities, the more severe measure of disability. The upper bound is all workers with a reportable disability. This data may understate an actual increase in productivity due to the limitations discussed in section 3.2. As shown in Table 5.2, the standards are projected to increase the value of government outputs by a conservative lower bound estimate of \$62.8 million to

⁹ OPM, "Federal Civilian Workforce Statistics."

\$125.7 million per year. Considering all workers with a reportable disability, the benefits are estimated to range from \$375.7 million to \$751.3 million.

Table 5-2

Disability Status	Number of Federal Employees FY 1997	Lower Bound Productivity Increase (5 %)	Upper Bound Productivity Increase (10 %)	Aggregate Range (millions)
Targeted	29,000	\$ 2,241	\$ 4,482	\$ 62.8 - \$ 125.7
All Reportable	168,000	\$ 2,241	\$ 4,482	\$ 375.7 - \$ 751.3

Limitations of the team based approach include:

- Choice of a specific productivity increase as a result of these standards is arbitrary.
- Team assumption does not hold true everywhere in the Federal government.

5.3.2 Increased Public Accessibility

It is difficult to quantify the benefits of increased public access to Federal electronic information and technology. Congress has enacted the Freedom of Information Act (FOIA) and other laws to ensure that the public has access to the government information. Unfortunately the FOIA process does not necessarily result in a quantitative value for evaluating the public's demand, and presumably benefit, from acquiring this information. One proxy for evaluating the value of this information to the public is the level of annual sales generated by the National Technical Information Service (NTIS). The NTIS serves as a government clearinghouse for the purchase of technical data and reports produced by the government. The advantage of this measure is that, since consumers actually purchase the data, it mimics private market transactions. The disadvantage is that NTIS only markets a small slice of government information. Recognizing these limitations, NTIS revenues were \$37 million in fiscal year 1998. The advent of the internet has impacted the method by which NTIS disseminates information to the public. NTIS staff report that nearly 55 percent of sales (\$20.3 million) is in electronic formats. Clearly the public demand for electronic access to government information is strong. It can reasonably be expected that demand for electronic access to government information will continue to grow and thus increase the benefits of improving public access to Federal electronic and information technology.

5.3.3 Lowering the Baseline Costs of Accommodation

Under sections 501 and 504, of the Rehabilitation Act, Federal agencies bear costs to accommodate individual Federal workers with disabilities. Federal agencies may have lower costs in the future when accommodating Federal workers with disabilities due to

the standards. While this does not increase the social benefits of sections 501, 504, or 508, it does reduce the Federal government's internal cost of compliance.

5.3.4 Reduction in Barriers to Entry into the Federal Workforce by Persons with Disabilities

Lack of accessibility to electronic and information technology is a barrier to entry into the Federal workforce by individuals with disabilities. This barrier becomes larger, over time, as innovative products that may not have been developed with accessibility in mind become more common in the workplace. The lack of accessibility may limit the type of job functions that individuals with disabilities can perform. The barriers presented by a limited level of accessibility to electronic and information technology, also limit the productivity of Federal employees with disabilities. Incorporating accessible features into new products will diminish or eliminate barriers to performing job functions and provide greater opportunity for individuals with disabilities to compete for employment across the Federal sector.

5.3.5 Productivity Increases for Federal Workers Who Are Not Considered Disabled but Who May Benefit From the Availability of More Accessible Technology

Other Federal workers may find that the accessible features of electronic and information technology enhance their own productivity. In addition, the standards will allow Federal workers who become temporarily disabled to maintain their productivity during their illness and convalescence. While it is difficult to quantify these benefits, they exist and may be substantial.

5.3.6 "Spill-Over" Effects from Transfer of Accessibility Improvements from the Federal Government to the Private Sector

It is likely that software manufacturers will modify and sell one version of their products with accessible features to the government and to the private sector in response to these standards. Any productivity increases associated with these features will also spill-over into the private sector. It is difficult to quantify the spill-over benefits.

CHAPTER 6

RESPONSE TO COMMENTS

Four sets of comments, two from Federal agencies and two from parties outside the government, specifically addressed the economic assessment. The comments highlight a number of important shortcomings in this assessment. However, the comments do not contain sufficient detail to allow us to modify the analysis. However, we appreciate the input from the commenters and seek in this chapter to address their concerns and describe the implications those concerns might have on the conclusions drawn in the economic assessment.

A Federal agency suggested looking at the analysis being done by commercial and professional organizations such as the May 3, 2000 report on the Tech Republic site or the technical index of the Association of Computer Machinery. Unfortunately, we were unable to locate any information that was generalizable in these locations. A thorough search for data sources was conducted at the time the original analysis was conducted. Undoubtedly, there were sources of data that were missed in that initial search. However, without performing an entirely new analysis based on a specific data source, there is no way to judge whether the new data will significantly change the conclusions of the economic assessment. The same agency also suggested that the Board work with the OMB to expand the Federal budget “object class codes.” While this may be useful for future assessment of information technology expenditures, it is not likely to provide information that is useful to inform this analysis.

The same agency also questioned the assumptions associated with the modification of mission specific software. The agency noted that it spends a far greater percentage of its information technology budget on mission specific applications than on general office software. The agency estimated that the cost to modify mission specific software was higher than the 1 percent to 5 percent used in the economic assessment.

With respect to the relative level of spending on general office software and mission specific software, it is not clear whether the comment represents the unique circumstance of a single agency or a more systematic misunderstanding on the part of the authors of this analysis of Federal information technology spending. Because the 20 percent assumption was meant to represent an average, it is assumed that some agencies will buy a greater proportion of general office software, while others will purchase a greater proportion of mission-specific products. If, however, the concerns of the commenter are broadly generalizable to the rest of the Federal government, the estimate of the cost to the Federal government of general office software would decrease and the mission-specific estimate would increase. The cost to the Federal government would increase as would the total cost to society – because changes in general office software cost are borne by the entire market irrespective of the amount purchased by the Federal government. The magnitude of this shift in costs is unknown.

With respect to the concern that a 1 percent to 5 percent increase in the cost of developing mission specific software applications may be low, we concede that this may be the case. However, the commenter gave no indication by how much this assumption may understate cost for the software the agency develops. Moreover, we have no basis for judging whether this concern is shared by other agencies, or represents a specific concern for a particular agency. As a result, we cannot draw any generally applicable conclusions from this concern, other than to note that the \$10 to \$52 million estimated as the increase in costs for these products may be understated by some unspecified amount.

The same agency also questioned whether the analysis includes contractor dollars to develop software. It is our understanding that contractor costs are included in the GSA categories used in the analysis. If this were not the case, the total costs of the rule estimated by this analysis would be an understatement of the real cost of the standards.

In addition to these concern, there are two other factors associated with the use of the GSA data that may systematically understate costs:

- The methodology does not capture expenditures on software that may be purchased in conjunction with other goods and services purchased by the government on other schedules.
- The methodology does not capture the marginal increase in the cost of developing software completely within the Federal government.

Again, the magnitude of these additional costs in unknown, but the direction of the bias is clear.

One private sector commenter expressed concern that the costs of the standards are “severely understated.” The commenter cited two specific flaws in the analysis, which are quoted here in their entirety:

The determination of price in the marketplace is not based totally on the cost of production but rather largely on perceived value to the consumer. Since, as the Access Board has pointed out, accessibility features will mostly be invisible to individuals who do not have disabilities, they will therefore not contribute to their perceived value of the product. Consider this, if a software developer were to just make accessibility modifications to a product and then offer it as a new version at a higher price, the individual who does not have disabilities would refuse to buy the product at the higher price.

The scarcest resource in software development is experienced developers. In general, adding accessibility modifications will divert resources from the production of new and enhanced features, which will have the potential of wide acceptance and significant return on investment. Distributing the cost of the accessibility modifications across society not only makes the non-handicapped customer pay for unperceived value but it also deprives the user of new features and functions that

may have value. Just hiring new people, even if they were available, does not change these parameters.

The first concern affects who pays for the costs, not their magnitude. It is assumed by this analysis that the total costs of adding accessible features to a software program (including development, marketing, documentation, etc.) is the same whether you sell one copy or one million copies. That cost can then be recovered in one of three ways: the price of the product can be raised to all consumers of the product; the price can be raised only to those consumers who benefit, or only to the Federal government; or the company is forced to bear the cost, in which case the stockholders or owners “pay” for the accessible features. The ability to pass costs on to consumers broadly will be limited by their willingness to pay for the new features and the consumer surplus associated with their purchase of the initial product. If the accessible features of a product are transparent and not valued by most consumers, it will be difficult to pass these costs on to consumers unless they were already paying less for the non-accessible version than they were willing to pay. This analysis assumes that consumer surplus is sufficient to absorb the increase in costs.

The ability to pass the costs along to consumers through price discrimination (charging different consumers different prices) is limited again by the value of the features and by the ability of the seller to control who buys which version of the software. If this is the approach taken, it may make sense for the seller to market two distinct versions of the software. An extreme version of this approach would be to increase the price of software sold to the government sufficiently to cover the entire cost of the new features. This option is only viable if the Federal government is somehow precluded from buying the product elsewhere. If neither of these options is available to the seller, then the seller will be forced to bear the entire cost of the standard. The likely result of these standards will be some combination of the above. However, the question of who pays for the costs does not affect the overall costs of the standard.

The other concern regarding diverting software development resources is a completely valid criticism of the analysis. The analysis only quantifies the cost of the resources diverted to incorporating accessible features into software. It does not quantify the opportunity costs associated with what those same programmers would have been doing otherwise. While we cannot estimate the magnitude of this cost, it should have been more fully discussed in the analysis. Section 4.7 attempted to identify some of the unquantified opportunity costs, including the reduction in the rate of innovation. It is important to note, however, that the magnitude of the opportunity cost is limited by the marginal value to sellers of selling to the Federal government.

A Federal agency questioned the assumptions used in the wage gap analysis of the Federal workforce. The agency suggested that Federal workers with disabilities can be accommodated without the standards and that job satisfaction surveys may be a better source of information. While we agree that the wage gap analysis has significant limitations, we disagree with the comment. While individual accommodations clearly

provide benefits, wage and productivity differences continue to exist despite such accommodations and may be decreased as a function of the standards. While increases in job satisfaction are clearly a benefit, the purpose of these standards is to reduce or eliminate the barriers to productivity that result from lack of access to electronic and information technology. Increases in productivity are the more appropriate measure of the benefits of the standards. Wages are a convenient measure of productivity.

Another federal agency questioned the use of aggregate statistics, favoring instead separate estimates of costs and benefits for each disability type. While such an analysis may be an improvement over the reliance on aggregates and averages used to generate estimates in this analysis, neither the data nor the Board's resources supported such an approach.

Another commenter raised a number of important issues with respect to the analysis. While the economic assessment can be an important tool to inform the discussion, it was never intended to be the dispositive analysis of all possible costs and benefits of the standards, nor is it intended, as suggested by the commenter, to guide the implementation of the standards in any way. We agree with the commenter that the document is insufficiently precise or complete to serve such a purpose. The commenter stated that the standards are likely to impose a wide variety of technical and non-technical costs including:

For Companies

engineering and development
usability/human factors
product testing and quality assurance
product management
product development process
management
marketing
government sales staff
product documentation
technical support
customer support
corporate communications
legal and regulatory

For the Federal Government

procurement
IT planning
human resources
legal
technical support

We believe that the analysis captures most of the costs borne by companies, both technical and non-technical, because these costs will be reflected in the price of the products sold to the Federal government. On the other hand, the costs to Federal agencies for the items enumerated above are not quantified in the analysis. Instead, we discuss these costs without attempting to attach a number to them. This approach was taken due to a lack of available information. As a result, however, the quantified estimates clearly understate the true total cost of the standards.

The commenter also correctly pointed out that the timing of benefits and costs matters. We agree. However, we did not have any reliable information on the rate of decline of costs. Therefore, we used a steady state approach that inherently assumes that accessible products are available at reasonable cost.

The commenter suggested that some of the cost estimates on the upper end of the cost range may represent an undue burden. This interpretation of undue burden is inconsistent with our understanding of that term. It is our understanding that an undue burden is an affordability, not a benefit/cost test. The commenter also notes that benefits may be underestimated due to a failure to consider increases in productivity of workers without disabilities resulting from some subset of the accessible features. Again, this benefit is discussed in the analysis, but not quantified. It is difficult without considerably more information to assess which functions will have what benefit to whom. We must again satisfy ourselves with the understanding that the quantified estimates of benefits may underestimate the true benefits of the standards for failure to quantify these effects. The same is true of improvements in providing public access to government information.

The commenter took issue with the assumption that software would only be produced in a single accessible form for all markets, citing the existence of multiple versions of many existing programs. This concern is testable merely by observing the number of software products that are currently marketed in separate accessible and non-accessible versions. We are unaware of any such product. Moreover, this concern is contradicted by the comments of manufacturers who agreed with this assumption. As discussed previously, this assumption affects who pays for the costs rather than total costs.

The commenter also took issue with the assumption that Federal and non-Federal versions of hardware would be available. The commenter cited the expense of manufacturing two product lines to serve the same function. While it may be beneficial in some cases to stay with a single design, the choice to do so will be based largely on the economic implications of that decision. Therefore, the assumption that two product lines will exist represents a reasonable upper bound of the costs that can be attributed to the standards. It should be noted, however, that to the extent this assumption does not hold true, the estimate of the benefits of the standards will be understated due to a failure to consider spill-over benefits of accessible hardware.

The commenter also suggested that the benefits are understated for failure to consider the benefits to all users. It is not clear to us which accessible features will have benefits of what magnitude to which users. Many accessible features are invisible unless you affirmatively turn them on. It is not clear who will do so and why. In any case, the statement that all accessible features increase the ease and convenience (and presumably productivity) of all users seems overstated. The commenter also suggested that unlike costs, which can be expected to decrease over time, the benefits of the standards can be expected to increase over time. The commenter appears to

suggest that this analysis may underestimate benefits as a result of the failure to consider this increase over time. The commenter offers five supporting arguments:

- First, the number of accessible features will increase over time and they will become more available as the associated costs fall below the undue burden level. While both of these factors may be true, the analysis assumes that fully compliant products will be available immediately and that Federal agencies will not use the undue burden exemption. As a result, the analysis may overstate benefits in the short-term, not understate them in the long-term. However, future benefits may be understated if costs come down sufficiently over time such that they no longer justify manufacture of a separate Federal hardware products and there is significant spill over of accessible hardware into the general market.
- Second, increase awareness of accessible features will create additional benefits without requiring actual changes in products. Again, while this may be true, the analysis already assumes perfect knowledge and implementation of all accessible features required by the standards.
- Third, the increased options of persons with disabilities will be recognized earlier in their education, perhaps reducing special education and remedial education, as well as improving educational and employment outcomes. This is, in fact, a category of benefits that is not included in the analysis. We do not know how to assess the magnitude of these benefits, but we acknowledge that they are important.

The commenter understood our analysis to assume that all software products were complete re-writes. This is, in fact, not the case. We assumed that software products were in a constant process of improvement and that some proportion of that process of improvement would be devoted to ensuring that both the underlying product and the improvements were accessible.

The commenter offered suggestions on the issue of training. On the one hand, the commenter argued that accessible technology should decrease the cost of training an employee with a disability. This benefit should already be captured in the increased productivity of that worker. On the other hand, the commenter agreed that the standards would result in the need for additional training within agencies and companies. The commenter suggested that requests for documentation in alternate format are likely to be low. We have no basis upon which to disagree with the comments. However, until those requests are zero, companies must still produce documents in alternative formats. In any case, documentation costs are not separable in the economic assessment. The commenter noted that the assumption in the analysis that the undue burden exemption will not be used may not be accurate. This was a simplifying assumption that results in both benefit and cost estimates being

overstated. The magnitude of this bias will be determined by how Federal agencies and the courts chose to interpret this language.

The commenter suggested that the inclusion of the “information technology services” category in the calculation of software costs may not be justified in its entirety. Some of the products purchased under this category may not be affected by the standards such as project management or temporary personnel services. The commenter suggests that we break this category of costs into services that are affected by the standards and those that are not. We do not have the information that would allow us to do such a breakdown of the spending in this category. Moreover, while the services identified by the commenter may not be directly analogous to the costs of software modification, the standards will impose additional costs in the form of training and other necessary expertise for all individuals who deal with Federal computer systems. The degree to which inclusion of these services leads to an overstatement of costs is also offset, at least to some degree, by the fact that there is likely to be some software, hardware, or other computer service component in many of the products purchased by the government on schedules not included in the analysis.

The commenter also suggested that the cost range estimated using the number of accessibility specialists in a software company overstates the cost of the standards because not all of the accessibility specialists are involved in software development. The commenter suggests that we lower our cost range by a factor of sixteen to reflect the fact that in one company only 25 percent of accessibility specialists are involved in software development and to reflect the unsupported assumption that accessibility specialists only leverage a quarter of a work year from other employees in the firm. We disagree with this conclusion. First, replacing one set of imperfect assumptions with a second does little to improve the analysis. Second, and more importantly, the cost of a product reflects all of the costs associated with its development, marketing, legal and regulatory compliance, and client service. The fact that many accessibility specialists are involved in the non-development activities at a firm does not eliminate their contribution to the cost of a product.

The commenter does not agree with the 5 percent upper bound incremental cost for compatible hardware products. As stated in the assessment, this cost estimate was included as a sensitivity analysis. We agree with the commenter that the real number is likely to be closer to the lower bound estimate of zero. If we use the 1 percent increase suggested by the commenter as an upper bound, the sensitivity of the analysis to our assumption of zero cost falls from \$337 million to \$67 million.

In sum, the comments raised a number of valid and interesting concerns. While we cannot say with absolute certainty what the overall impact of weaknesses in the assumptions used in this analysis might be, it appears a reasonable conclusion that both the benefits and the costs of the standards are understated by some amount.