DECLARATION OF JUNE ANN MUNFORD

POSCO-1082
POSCO v. ArcelorMittal
IPR2025-00371

1. My name is June Ann Munford. I am over the age of 18, have personal knowledge of the facts set forth herein, and am competent to testify to the same.

2. I earned a Master of Library and Information Science (MLIS) from the University of Wisconsin-Milwaukee in 2009. I have over ten years of experience in the library/information science field. Beginning in 2004, I have served in various positions in the public library sector including Assistant Librarian, Youth Services Librarian and Library Director. I have attached my Curriculum Vitae as Appendix CV.

3. During my career in the library profession, I have been responsible for materials acquisition for multiple libraries. In that position, I have cataloged, purchased and processed incoming library works. That includes purchasing materials directly from vendors, recording publishing data from the material in question, creating detailed material records for library catalogs and physically preparing that material for circulation. In addition to my experience in acquisitions, I was also responsible for analyzing large collections of library materials, tailoring library records for optimal catalog

search performance and creating lending agreements between libraries during my time as a Library Director.

4. I am fully familiar with the catalog record creation process in the library sector. In preparing a material for public availability, a library catalog record describing that material would be created. These records are typically written in Machine Readable Catalog (herein referred to as "MARC") code and contain information such as a physical description of the material, metadata from the material's publisher, and date of library acquisition. In particular, the 008 field of the MARC record is reserved for denoting the date of creation of the library record itself. As this typically occurs during the process of preparing materials for public access, it is my experience that an item's MARC record indicates the date of an item's public availability.

5. Typically, in creating a MARC record, a librarian would gather various bits of metadata such as book title, publisher and subject headings among others and assign each value to a relevant numerical field. For example, a book's physical description is tracked in field 300 while title/attribution is tracked in field 245. The 008 field of the MARC record is reserved for denoting the creation of the library record itself. As this is the only date reflecting the inclusion of said materials within the library's collection, it is my experience

that an item's 008 field accurately indicates the date of an item's public availability.

6. I am familiar with the Internet Archive, a digital library formally certified by the State of California as a public library. Among other services that the Internet Archive makes available to the general public is the Wayback Machine, an online archive. The Internet Archive's Wayback Machine service archives webpages as of a certain capture date to track changes in the web over time. The Internet Archive has been in operation as a nonprofit library since 1996 and has hosted the Wayback Machine service since its inception in 2001. During my time as a librarian, I frequently used the Internet Archive's Wayback Machine for research and instruction purposes. This includes teaching instructional classes on using the Wayback Machine to library patrons and using the Wayback Machine to research reference inquiries that require hard-to-find online resources. I consider the Internet Archive's recordkeeping to be as rigorous and detailed as other formal library recordkeeping practices such as MARC records, OCLC records and Dublin Core.

Suehiro

7. I was asked to evaluate the public availability of Exhibit EX-1053 and Exhibit EX-1054 with respect to a December 2005 priority date. I have reviewed Exhibit EX-1053, a document entitled "Properties of Aluminum-casted Steels for Hot-forming" by Masayoshi Suehiro, et al as published in Nippon Steel Technical Report July 2003. I have also reviewed Exhibit EX-1054, a document entitled "ホットプレス用アルミニウムめっき鋼板の諸特性" by Masayoshi Suehiro, et al as published in 自動車用材料特集 July 2003. Based on the bibliographic information contained within each exhibit, EX-1054 appears to be a Japanese-language version of EX-1053.

8. For the sake of clarity when discussing these two versions of the same paper, I will be hereto referring to "Properties of Aluminum-casted Steels for Hot-forming" by Masayoshi Suehiro, et al as published in Nippon Steel Technical Report July 2003 as the "Suehiro Paper (English Language)," and I have also reviewed will refer to "ホットプレス用アルミニウムめっき鋼板の諸特性" by Masayoshi Suehiro, et al as published in 自動車用材料特集 July 2003, as the "Suehiro Paper (Japanese Language)."

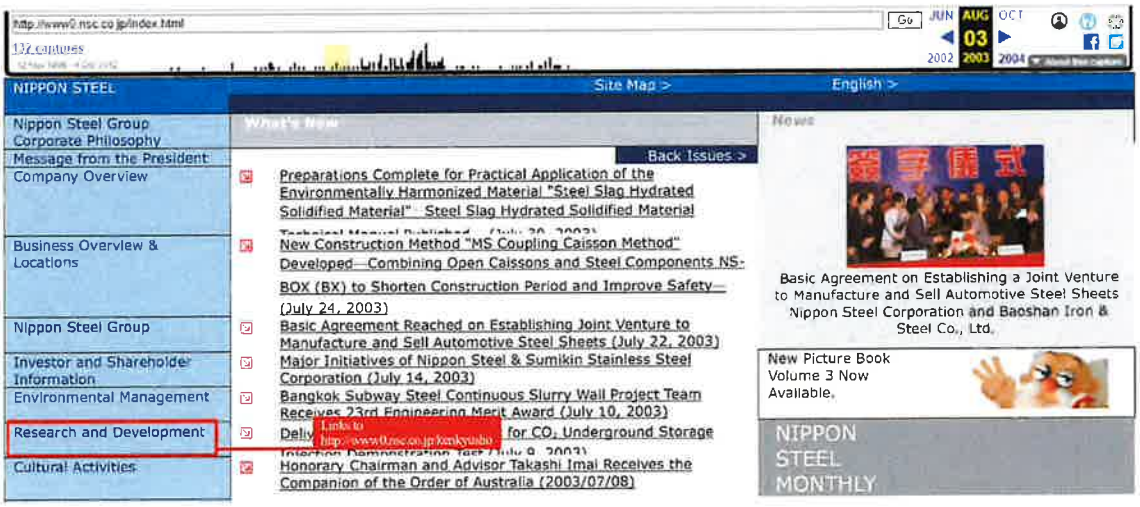
9. Based on my review, Suehiro was available to the public as of October 2003 via Nippon Steel's website, and likely earlier via libraries.

10. Specifically, an interested researcher would have accessed the webpage attached as Appendix SUEHIRO02, a certified translation of which is attached as Appendix SURHIRO03. A certificate from the translator of this page is attached as Appendix SUEHIRO01. The certificate refers to Appendix SUEHIRO02 as "#107636_JP-1." Appendix SUEHIRO02 is an Internet Archive record of the Nippon Steel website, capturing http://www0.nsc.co.jp/index.html as of August 3, 2003. This record can be found at https://web.archive.org/web/20030803020432/http://www0.nsc.co.jp/index.html. This webpage appears to be Nippon Steel's homepage. It would have been obvious for an interested person to access this webpage, as it provides news, research information, financial information, and other information for Nippon Steel, which I understand from background was, and continues to be, a major, globally-significant steel manufacturer.

11. On the homepage, it would have been obvious for an interested person (for example, someone interested in Nippon Steel's research) to click the link labeled in red below, which is labeled "Research and Development.":



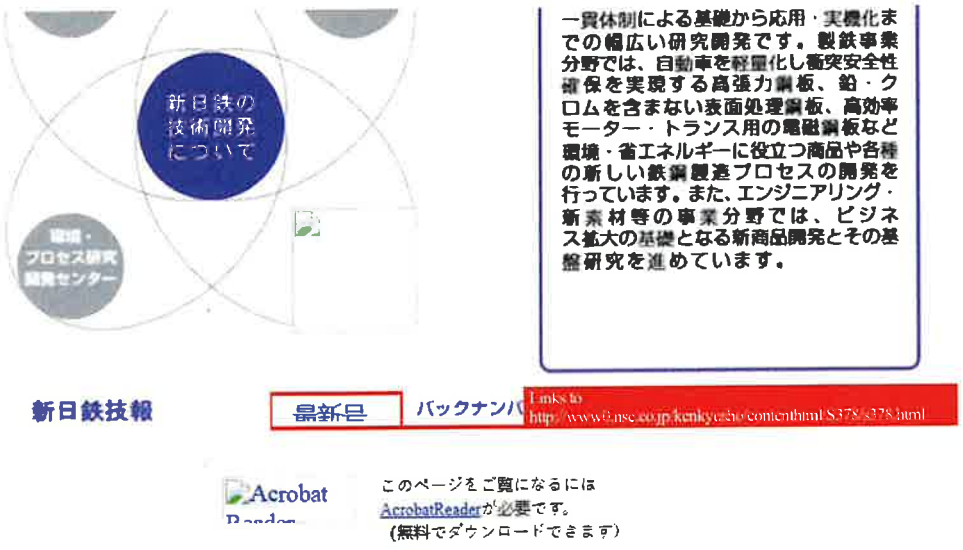
The Japanese-language Homepage as presented in Appendix SUEHIRO02



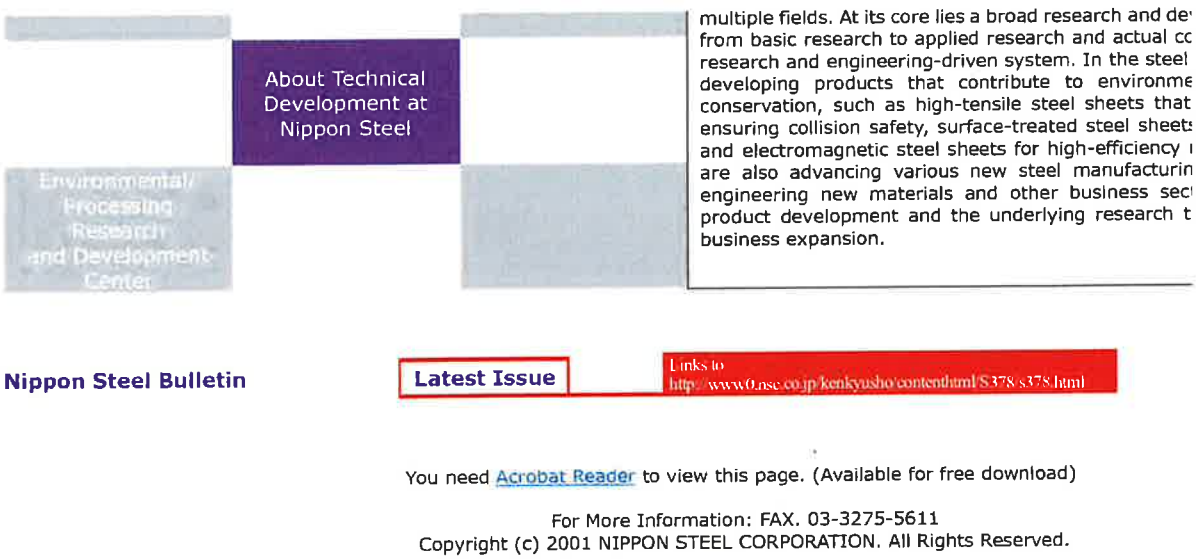
The English-language Homepage as translated in Appendix SUEHIRO03

12. Clicking that link would bring the person to the webpage attached as Appendix SUEHIRO04, a certified translation of which is attached as Appendix SUEHIRO05. A certificate from the translator of this page is attached as Appendix SUEHIRO01. The certificate refers to Appendix SUEHIRO04 as "#107636_JP-2." Appendix SUEHIRO04 is an Internet Archive record of the Nippon Steel website, capturing http://www0.nsc.co.jp/index.html/kenkyusho/ as of October 31, 2003. This record can be found at https://web.archive.org/web/20031031193545/http://www0.nsc.co.jp/kenkyusho/. This webpage appears to be a general research and development page, as it includes links about Nippon Steel's research and development centers.

13. From this webpage, it would have been obvious for an interested person to click the link labeled in red below, which states "Latest Issue," i.e., the latest issue of the "Nippon Steel Bulletin" named to the left of the link:



The Japanese-language R&D Page as presented in Appendix SUEHIRO04



The English-language R&D Page as presented in Appendix SUEHIRO05

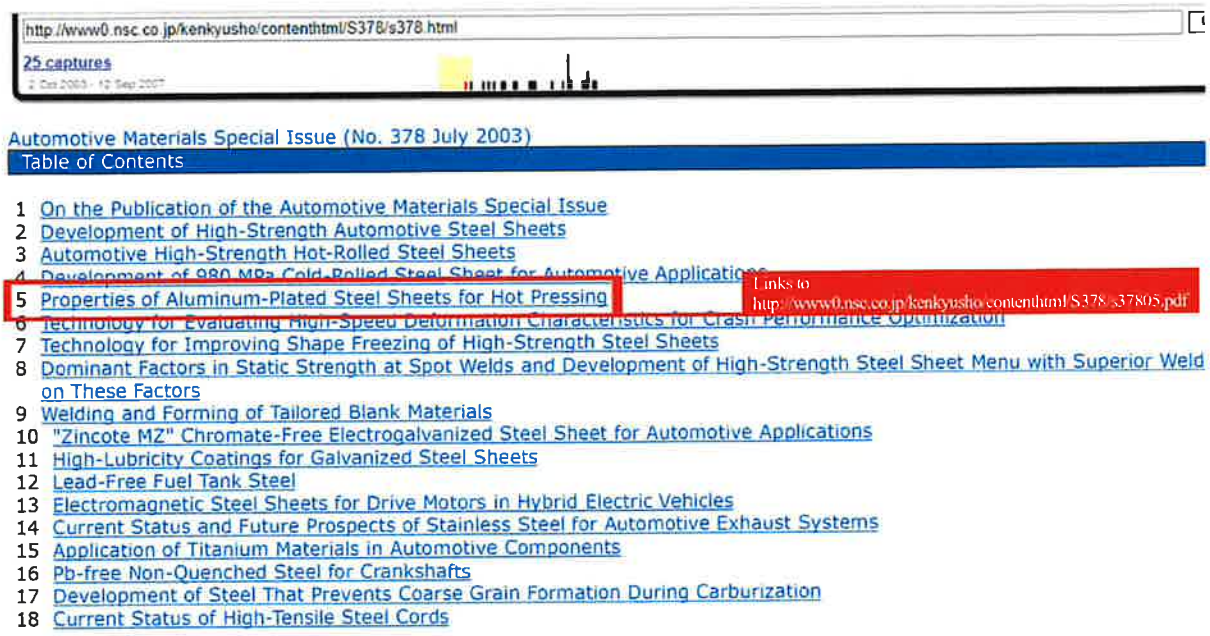
14. A researcher would expect that the "Latest Issue" would reflect the most recent, up-to-date research being performed by Nippon Steel.

15. Clicking that link would bring the person to the webpage attached as Appendix SUEHIRO06, a certified translation of which is attached as Appendix SUEHIRO07. A certificate from the translator of this page is attached as Appendix SUEHIRO01. The certificate refers to Appendix SUEHIRO06 as "#107636_JP-3." Appendix SUEHIRO06 is an Internet Archive record of the Nippon Steel website, capturing http://www0.nsc.co.jp/index.html/kenkyusho/contenthtml/S378/s378.html as of October 2, 2003. This record can be found at

https://web.archive.org/web/20031002234705/http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s378.html. This webpage appears to be a "Table of Contents" for Issue No. 378 of the Nippon Steel Technical Report, titled "Automotive Materials Special Issue." Item 5 in the Table of Contents has a link, labeled in red below, titled "Properties of Aluminum-Plated Steel Sheets for Hot Pressing," i.e., the title of Suehiro. It would have been obvious for a person interested in hot-pressed steel to click this link to view the corresponding article:



The Japanese-language ToC Page as presented in Appendix SUEHIRO06



The Japanese-language ToC Page as presented in Appendix SUEHIRO07

16. Clicking this link in the Table of Contents, a person would have been provided with a PDF download of Suehiro. This PDF is archived at the Internet Archive and attached as Appendix SUEHIRO08, which was captured by the Internet Archive on November 19, 2004. This appears to be the earliest available capture of Suehiro on the Internet Archive. However, the fact that the October 2, 2003 capture of the Table of Contents includes a clickable link to the same page as the archived PDF strongly suggests that the PDF was also available as of October 2, 2003. In any case, the PDF was clearly available as of November 19, 2004.

17. Thus, my analysis of the Nippon Steel website leads me to conclude that, no later than October 2003, an interested person would have found it natural to navigate from Nippon Steel's homepage, to Nippon Steel's "Research and Development" page, to the Table of Contents for the latest issue of the Nippon Steel Technical Report, to Suehiro. As a result, I conclude that Suehiro was publicly available, and easy for an interested researcher to find, no later than October 2003.

18. Records from the Penn State University Library corroborate that interested persons would have known to navigate Nippon Steel's website to obtain technical articles such as Suehiro. Attached hereto as Appendix SUEHIRO09 is a true and correct copy of the MARC record for Nippon Steel Technical Report as held by the Penn State University Library. I secured this record myself from the library's public catalog. The MARC record contained within Appendix SUEHIRO02 accurately describes the title, publisher and ISSN number of Nippon Steel Technical Report. The availability field present on page 2 of Appendix SUEHIRO02 provides a link to the www0.nsc.co.jp website captured in Appendices SUEHIRO01 – SUEHIRO07. As this record indexes several bibliographic details such as the journal's title, publisher and subject, it is reasonable to assume any POSITA searching in the Penn State catalog would be able to discover the

record captured in Appendix SUEHIRO02 and thus, the www0.nsc.co.jp website containing a PDF copy of the Suehiro paper.

19. To further evaluate the public availability of Suehiro, I searched for relevant Japanese library records. Based on my review, Suehiro was publicly available at the National Diet Library in Tokyo no later than September 16, 2003.

20. First, the National Diet Library's records demonstrate a long history of collecting and making available the Nippon Steel Technical Report journal, which published the Suehiro Paper (Japanese Language). Attached hereto as Appendix SUEHIRO11 is the MARC record from the National Diet Library describing Nippon Steel Technical Report, a certified translation of which is attached as Appendix SUEHIRO12. A certificate from the translator of this page is attached as Appendix SUEHIRO10. Appendices SUEHIRO11 & SUEHIRO12 are true and correct copies of the MARC record for Nippon Steel Technical Report as held by the National Diet Library. I secured this record myself from the library's public catalog at https://ndlsearch.ndl.go.jp/books/R100000002-I000000079970?page=1#ndl. The MARC record contained within Appendix SUEHIRO11 & SUEHIRO12 accurately describes the title, publisher and ISSN number of

Nippon Steel Technical Report. The National Diet Library Collection field present on page 3-5 of this record indicates the library's collection includes the 378th issue of Nippon Steel Technical Report containing the Suehiro Paper (Japanese Language).

21. The 008 field of the MARC record in Appendix SUEHIRO11 & SUEHIRO12 indicates the date of record creation. The 008 field of Appendix SUEHIRO11 & SUEHIRO12 indicates the National Diet Library first acquired Nippon Steel Technical Report as of November 11, 1991 and held the journal in perpetuity until the publication of the 378th edition and further. Considering this information, it is my determination that Nippon Steel Technical Report 378 and therefore The Suehiro Paper (Japanese Language) was made available to the public shortly after its initial publication in 2003.

22. Second, the National Diet Library's records indicate that an indexing record for The Suehiro Paper (Japanese Language) was created on September 16, 2003, consistent with public availability long before December 2005. Attached hereto as Appendix SUEHIRO13 is the MARC record from the National Diet Library describing The Suehiro Paper (Japanese Language), a certified translation of which is attached as Appendix SUEHIRO14. A

certificate from the translator of this page is attached as Appendix SUEHIRO10. Appendices SUEHIRO13 & SUEHIRO14 are true and correct copies of the MARC record for The Suehiro Paper (Japanese Language) as held by the National Diet Library. I secured this record myself from the library's public catalog at https://ndlsearch.ndl.go.jp/books/R000000004-I6674061. The MARC record contained within Appendix SUEHIRO13 & SUEHIRO14 accurately describes the title, author and issue number of Nippon Steel Technical Report associated with The Suehiro Paper (Japanese Language).

23. The 008 field of the MARC record in Appendix SUEHIRO13 & SUEHIRO14 indicates the date of record creation. The 008 field of Appendix SUEHIRO13 & SUEHIRO14 indicates the National Diet Library created a record for The Suehiro Paper (Japanese Language) as of September 16, 2003 and therefore The Suehiro Paper (Japanese Language) was made available to the public via the National Diet Library no later than September 16, 2003.

24. Third, a signed statement from a director at the National Diet Library certifies that The Suehiro Paper (Japanese Language) was received by the National Diet Library on August 13, 2003, consistent with being made

publicly available about a month later as indicated by the above-discussed September 16, 2003 date of record creation. Attached hereto as Appendix SUEHIRO16 is a certificate from the National Diet Library, a certified translation of which is attached as Appendix SUEHIRO17. A certificate from the translator of this page is attached as Appendix SUEHIRO15. Appendices SUEHIRO16 & SUEHIRO17 are a certified statement from the National Diet Library describing the library's copy of The Suehiro Paper (Japanese Language) as well as a scan of that paper from the original journal issue. This document from the National Diet Library supports my above opinion on public availability, as page 1 of this certified statement confirms the 378th issue of Nippon Steel Technical Report was received by the library as of August 13, 2003, which would result in its public availability shortly thereafter (e.g., on or about September 16, 2003, when the MARC record for the paper was created).

25. Based upon my analysis of Appendices SUEHIRO10 – SUEHIRO14, the National Diet Library was regularly making new issues of Nippon Steel Technical Support available to the public soon after receipt. Appendices SUEHIRO16 & SUEHIRO17 indicate the 378th was processed and made available according to this standard procedure. Appendices SUEHIRO13 & SUEHIRO14 present a fully-indexed record of The Suehiro Paper (Japanese

Language), indicating the library was able to review and catalog material from the 378th issue of Nippon Steel Technical Report certainly no later than September 16, 2003.

26. There are other strong reasons, too, to believe that Suehiro was publicly available in 2003, i.e., its listed date of publication. For example, Suehiro includes a UDC (Universal Decimal Classification) code in its first-page header. EX1055. Page 1 of The Suehiro Paper (Japanese Language) contains the following UDC (Universal Decimal Classification) Call Number: 669.718.5:669.14.018.295-415. The Universal Decimal Classification is an alternative to more country-specific call number schemas such as the Dewey Decimal System and the Library of Congress Classification System. This universal system is adopted globally by librarians as a way to classify academic works by subject and organize collections within the library. The inclusion of the UDC on the front page of The Suehiro Paper (Japanese Language) indicates the publishers of Nippon Steel Technical Report intended to distribute this journal to libraries.

27. University library records for The Suehiro Paper (English Language) (EX-1053) support the public availability of Suehiro prior to December 2005.

Indeed, the Nippon Steel Technical Report was widely available in libraries in the United States.

28. For example, as detailed in Appendix SUEHIRO18, Colorado School of Mines created a hybrid record combining the paper and digital editions of the Nippon Steel Technical Report in a single MARC. This is because the Nippon Steel Technical Report changed publishing methodology in the United States from print to digital in 2002. The 'Available' field present on page 2 of Appendix SUEHIRO18 indicates Colorado School of the Mines collected paper copies of Nippon Steel Technical Report from 1983 – 2002, while the school's e-book holdings span from 1993 – 2013. These holdings encompass The Suehiro Paper (English Language) published in 2003. This hybrid MARC record describing both formats illustrates the standard library practice of acquiring a publication and collecting subsequent issues of the given publication for library use: library catalogers created this record to create a consistency in access and service as the publication's format and distribution method changes.

29. That is, Colorado School of Mines worked diligently to maintain Nippon Steel Technical Report editions for a span of thirty years, even maintaining the journal in multiple formats to ensure continuous availability. Standard

library practice with periodicals like the Nippon Steel Technical Report is to make editions of time-sensitive materials such as journals available to patrons as they were released. While this Colorado School of the Mines MARC record does not definitively index or describe the Suehiro Paper, it is consistent with the record of a library actively collecting and making available to the public Nippon Steel Technical Report as of 2003.

30. Further, the MARC record treats Nippon Steel Technical Report like any other publicly-disseminated journal: indexing it in multiple categories, making it available in the Journals Collection, etc. This is quite different from how a library might treat a private, unindexed, or limited-access document.

31. I have reviewed comments related to Internet Archive captures in the Patent Owner's Response for case IPR2025-00370. The comments state that "although Ms. Munford attaches an exhibit purporting to show the first URL was captured by the Internet Archive on November 19, 2004, when Patent Owner's expert visited that URL, the earliest recorded capture date was November 3, 2005." POR, 54. The indicated URL is "http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s37805.pdf". POR, 54.

32. The foregoing statement in the Patent Owner's Response appears to reflect an error in accessing the relevant URL. The Internet Archive does have a November 19, 2004 capture of this URL, which stores Suehiro as a PDF. See "https://web.archive.org/web/20041119035423/http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s37805.pdf". This is corroborated by the Declaration of Mina Ching (Appendix CHING01), which includes an explanation of how Internet Archive URLs indicate the date of capture and which includes (as its own Exhibit B) a copy of Suehiro with a URL including "20041119", indicating a capture date of November 19, 2004.

GWM14400

33. I was previously asked to evaluate the public availability of GMW14400 (EX-1026), a standard entitled Low Carbon, Heat-Treatable Boron Steel – Uncoated or Aluminized Pre-Coated by GM Worldwide Engineering Standards.

34. My previous declaration (EX-1027) cited a declaration (Appendix SCHUSTER01) by Shannon Schuster, an employee of Accuris. Accuris is a data analysis and distribution firm that serves as a third-party distributor of

standards. Accuris is a successor company of Information Handling Services (IHS), which launched its online "Standards Store" in 2000. IHS and its successors have served as third-party distributors for General Motors' engineering standards.

35. According to the Schuster declaration, Low Carbon, Heat-Treatable Boron Steel – Uncoated or Aluminized Pre-Coated (short-handed in the Schuster declaration by its standard number #GMW14400) has been available for purchase from Accuris since December 1, 2005.

36. My previous declaration also cited webpage captures illustrating that the IHS Standards Store ("Global Engineering Documents") had search and indexing functionality that would have enabled a user accessing "global.ihs.com" to find GMW14400.

37. I have now been asked to further assess the public availability of GMW14400, with a focus on whether an interested person would have known about the IHS Standards Store ("Global Engineering Documents") in order to thereby access GMW14400. I have also been asked to further assess whether the IHS Standards Store would have had search and indexing

functionality in December 2005, when, according to Shannon Schuster, GMW14400 became publicly available.

38. I have identified notable references to Global Engineering Documents, and to "global.ihs.com" specifically, demonstrating that an interested person—for example, someone interested in obtaining General Motors standards—would have known to access "global.ihs.com" to obtain GMW14400.

39. First, a librarian's reference book (Appendix GMW144002) from 1998 specifically lists "Global Engineering Documents" and the URL "global.ihs.com" as sources for obtaining numerous standards. How To Get It: A Guide to Defense-Related Information Resources ("Librarians' Edition") "is a reference tool to identify and/or obtain government published or sponsored publications, documents, maps, patents, specifications, standards regulations, and other information resources of interest to the defense community." Thus, How To Get It is highly relevant to public availability and knowledge of the IHS Standards Store as a source for documents: librarians would have consulted this book in order to direct patrons to requested resources.

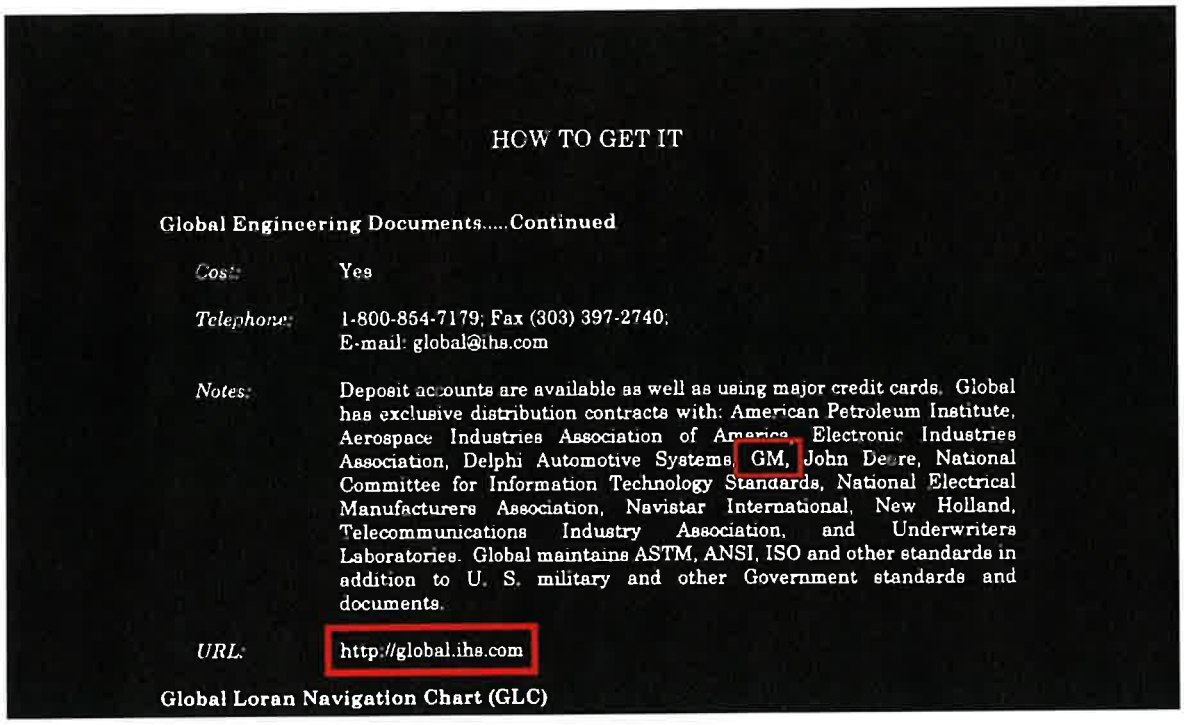
40. Attached hereto as Appendix GMW144001 is a true and correct copy of the MARC record for How to Get It: A Guide to Defense-Related Information Resources July 1998 as held by the University of Akron Library. I secured this record myself from the library's public catalog. The MARC record contained within Appendix GMW144001 accurately describes the title, author, publisher, and ISBN number of How to Get It: A Guide to Defense-Related Information Resources July 1998.

41. Attached hereto as Appendix GMW144002 is a true and correct copy of portions of How to Get It: A Guide to Defense-Related Information Resources July 1998 as held by the University of Akron Library. These scans were secured from the library's collection. A stamp reading 'University of Akron/477-C Bierce Library Dec 10 1998 Received Depository' indicates this document was physically present within the library as of December 10, 1998.

42. The 008 field of the MARC record in Appendix GMW144001 indicates the date of record creation. The 008 field of Appendix GMW144001 indicates the University of Akron Library first acquired How to Get It: A Guide to Defense-Related Information Resources July 1998 as of December 3, 1998. Considering this information, it is my determination that How to Get It: A

Guide to Defense-Related Information Resources July 1998 was made available to the public shortly after its initial acquisition as of December 3, 1998.

43. How To Get It include several specific references to "global.ihs.com". For example, How To Get It, in association with the "URL" "http://global.ihs.com", states that "Global has exclusive distribution contracts with: American Petroleum Institute, Aerospace Industries Association of America, Electronic Industries Association, Delphi Automotive Systems, GM, John Deere, National Committee for Information Technology Standards, National Electrical Manufacturers Association, Navistar International, New Holland, Telecommunications Industry Association, and Underwriters Laboratories. Global maintains ASTM, ANSI, ISO and other standards in addition to U.S. military and other Government standards and documents." See Appendix GMW144002, pg. 14. Note the specific reference to "GM" (General Motors).



HOW TO GET IT

Global Engineering Documents.....Continued

Cost: Yes

Telephone: 1-800-854-7179; Fax (303) 397-2740;
E-mail: global@ihs.com

Notes: Deposit accounts are available as well as using major credit cards. Global has exclusive distribution contracts with: American Petroleum Institute, Aerospace Industries Association of America, Electronic Industries Association, Delphi Automotive Systems, GM, John Deere, National Committee for Information Technology Standards, National Electrical Manufacturers Association, Navistar International, New Holland, Telecommunications Industry Association, and Underwriters Laboratories. Global maintains ASTM, ANSI, ISO and other standards in addition to U. S. military and other Government standards and documents.

URL: http://global.ihs.com

Global Loran Navigation Chart (GLC)

Page 14 of Appendix GMW144002

44. Thus, How To Get It demonstrates that a wide variety of people would have been directed to "global.ihs.com" to access standards, including people interested in General Motors' standards, people in the automotive industry, and people in the aerospace, telecommunications, and electrical industries.

45. How To Get It further demonstrates that "global.ihs.com" was not a private, obscure, or otherwise unknown source. Rather, this online store was a well-known, documented source for documents in many different fields, including widely-used standards such as ASTM, ISO, and JEDEC standards. See Appendix GMW144002, pg. 12, 14.

46. The well-known nature of "global.ihs.com" is further corroborated by Appendix GMW144003, an August 2005 capture of the University of Washington Library's "Engineering Standards Database Search" webpage. This webpage includes a note that "The edition held by the Engineering Library, may not be the most current edition. To check for other editions of a standard, search...Global Engineering Documents." "Global Engineering Documents" is a hyperlink that can be clicked to access "global.ihs.com". Appendix GMW144003 demonstrates that engineering students and other patrons of the University of Washington Library would have been directed to "global.ihs.com" to access the most up-to-date standards.

47. Regarding "global.ihs.com" itself, Internet Archive captures of this page demonstrate its search and indexing capabilities in December 2005. Appendix IHS01 is a capture showing "global.ihs.com" in July 2003, and Appendix CHING02 is a capture showing "global.ihs.com" in April 2006 (the first time the webpage was archived since July 2003). In both July 2003 and April 2006, the webpage included "Title/Keyword" search functionality, standards categorized by "industry" (for example, "Automotive"), and links to "Search Help," "Customer Service," and other useful information.

48. Based on these webpage captures, "global.ihs.com" had search and indexing functionality both before and after December 2005. I have no reason to believe that this functionality would have been absent in December 2005, and therefore conclude that the functionality was present in December 2005. My experience with library catalogs and information management indicates that search and indexing functionality is widely known to be critical for accessing useful information, and it is very unlikely that IHS would have provided this functionality by July 2003, removed it before December 2005, and then re-added it by April 2006.

Cornette

49. I was also asked to evaluate the public availability of Cornette (EX-1014). The public availability of this document in December 2005 was previously supported by the declaration of Mel DeSart (EX-1015), the "Head of the Engineering Library at the University of Washington." This declaration states that Cornette (the library's edition of which was stamped "MAR 13 2001") "was publicly available at the Library within a few weeks of March 13, 2001." EX-1015, pg. 1.

50. I have reviewed the Patent Owner's Response as presented in case no. IPR2025-00370. Page 57 contains the following passage: "Mr. DeSart's declaration provides no information about whether Cornette was indexed or

cataloged in any way, let alone meaningfully. Instead, it merely says that when Cornette was received by the library, it was stamped with the words 'Engineering' and 'University of Washington' and the date and then routed for 'shelving.' Petitioner fails to provide any information showing that a POSITA or interested person could have located Cornette at the University of Washington before the critical date."

51. In my experience, this statement misconstrues the declaration made by Mr. DeSart. Appendices CORNETTE01 – CORNETTE04 (discussed in further detail below) illustrate that the publication containing the Cornette paper was indexed and cataloged by the University of Washington Library. And Appendices CORNETTE05 – CORNETTE09 demonstrate that, in the library context, "shelving" is indicative of public availability and indexing. That is, my experience with library cataloging is that the indexing and cataloging process represented in Appendices CORNETTE01 – CORNETTE04 and reflected in Mr. DeSart's statement is standard library practice when making periodicals available to the public. This standard library practice would have allowed library users to discover Cornette (and its series, the SAE Technical Paper Series) via the library's catalog.

52. I will first provide an overview on "shelving" and discuss how Mr. DeSart's declaration demonstrates public availability. Shelving, the practice noted in the DeSart declaration, is library jargon both describing the library's physical collection of materials accessible on-site as well as the regular library practices related to maintaining the library's physical collection. To provide context, a library book is said to be 'shelved' if it could be found on a library shelf by an interested user. A library book could be sent to 'shelving' to be transferred from one library processing pipeline to the physical collection. A librarian placing a recently-returned library book within the library's physical collection could be said to be 're-shelving' that book. Based on this understanding, it is my determination that Mr. DeSart's declaration claiming that Cornette would be 'routed to shelving' reflects the library's intent to make the Cornette paper available to library patrons browsing the physical collection.

53. This understanding of "shelving" is reflected in Appendices CORNETTE05 – CORNETTE09. Attached hereto as Appendix CORNETTE05 is a paper entitled "A Review and Analysis of Library Availability Studies" by Thomas E. Nisonger as published in American Library Association Journals. In this paper, Nisonger describes availability studies conducted by librarians to determine how to best ensure access to library materials and as such,

associates the concept of 'shelving' materials with making those materials available to the public. Page 1 of the Nisonger paper describes availability in the context of library studies as "Can a library patron locate a desired item on a library's shelves". Page 1 also notes that librarians conducting an availability study to determine how discoverable library materials are the average library user as a "shelf availability study".

54. Attached hereto as Appendix CORNETTE06 is a paper entitled "The Use of the Library Catalogue by Undergraduates" by Maidul Islam as published in Library Philosophy and Practice 2010. This study describes the use practices of library patrons at the University of Dhaka, with the author tracking users discovering library materials via the library catalog or discovering library materials via browsing the library's physical collection. Page 4 of Appendix CORNETTE06 indicates that 70% of University of Dhaka library users prefer to discover library materials via browsing the library's physical collection, a practice described in this paper as browsing the library shelves.

55. Attached hereto as Appendix CORNETTE07 is a paper entitled "Reflections on Ranganathan's Five Laws of Library Science" by Richard Leiter in the Law Library Journal Summer 2003. Appendix CORNETTE07 is a rumination on the modern applications of the Ranganathan's Five Laws of

Library Science, one of the primary bases for standard library practices. The Leiter paper describes the importance of 'shelving' practices on page 5 as follows: "proper and regular shelving of library materials facilitates the use of books. Logical, topical arrangement of materials also facilitates their use. To sum up what we should take from this first law, care must be taken to provide a facility and an organized collection that invite and promote the use of its resources.". Leiter also connects 'shelving' to availability in the following passage found on pages 8-9: "The technical services function of a library is charged with keeping a collection healthy. It must receive a steady diet of "nutrients and supplements" (information resources) to keep all of the library's parts healthy and reliable…Each subscription must be accounted for, supplementation recorded and checked against prior receipts of similar material, invoices checked, and materials promptly processed and accurately shelved.".

56. Attached hereto as Appendix CORNETTE08 is a paper entitled "Weed to Achieve: A Fundamental Part of the Public Library Mission?" by Juris Delevko and Lisa Gottleib in Library Collections, Acquisitions & Technical Services 2003. Appendix CORNETTE08 is a paper describing the practice of weeding, in which materials are regularly removed from the collection to

maintain collection integrity. On page 7 of this paper, Delevko describes the following relationship between libraries purchasing new materials to managing shelf space: "The more new materials we buy for a certain collection, the more shelf space we will need. We accession approximately 33,000 new items every year. If we use 10 books per foot as an average, that would mean we need 3,300 linear feet of available shelf space every year just for the new materials." This passage indicates the importance of 'shelving' new materials to facilitate their discovery. Page 18 contains the following passage describing the relationship between library users and the shelf as a concept: "The public has come to expect shelves stocked with fresh, new clean books whether they are in their local library or in a bookstore".

57. Attached hereto as Appendix CORNETTE09 is a book entitled Interior Design for Libraries: Drawing on Function & Appeal by Carol R. Brown. Appendix CORNETTE09 is a book examining the role of the library facility in providing library services. In describing the shelving process on page 13, Brown creates a clear association with 'shelving' as the final step in the process of preparing books for public availability: "In a technical-services area, for example, the furniture and shelving layout should reflect the

workflow and the movement of new materials through receipt and check-in, to cataloging, and finally to processing. In a small library, it may be necessary to lay out the space carefully to distinguish between the location where new, unprocessed materials come into the technical-services area and the location where processed materials are housed when they are ready to go to the shelves." In this context, 'going to the shelves' is a described as the final step in the processes of adding new materials to the library collection.

58. Appendix CORNETTE05 uses the terms 'availability study' and 'shelf availability study' interchangeably. Appendix CORNETTE05 also defines availability as the ability of library users to discover library materials on the shelf. Appendix CORNETTE06 describes the common association library users have between the availability of a given material with said material's presence on the library shelf. Appendix CORNETTE07 associates the role of the technical services departments (and therefore the library cataloger) with the task of maintenance and upkeep of the library shelves. Appendix CORNETTE07 also associates this maintenance and upkeep of library shelves with ensuring library users will be able to discover a given work within the collection. Appendix CORNETTE08 associates the purchase and acquisition of new library materials with the logistical issues of ensuring those materials are represented within the library's physical collection,

referring to this collection as the library shelf. Finally, Appendix CORNETTE09 describes 'shelving' as the final process in acquiring and processing new library materials for public access.

59. In comparing usage of the term 'routed for shelving' found in the DeSart declaration to the common usage of 'shelf' and 'shelving' found in Appendix CORNETTE05 – CORNETTE09, it is my determination the DeSart declaration is describing 'shelving' as the final step in the process of preparing the Cornette paper for public access. As Appendices CORNETTE05 – CORNETTE09 note, 'shelving' is a significant library practice that is directly associated with making library materials available and discoverable to members of the public. According to my own experience and usage of 'shelving'-related terminology in Appendices CORNETTE05 – CORNETTE09, it is my determination a publication is said to be 'shelved' if that publication has been fully acquired, cataloged, processed by library staff and added to the library's physical on-site collection.

60. Appendices CORNETTE01 – CORNETTE04 indicate indexing and illustrate search capabilities that would have allowed an interested person to find Cornette.

61. Attached hereto as Appendix CORNETTE01 is a true and correct copy of the MARC record for SAE Technical Paper Series as held by the University

of Washington Library. I secured this record myself from the library's public catalog. The Location Items field present on page 2 of this record indicates the library's collection includes the 2001-01-0078 issue of SAE Technical Paper Series containing "High Strength Steels for Automotive Safety Parts".

62. The MARC record contained within Appendix CORNETTE01 accurately describes several bibliographic elements typically indexed during the library cataloging process, indicating indexing and public availability of Cornette. In comparing Cornette (EX-1014) to Appendix CORNETTE01, it is my determination that Appendix CORNETTE01 correctly refers to Cornette, as published in SAE Technical Paper Series. This determination is based on the number of fields found in Appendix CORNETTE01 which accurately index the SAE Technical Paper series. The following MARC fields can be compared to Cornette in such a way that indicates the University of Washington Library's record accurately describes the Cornette publication: the Online Computer Learning Center Number (field 19), the International Standard Serial Number (fields 022 & 023), Library of Congress Classification Number (field 050), Publication Title (fields 210, 222, 245 & 246), Publisher Name (fields 260 & 710), Subject Headings (fields 650 & 655) and alternate publication formats (field 776). In my experience, it is typical for library cataloging software to rely upon these MARC fields to

power the library catalog's search algorithm. Given the importance of the catalog as a tool of discovery, it is in the library's best interest for these fields to accurately index library materials so as to provide accurate library catalog search results.

63. In addition to the library catalog, the MARC record also reflects the process in which library users could discover the library's collection by visiting the library's facilities. The indexing present in Appendix CORNETTE01 provides the basis for assigning the SAE Technical Paper Series library shelf call numbers. These call numbers are assigned to publications based on the subject headings assigned in the MARC, assuring that library users are able to discover similar publications based on physical proximity to other materials on the library shelf.

64. Therefore, contrary to the argument in the Patent Owner's Response, Mr. DeSart's declaration establishes not only that Cornette was present at the University of Washington Engineering Library but also that Cornette was catalogued, indexed, discoverable, and publicly accessible.

65. Webpage captures from the University of Washington demonstrate that an interested person would have had access to search features in order to identify Cornette in the Engineering Library's system.

66. Attached hereto as Appendix CORNETTE02 is a screen capture of the Internet Archive Wayback Machine entry for http://catalog.lib.washington.edu/. I secured these screen captures myself from https://web.archive.org/web/20010524152612/http://catalog.lib.washington.edu/. This record was captured as of May 24, 2001.

67. Appendix CORNETTE02 is an Internet Archive capture of a web page entitled Search the UW Libraries Catalog as hosted on the University of Washington website. Appendix CORNETTE02 is a page describing the search features of the University of Washington Library's library catalog. The links present on this page indicates users of the University of Washington library catalog are capable of searching via the following criteria among others: Author, Title, Keywords, Call Numbers, Library of Congress Subject Heading. In submitting a search query to this library catalog, a user is presented results based upon the descriptive fields found in MARC records. For instance, a user searching for the title of a given publication will be provided results based upon querying the MARC fields 210, 222, 245 & 246.

68. Attached hereto as Appendix CORNETTE03 is a screen capture of the Internet Archive Wayback Machine entry for http://catalog.lib.washington.edu/search/t. I secured these screen captures myself from https://web.archive.org/web/20050706043648/http://catalog.lib.washington.edu/search/t. This record was captured as of July 6, 2005.

69. Appendix CORNETTE03 is an Internet Archive capture of a web page entitled Title Search as hosted on the University of Washington website Appendix CORNETTE03 is a page describing the search features of the University of Washington Library's library catalog. The links present on this page indicates users of the University of Washington library catalog are capable of searching via the following criteria among others: Keyword, Title, Author, Library of Congress Subject Heading, LC Call Number and ISBN/ISSN. Similar to Appendix CORNETTE02, in submitting a search query to this library catalog, a user is presented results based upon the descriptive fields found in MARC records.

70. Attached hereto as Appendix CORNETTE04 is a screen capture of the Internet Archive Wayback Machine entry for http://catalog.lib.washington.edu/search/X. I secured these screen captures

myself from https://web.archive.org/web/20061009004814/http://catalog.lib.washington.edu/search/X. This record was captured as of October 9, 2006.

71. Appendix CORNETTE04 is an Internet Archive capture of a web page entitled Advanced Keyword Search as hosted on the University of Washington website. Appendix CORNETTE04 is a page describing the search features of the University of Washington Library's library catalog. The links present on this page indicates users of the University of Washington library catalog are capable of searching with the use of specialized language queries present in commercial search engines such as Google. Users are able to search multiple words as a single phrase, use truncation features to search for multiple words with similar meanings and the use of boolean operators such as 'and' / 'or' / 'and not'.

72. Appendix CORNETTE01 is a MARC record from the University of Washington indexing the SAE Technical Paper Series, the periodical which first made the Cornette paper available to the public. This record accurately indexes the SAE Technical Paper Series according to standard cataloging procedures and confirms the library's collection contains a copy of the 2001-01-0078 issue of SAE Technical Paper Series containing "High Strength

Steels for Automotive Safety Parts". Appendices CORNETTE02 and CORNETTE03 describe how the University of Washington's MARC record corresponds to the search capabilities of the library's catalog: the catalog search feature requires accurately descriptive MARC fields to provide accurate catalog results. Appendix CORNETTE04 indicates this library catalog search is capable of advanced search queries via the use of search operators. Considering these appendices in concert, it is my determination the SAE Technical Paper Series containing "High Strength Steels for Automotive Safety Parts" was accurately indexed by the University of Washington Library in such a way to facilitate discovery of the periodical within the library's catalog.

73. I have been retained on behalf of the Petitioner to provide assistance in the above-illustrated matter in establishing the authenticity and public availability of the documents discussed in this declaration. I am being compensated for my services in this matter at the rate of $200.00 per hour plus reasonable expenses. My statements are objective, and my compensation does not depend on the outcome of this matter.

74. I declare under penalty of perjury that the foregoing is true and correct. I hereby declare that all statements made herein of my own knowledge are

true and that all statements made on information and belief are believed to be true; and further that these statements were made the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: 2/24/2026

June Ann Munford

Appendix

CV

June A. Munford
Curriculum Vitae

Education

University of Wisconsin-Milwaukee - MS, Library & Information Science, 2009
Milwaukee, WI

- Coursework included cataloging, metadata, data analysis, library systems, management strategies and collection development.
- Specialized in library advocacy, cataloging and public administration.

Grand Valley State University - BA, English Language & Literature, 2008
Allendale, MI

- Coursework included linguistics, documentation and literary analysis.
- Minor in political science with a focus in local-level economics and government.

Professional Experience

Researcher / Expert Witness, October 2017 – present
Freelance • Pittsburgh, Pennsylvania & Grand Rapids, Michigan

- Material authentication and public accessibility determination. Declarations of authenticity and/or public accessibility provided upon research completion. Experienced with appeals and deposition process.

- Research provided on topics of public library operations, material publication history, digital database services and legacy web resources.

- Past clients include Alston & Bird, Arnold & Porter, Baker Botts, Fish & Richardson, Erise IP, Irell & Manella, O'Melveny & Myers, Perkins-Coie, Pillsbury Winthrop Shaw Pittman and Slayden Grubert Beard.

Library Director, February 2013 - March 2015
Dowagiac District Library • Dowagiac, Michigan

- Executive administrator of the Dowagiac District Library. Located in Southwest Michigan, this library has a service area of 13,000, an annual operating budget of over $400,000 and total assets of approximately $1,300,000.

- Developed careful budgeting guidelines to produce a 15% surplus during the 2013-2014 & 2014-2015 fiscal years while being audited.

- Using this budget surplus, oversaw significant library investments including the purchase of property for a future building site, demolition of existing buildings and building renovation projects on the current facility.

- Led the organization and digitization of the library's archival records.

- Served as the public representative for the library, developing business relationships with local school, museum and tribal government entities.

- Developed an objective-based analysis system for measuring library services - including a full collection analysis of the library's 50,000+ circulating items and their records.

November 2010 - January 2013
Librarian & Branch Manager, Anchorage Public Library • Anchorage, Alaska

- Headed the 2013 Anchorage Reads community reading campaign including event planning, staging public performances and creating marketing materials for mass distribution.

- Co-led the social media department of the library's marketing team, drafting social media guidelines, creating original content and instituting long-term planning via content calendars.

- Developed business relationships with The Boys & Girls Club, Anchorage School District and the US Army to establish summer reading programs for children.

June 2004 - September 2005, September 2006 - October 2013
Library Assistant, Hart Area Public Library
Hart, MI

- Responsible for verifying imported MARC records and original MARC cataloging for the local-level collection as well as the Michigan Electronic Library.

- Handled OCLC Worldcat interlibrary loan requests & fulfillment via ongoing communication with lending libraries.

Professional Involvement

Alaska Library Association - Anchorage Chapter

- Treasurer, 2012

Library Of Michigan
- Level VII Certification, 2008
- Level II Certification, 2013

Michigan Library Association Annual Conference 2014
- New Directors Conference Panel Member

Southwest Michigan Library Cooperative
- Represented the Dowagiac District Library, 2013-2015

Professional Development

Library Of Michigan Beginning Workshop, May 2008
Petoskey, MI
- Received training in cataloging, local history, collection management, children's literacy and reference service.

Public Library Association Intensive Library Management Training, October 2011
Nashville, TN
- Attended a five-day workshop focused on strategic planning, staff management, statistical analysis, collections and cataloging theory.

Alaska Library Association Annual Conference 2012 - Fairbanks, February 2012
Fairbanks, AK
- Attended seminars on EBSCO advanced search methods, budgeting, cataloging, database usage and marketing.

Depositions

2019 • Fish & Richardson

Apple v. Qualcomm (Case No. IPR2018-001281, 39521-00421IP, IPR2018-01282 and 39521-00421IP2)

2019 • Erise IP

Implicit, LLC v. Netscout Systems, Inc (Case No. 2:18-cv-53-JRG)

2019 • Perkins-Coie

Adobe Inc. v. RAH Color Technologies LLC (Case No. IPR2019-00627, IPR2019-00628, IPR2019-00629 and IPR2019-00646)

2020 • O'Melveny & Myers

Maxell, Ltd. v. Apple Inc. (Case No. 5:19-cv-00036-RWS)

2021 • Pillsbury Winthrop Shaw Pittman LLP

Intel v. SRC (Case No. IPR2020-1449)

2022 • Perkins-Coie

Realtek v. Future Link (Case No. IPR2021-01182)

2023 • Fish & Richardson

Neuroderm Ltd. v. Abbvie, Inc (Case No. PGR2022-00040)

2023 • Fish & Richardson

Nearmap US Inc. v. Pictometry International Corp. (Case No. IPR2022-00735)

2023 • Fish & Richardson

Samsung Electronics v. MemoryWeb LLC (Case No. 39843-0136PS1)

2023 • Pillsbury Winthrop Shaw Whitman LLP

Gravel Rating Systems v. Costco Wholesale Corp. (Case No. 4:21-cv-149-ALM)

2024 • Willkie-Farr

Netflix, Inc. v. VideoLabs. Inc. (Case No. IPR2023-00628)

2024 • Quinn Emanuel Urquhart & Sullivan

Purdue University v. Wolfspeed (Case No. 1:21-CV-840)

2024 • Fish & Richardson

Dish Network v. Entropic Communications (Case No. IPR2024-00393)

2025 • Perkins Coie

Amazon.com, Inc. v. Nokia Technologies Oy (Case No. IPR2024-00572)

2025 • Fish & Richardson

Dish Network v. Entropic Communications (Case No. IPR2024-00373)

2025 • Fish & Richardson

SK Nexilis Co., Ltd. v. Solus Advanced Materials (Case No. 2:2023-cv-00539)

2025 • Covington & Burling

Samsung v. Pictiva (Case No. IPR2024-01222)

Limited Case and Clientele History

Alston & Bird

- Ericsson

  v. Collision Communications (Case No. IPR2022-01233)

- Nokia

  v. Neptune Subsea, Xtera (Case No. 1:17-cv-01876)

- Universal Electronics Inc

  v. Roku Inc (Case No. IPR2022-00818)

Alavi & Anaipakos PLLC

- Stingray Group Inc. and Stingray Music USA, Inc.

  v. Edwin A. Hernandez-Mondragon and Egla Corp. (Case No. 1:24-cv-21226-RAR)

Arnold & Porter

- Ivantis

  v. Glaukos (Case No. 8:18-cv-00620)

- Samsung

  v. Jawbone (Case No. 2:21-cv-00186)

Benesch Friedlander Coplan & Aronoff

- Voyis

  v. Cathx (Case No. 5:21-cv-00077-RWS)

Buchanan, Ingersoll & Rooney PC

- Google LLC, AT&T Service Inc., T Mobile USA Inc., Cellco Partnership, Ericsson Inc. & Nokia of America Corp.

  v. KT Corp & Pegasus Wireless Innovation LLC (Case No. IPR2025-00293)

- Google LLC

  v. K. Mizra LLC (Case No. 1:25-cv-00236)

Covington & Burling

- First Solar, Inc.

  v. JinkoSolar (Case No. 25-cv-223)

- Samsung

  v. Pictiva (Case No. IPR2024-01222)

Deschert LLP

- Smaxtec Animal Care

  v. ST Reproductive Technologies, LLC (Case No. IPR2024-00885)

Duane Morris

- Kangxi Communication Technologies

  v. Skyworks Solutions Inc. (Case No. IPR2025-00373)

- Microsoft

  v. Edge Networking Systems LLC (Case No. 1:24-cv-00215)

Erise I.P.

- Apple

  v. Ericsson Inc. (Case No. IPR2022-00715)

  v. Future Link Systems (Case No. IPRs 6317804, 6622108, 6807505, and 7917680)

  v. INVT (Case No. 20-1881)

  v. Navblazer LLC (Case No. IPR2020-01253)

  v. Qualcomm (Case No. IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)

  v. Quest Nettech Corp (Case No. 2:19-cv-00118-JRG)

  v. Telefonaktiebolaget LM Ericsson (Case No. IPR2022-00275)

  v. Theta IP, LLC (Case No. IPR2024-00818)

  v. THL Holding Company LLC (Case No. 1:23-cv-00548)

- CrowdStrike

  v. Skysong Innovations (Case No. IPR2025-01398)

- Fanduel
  - v. CGT (Case No. 19-1393)

- Garmin
  - v. Phillips North America LLC (Case No. 2:19-cv-6301-AB-KS)

- Netscout
  - v. Longhorn HD LLC (Case No. 2:20-cv-00349)
  - v. Implicit, LLC (Case No. 2:18-cv-53-JRG)

- Sony Interactive Entertainment LLC
  - v. Bot M8 LLC (Case No. IPR2020-01288)
  - v. Infernal Technology LLC (Case No. 2:19-CV-00248-JRG)

- Tesla
  - v. Charge Fusion Technologies LLC (Case No. IPR2025-00032)

- Unified Patents
  - v. GE Video Compression (Case No. 2:19-cv-248)

Fish & Richardson

- Apple
  - v. AliveCor (Case No. 3:21-cv-03958)
  - v. LBS Innovations (Case No. 2:19-cv-00119-JRG-RSP)
  - v. Koss Corporation (Case No. IPR2021-00305)
  - v. Masimo (Case No. IPR 50095-0012IP1, 50095-0012IP2, 50095-0013IP1, 50095-0013IP2, 50095-0006IP1, 50095-0135IP1)
  - v. Neonode (Case No. 21-cv-08872-EMC)

v. Qualcomm (Case No. IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)

v. Resonant Sys. (Case No. 7:23-cv-00077-ADA)

- AsusTek Computer Inc.
  v. Videolabs, Inc. (Case No. 22-CV-00720-ADA)

- Dell
  v. Neo Wireless (Case No. IPR2022-00616)

- Dish Network
  v. Entropic Communications, LLC (Case No. 2:2023-CV-01043)
  v. Entropic Communications LLC (Case No. IPR2024-00393)
  v. Realtime Adaptive Streaming (Case No. 1:17-CV-02097-RBJ)
  v. TQ Delta LLC (Case No. 18-1798)

- Evapco Dry Cooling
  v. SPG Dry Cooling (Case No. IPR2021-00688)

- Generac
  v. PSLC (Case No. 2:24-cv-01270)

- Genetec
  v. Sensormatic Electronics (Case No. 1:20-CV-00760)

- Huawei
  v. Bell Northern Research LLC (Case No. IPR2019-01174)

- Kianxis
  v. Blue Yonder (Case No. 3:20-cv-03636)

- LG Electronics

  v. Bell Northern Research LLC (Case No. 3:18-cv-2864-CAB-BLM)

- MediaTek

  v. MOSAID (Case No. IPR2024-00718)

- Metaswitch

  v. Sonus Networks (Case No. IPR2018-01719)

- Microsoft

  v. Throughputer Inc (Case No. IPR2022-00757)

- Mom Enterprises

  v. Ddrops Company (Case No. 1:22-cv-00332)

- MLC Intellectual Property

  v. MicronTech (Case No. 3:14-cv-03657-SI)

- Nearmap Inc

  v. EagleView Technologies (Case No. IPR2022-01009)

- Neuroderm Ltd.

  v. Abbvie, Inc (Case No. PGR2022-00040)

- Par-Kan

  v. Unverferth (Case No. 3:23-cv-00653)

- Posco Co Ltd.

  v. Pascal Drillet et al. (Case No. IPR2025-00370)

- Realtek Semiconductor

v. Future Link (Case No. IPR2021-01182)

- Quectel
  - v. Koninklijke Philips (Case No. 1:20-cv-01710)
- Samsung
  - v. Aire Technology (Case No. IPR2022-00877)
  - v. Bell Northern Research (Case No. 2:19-cv-00286-JRG)
  - v. Communication Technologies Inc (Case No. IPR2022-01221)
  - v. Jawbone Innovations (Case No. IPR2022-00865)
  - v. MemoryWeb LLC (Case No. IPR2022-00885)
  - v. Dodots Licensing Solutions (Case No. IPR2023-00701)
  - v. Telefonaktiebolaget LM Ericsson (Case No. IPR2021-00615)
- Tesla
  - v. Intellectual Ventures (Case No. 1:24-cv-00390, 6:24-cv-00188)
- Texas Instruments
  - v. ParkerVision (Case No. IPR2024-00934)
  - v. Vantage Micro LLC (Case No. IPR2020-01261)
- Xilinx
  - v. Sentient Sensors LCC (Case No. 1:22-cv-00173)

Goodwin Proctor

- Intel
  - v. Proxense, LLC (Case No. 6:24-cv-00283)

- Samsung Electronics

  v. Mobile Data Technologies (Case No. 2:24-cv-00435)

- Taiwan Semiconductor Manufacturing Company Ltd.

  v. Advanced Integrated Circuit Process LLC (Case No. 2:24-cv-00623)

Groombridge Wu

- Atossa

  v. Jina & Intas Pharmaceuticals (Case No. PGR2025-00043)

- Nearmap

  v. Eagle View Technologies Inc. and Pictometry International Corp. (Case No. 2:21-cv-00283-TS-DAO)

Holland & Knight

- Wilmington Trust, N.A.

  v. Herman Segal & John Hancock Life Insurance Company of New York (Case No. 1:21-CV-01540-PKC-TAM)

Irell & Manella

- Curium

Latham & Watkins LLP

- Apple

  v. Advanced Coding Research LLC

- Google

  v. Advanced Coding Research (Case No. 2:24-cv-0035)

- Western Digital Technologies

  MR Technologies GmbH (Case No. 8:24-cv-01848-JVS)

Leydig, Voit & Mayer, Ltd.

- Public Availability Consultancy

O'Melveny & Myers

- Apple

  v. Maxell (Case No. 5:19-cv-00036-RWS)

- Disney Media & Entertainment Distribution LLC

  v. Digital Media Technology Holdings, LLC (Case No. 2:22-cv-01642)

- Micron Technology Inc.

  v. Besang Inc (Case No. IPR2023-00900)

- Samsung

  v. Daedalus Prime LLC (1335 Investigation)

Perkins-Coie

- Amazon
  - v. Nokia (Case No. IPR2024-00847 and IPR2024-00848)
  - v. Nokia Technologies Oy (Case No. IPR2024-00572)

- Google LLC
  - v. Clear Imaging Research LLC (Case No. 202510451)

- Heru Industries
  - v. The UAB Research Foundation (Case No. IPR2022-01148)

- Intel Corporation
  - v. BeSang Inc. (Case No. IPR2023-00991)
  - v. BitMICRO (Case No. 5:23-cv-00625)
  - v. Telefonaktiebolaget L M Ericsson (Case No. IPR2024-00610)

- Microsoft
  - v. Sandpiper (Case No. 2:25-cv-00664)

- Niantic, Inc.
  - v. ImagineAR, Inc. (C.A. No. 24-1252-JD)

- Realtek Semiconductor
  - v. Future Link (Case No. IPR2021-01182)

- r-pac
  - v. Adasa, Inc. (Case No. 1:2024cv06102)

- Twitter Inc

  v. VOIP-Pal.com (Case No. 3:20-cv-02397-JD)

- Twitch/Amazon

  v. RazDog (Case No. IPR2025-00308)

- TCL Industries

  v. Koninklijke Philips NV (Case No. IPR2021-00495, IPR2021-00496 and IPR2021-00497)

- VusionGroup

  v. Hanshow (Case No. IPR2024-00857)

Pillsbury Winthrop Shaw Pittman

- Intel

  v. FG SRC LLC (Case No. 6:20-cv-00315)

- Gravel Rating Systems

  v. Costco (Case No. 4:21-cv-149)
  v. Lowe's Home Centers (Case No. 4:21-cv-150)
  v. T-Mobile USA (Case No. 4:21-cv-152)
  v. Kohl's Inc. (Case No. 4:21-cv-258)
  v. Under Armor (Case No. 4:21-cv-356)

Quinn Emanuel

- Exact Sciences Corporation

  v. Geneoscopy, Inc. (Case No. IPR2024-00459 and IPR2024-1330)

- ServiceNow, Inc.

  v. InQuisient, Inc. (Case No. 22-900-CJB)

- Wolfspeed

  v. The Trustees of Purdue University (Case No. 1:2021-cv-00840)

Sheppard, Mullin, Richter & Hampton LLP

- Advanced Micro Devices, Inc and Pensando Systems, Inc.

  v. Concurrent Ventures LLC and Xtreamedge, Inc. (Case No. IPR2025-00478)

- Amazon

  v. Nokia

- Cadence Design Systems Inc.

  v. Semiconductor Design Technologies (Case No. 3:23-cv-01001)

- Marvell Semiconductor

  v. Credo Technology (Case No. IPR2025-01219)

- Sandisk Technologies, Inc.

  v. Longitude Flash Memory Solutions Ltd. (Case No. IPR2025-01283)

Shook, Hardy & Bacon LLP

- HP Inc.

  v. Universal Connectivity Technologies (Case No. 1:23-cv-01177)

Stern, Kessler, Goldstein & Fox

- Preliminary Research

Wilmer, Cutler, Pickering, Hale and Dorr

- Apple

  v. Shunock (Case No. 1:23-cv-08598)

- Dell Technologies Inc

  v. EireOg Innovations Ltd. (Case No. 1:24-cv-00416-AD)

- Dropbox

- Quest Diagnostics Inc., Haystack Oncology Inc. and Haystack Oncology GmbH

  v. Natera, Inc. (Case No. 1:23-cv-08598)

- NVIDIA

  v. Onesta IP (Case No. 1:25-cv-00586)

- Oracle

  v. EireOg Innovations Ltd. (Case No. 4-cv-00697-ADA)

- Roche Diabetes, Inc.

  v. Trividia Health, Inc. (Case No. 1:24-cv-00668)

- Shopify Inc.

  v. Lower48 IP LLC (C.A. No. 6:22-cv-00997-DAE)

- United Services Automobile Association

  v. Regions Bank (Case No. 2-25-cv-00082)

Willkie, Farr & Gallagher LLP

- Lenovo, Dell, HP

  v. Universal Connectivity Technologies Inc. (Case No. 2:2023cv00449)

- Neurent

  v. The Foundry, LLC (Case No. IPR2024-00669)

- Netflix, Inc.

  v. DivX (Case No. 2:19-cv-1602-GW-AGR)

- Netflix, Inc.

  v. VideoLabs, Inc. (Case No. IPR2023-00628)

Appendix
CHING01



archive.org

DECLARATION OF MINA CHING

1. I am a Records Request Processor at the Internet Archive. I make this declaration of my own personal knowledge.

2. The Internet Archive is a website that provides access to a digital library of Internet sites and other cultural artifacts in digital form. Like a paper library, we provide free access to researchers, historians, scholars, and the general public. The Internet Archive has partnered with and receives support from various institutions, including the Library of Congress.

3. The Internet Archive has created a service known as the Wayback Machine. The Wayback Machine makes it possible to browse more than 450 billion pages stored in the Internet Archive's web archive. Visitors to the Wayback Machine can search archives by URL (i.e., a website address). If archived records for a URL are available, the visitor will be presented with a display of available dates. The visitor may select one of those dates, and begin browsing an archived version of the Web. Links on archived files in the Wayback Machine point to other archived files (whether HTML pages or other file types), if any are found for the URL indicated by a given link. For instance, the Wayback Machine is designed such that when a visitor clicks on a hyperlink on an archived page that points to another URL, the visitor will be served the archived file found for the hyperlink's URL with the closest available date to the initial file containing the hyperlink.

4. The archived data made viewable and browseable by the Wayback Machine is obtained by use of web archiving software that automatically stores copies of files available via the Internet, each file preserved as it existed at a particular point in time.

5. The Internet Archive assigns a URL on its site to the archived files in the format http://web.archive.org/web/[Year in yyyy][Month in mm][Day in dd][Time code in hh:mm:ss]/[Archived URL] aka an "extended URL". Thus, the extended URL http://web.archive.org/web/19970126045828/http://www.archive.org/ would be the URL for the record of the Internet Archive home page HTML file (http://www.archive.org/) archived on January 26, 1997 at 4:58 a.m. and 28 seconds (1997/01/26 at 04:58:28). The date indicated by an extended URL applies to a preserved instance of a file for a given URL, but not necessarily to any other files linked therein. Thus, in the case of a page constituted by a primary HTML file and other separate files (e.g., files with images, audio, multimedia, design elements, or other embedded content) linked within that primary HTML file, the primary HTML file and the other files will each have their own respective extended URLs and may not have been archived on the same dates.



6. Attached hereto as Exhibit A are true and accurate copies of browser screenshots of the Internet Archive's records of the archived files for the URLs and the dates specified in the attached coversheet of each screenshot.

7. Attached hereto as Exhibit B are true and accurate copies of the Internet Archive's records of the archived files for the URLs and the dates specified in the attached coversheet of each file.

8. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

DATE: February 4, 2026

Mina Ching

EXHIBIT A

https://web.archive.org/web/20030803020432/http://www0.nsc.co.jp/index.html


INTERNET ARCHIVE
WayBack Machine
http://www0.nsc.co.jp/index.html
Go
132 cap
12 Nov 19
JUN
AUG
OCT
03
2002
2003
2004
About this capture
新日本製鐵
NIPPON STEEL
Site Map
English
新日鉄グループ企業理念
ごあいさつ
会社概要
事業概要・事業所
新日鉄グループ
投資家・株主情報
環境経営
研究開発
文化活動
スポーツ
地域貢献活動
採用情報
貸借対照表・損益計算書
What's New
バックナンバー
環境調和型素材「鉄鋼スラグ水和固化体」の実用化準備整う―鉄鋼スラグ水和固化体技術マニュアルを発刊―(2003/07/30)
新工法「MSカップリングケーソン工法」を開発―オープンケーソンと鋼製部材NS-BOX(BX)を組み合わせて工期短縮・安全性を向上―(2003/07/24)
自動車用鋼板を製造・販売する合弁会社設立に関する基本合意(2003/07/22)
新日鐵住金ステンレス株式会社の主要株主について(2003/07/14)
バンコク地下鉄鋼製地中連続壁プロジェクトチーム　第23回エンジニアリング功労者賞受賞(2003/07/10)
二酸化炭素（CO2）地中貯留圧入実証試験における圧入設備の納入について(2003/07/09)
相談役名誉会長　今井敬　オナラリー・コンパニオン勲章（オーストラリア）受章について(2003/07/08)
鋼橋NET研究会の活動状況について(2003/07/03)
中央合同庁舎第7号館整備等事業（PFI）正式契約を締結(2003/07/02)
ごみ焼却炉技術のクロスライセンスを実施(2003/07/01)
特定規模電気事業者向け電力卸供給事業会社を設立(2003/06/25)
1杭1方式(サットインパイル)の建築認定を取得，6月から本格営業開始（施工期・得土低減）(2003/06/24)
署名儀式
＜自動車用鋼板を製造・販売する合弁会社設立に関する基本合意＞
新日本製鐵株式会社　宝山鋼鉄株式・・・
新・モノ語りの絵本第3巻できました。
NIPPON STEEL MONTHLY
新日鉄の新しい姿を毎月紹介します
最新号はこちら
バックナンバー
バーチャル工場見学
新日鉄の工場をご案内します
内容に関するお問い合わせ
FAX 03-3275-5607
Copyright(c)2003 NIPPON STEEL CORPORATION. All Rights Reserved.

https://web.archive.org/web/20031031193545/http://www0.nsc.co.jp/kenkyusho/


http://www0.nsc.co.jp/kenkyusho/
Go
15 captu
31 Oct 200
SEP
OCT
31
NOV
2003
2004
About this capture
新日本製鐵
Home | English
ニュース
投資家・株主情報
環境経営
新日鉄グループ
文化／スポーツ
採用情報
●事業紹介
研究開発
各研究所のサイト
CONTENTS
新日鉄の技術開発について
研究開発
当社では、鉄鋼事業で培った独自の高度な技術力を基軸に多分野に渡って事業展開しています。その根幹となっているのがリサーチ＆エンジニアリング一貫体制による基礎から応用・実機化までの幅広い研究開発です。鉄鋼事業分野では、自動車を軽量化し衝突安全性確保を実現する高強力鋼板、鉛・クロムを含まない表面処理鋼板、高効率モーター・トランス用の電磁鋼板など環境・省エネルギーに役立つ商品や各種の新しい鉄鋼製造プロセスの開発を行っています。また、エンジニアリング・新素材等の事業分野では、ビジネス拡大の基礎となる新商品開発とその基盤研究を進めています。
新日鉄技報
バックナンバー
Acrobat
このページをご覧になるには
が必要です。
（無料でダウンロードできます）
内容に関するお問い合わせ　FAX.03-3275-5611
Copyright(c) 2003 NIPPON STEEL CORPORATION. All Rights Reserved

https://web.archive.org/web/20031002234705/http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s378.html

INTERNET ARCHIVE
WayBack Machine
http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s378.html
Go
25 captu
02 Oct 200
SEP OCT NOV
02
2002 2003 2004
About this capture

自動車用材料特集（No.３７８　２００３年７月）

目次

1 自動車用材料の特集号発刊に際して
2 自動車用高強度鋼板の開発
3 自動車用高強度熱延鋼板
4 自動車用980MPa冷間圧延鋼板の開発
5 ホットプレス用アルミニウムめっき鋼板の諸特性
6 衝突性能最適化のための高速変形特性評価技術
7 高強度鋼板の形状凍結性改善技術
8 マルテンサイト母相強靭化組織の支配因子とそれにもとづく高穴拡げ性の優れた高強度鋼板・ミニューの開発
9 ローラードヴランク材の開発と成形
10 自動車用クロメートフリー電気亜鉛めっき鋼板"ジンコートMZ"
11 亜鉛めっき鋼板の高耐疲労性技術
12 鉛フリー燃料タンク用鋼板
13 ハイブリッド／電気自動車の駆動モータ用電磁鋼板
14 自動車排気系用ステンレス鋼の現状と今後の展望
15 自動車部品へのチタン材適用
16 クランクシャフト用Pb-free非調質鋼について
17 従来無人軌道走行の開発
18 ハイテンスチールコードの現状

このページをご覧になるには
AcrobatReaderが必要です。
（無料でダウンロードできます）

内容に関するお問い合わせ　FAX 03-3275-5634
Copyright(c) 2001 NIPPON STEEL CORPORATION. All Rights Reserved.

EXHIBIT B

https://web.archive.org/web/20041119035423/http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s37805.pdf

〔新 日 鉄 技 報 第378号〕 (2003)

UDC 669.718.5:669.14.018.295-415

ホットプレス用アルミニウムめっき鋼板の諸特性

Properties of Aluminum Coated Steels for Hot-forming

末広正芳*(1) Masayoshi SUEHIRO
真木 純*(2) Jun MAKI
楠見和久*(2) Kazuhisa KUSUMI
大神正浩*(2) Masahiro OHGAMI
宮腰寿拓*(3) Toshihiro MIYAKOSHI

抄 録

オーステナイト域の温度に加熱した鋼板をプレス成形すると同時に焼入れを行い高強度の部品を作製するホットプレスが注目を集めている。このホットプレスには加熱時の表面酸化とその後の耐食性確保にアルミニウムめっき鋼板が適していると考えられる*。焼入れ性に優れた母材にアルミニウムめっきを施した鋼板をこのホットプレスに適用した際の材質特性，表面特性，スポット溶接性等に関し検討した。金型での焼入れ後に1 500MPa以上の強度となること，また，表面のめっき層は加熱によりFe-Al合金相となり，JASO法CCT試験による耐食性試験結果では合金化溶融亜鉛めっき鋼板と同等の耐食性を示すこと，スポット溶接性にも優れること等が明らかとなった。(*Arcelor社とのグローバル戦略提携契約に基づくライセンス契約商品(USIBOR1500))

Abstract

Production of parts with high strength by means of hot-forming process has been receiving considerable attention lately. Application of aluminized steel with good hardenability for this process has been investigated*. Tensile strength over than 1500MPa was obtained with steel containing around 0.2mass% C. Surface coated layer changed from Al-10% Si to Fe-Al(-Si) phases through the hot-forming process. The steel with Fe-Al(-Si) surface layer showed good paintability even without phosphatized treatment. After painting, they showed good corrosion resistance in JASO-CCT as galvanized steel did. The steel showed good spot weldability due to the stable surface layer at high temperature. (*license product within the frame of global strategic alliance with Arcelor (USIBOR1500))

1. 緒 言

近年，環境問題に端を発する自動車の軽量化や衝突時の安全性向上といった観点から高強度鋼板の使用が積極的に行われている。部材によってはより高強度の鋼板を用いることで鋼板厚みをより低減でき大きな軽量化を可能とできることから，用いられる鋼板強度も440MPaや590MPa級にとどまらず780MPa級以上へと上昇している。鋼板強度が増加するにつれ一般的には成形性が劣化する。これを克服するため各種組織制御を行った高強度鋼板が開発されてきた[1]。しかしながら，鋼板強度が1 500MPa程度になると複雑な形状へのプレス成形は困難になると思われる。

1 500MPa程度の強度を持つ部材を得るため欧州ではダイクエンチ，ホットフォーム，ホットスタンプあるいはホットプレスと呼ばれる成形法が実用化されている[2]。この成形法では鋼板は900℃程度のオーステナイト域の温度に加熱され常温の金型で成形することにより焼入れ鋼板強度を高める。また，このような工法は国内においても検討されており，めっきを施していない鋼板を用い検討あるいは実用化されている[3,4]。また欧州においてはArcelor社がホットプレス特性と優れた耐食性を有するアルミニウムめっき(以下アルミめっき)製品USIBOR1500をすでに開発実用化している[2,5,6]。新日本製鐵は，Arcelor社とのグローバル戦略提携契約に基づき，USIBOR1500のライセンス契約を結び，商品の製造技術および製品特性の検討を進めてきた。本論文ではホットプレス用のアルミめっき鋼板の各種特性に関し検討した結果を報告する。

2. ホットプレス工程

ホットプレス工程は既に実用化されている。図1にその工程を簡単に示す。この製法では鋼板をオーステナイト域の温度(A_{c3}以上)ま

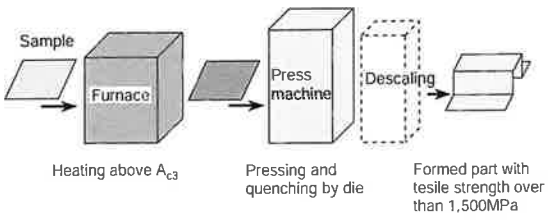


図1 ホットプレス工程の模式図

*(1) 八幡技術研究部 主幹研究員 工博(現 鉄鋼研究所 マネジャー)
北九州市戸畑区飛畑町1-1 〒804-8501 TEL:(093)872-6812
*(2) 八幡技術研究部 主任研究員
*(3) 八幡製鉄所 薄板部 マネジャー

で加熱することが必要である。例えば0.2mass%程度のC量を含有する鋼では850℃以上の温度に加熱することが必要となる。加熱後，炉から取り出された鋼板はプレス機まで搬送され常温の金型で成形し同時に焼入れが行われる。成形後鋼板全体が充分焼入れされるまで下死点で保持する。

このような成形工程をとるが，めっきを施していない鋼板を使用する場合には加熱時のスケール生成や表層脱炭を抑えるため非酸化雰囲気とする必要がある。また，非酸化雰囲気で加熱した場合でも炉からプレス機までの間は大気雰囲気となるため短時間でも表層にスケールが生成する。プレス成形品は使用時には塗装が付与されるが表層にスケールが存在すると問題となる。したがって，めっきを施していない鋼板を使用した場合にはスケールを除去するプロセスが必要となる。スケール層の除去はショットブラストや酸洗で可能であるがこれらはコスト上昇を招く。また，ショットブラストを用いた場合には形状変化を生じる懸念がある。耐熱性に優れためっき鋼板を用いるとこの工程が不要となる。

3. 素　　材

前述したようにホットプレス工程では鋼板を急速に冷却することで強度を高めるため焼入れ性に優れることが必要となる。表面に関しては耐熱性に優れためっきを施しておくことで前述した加熱炉の雰囲気制御やスケール除去のためのプロセスが不要となり，製造を容易にすることができる。以上のような条件を満足する鋼板として，表1に示すような成分系のアルミめっき鋼板があげられる。なおめっき付着量は120～160g/m²のものを用いた。この鋼板の各種特性を以下に概説する。

4. 母材特性

4.1 焼入れ前後の引張特性

本鋼板の焼入れ前後の特性を表2に示す。引張試験は1.4mmの厚みの素材からJIS5号引張試験片を作製し行った。出荷時の強度は490～590MPa級であり，金型での焼入れ後は1 500MPa以上となる。なお強度は図2に示すようにC量で調整することが可能である。図2は実験室的にC量を変化させた素材を真空溶解で溶製し焼入れ後の機械的特性を調査した結果である。これまでに知られているように焼入れ後の機械的特性はC量とともに増加することがわかる。焼入れ後の強度，つまり成形部品の強度はC量を調整することで制御可能である。なお，焼入れ時の強度に対するMn，Cr等の置換型固溶元素の影響は小さいことが知られている。これら置換型固溶元素は焼入れ性に影響するため，次章で述べる焼入れ性を確保するためには重要となる。ただし，これら元素を過剰に添加すると製品板の強度が高くなることを考慮しておく必要がある。

表1　検討に用いた鋼板の成分(mass%)

C	Mn	Cr	B
0.22	1.2	0.15	0.002

表2　焼入れ前後の引張特性

	Yield strength (MPa)	Tensile strenght (MPa)	Elongation (%)
As coated	394	615	26
As formed	1,280	1,530	8

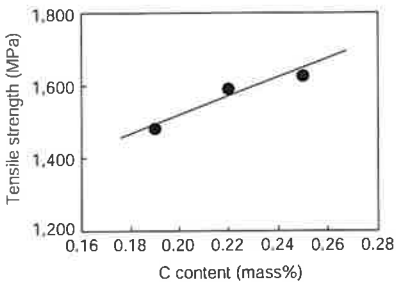


図2　C量と引張特性の関係

4.2 焼入れ性

図3にこの鋼のCCT曲線(950℃からの連続冷却曲線)を，図4に冷却速度と硬さの関係を示す。この鋼板は焼入れ性を高めるためMnやBが添加されており，加熱温度が950℃の場合約20℃/s以上の冷却速度で硬度をHV450～500の範囲とすることができる。この焼入れ速度は冷却中でのフェライト，パーライトおよびベイナイトへの変態を避ける条件で決まる。これらの変態はオーステナイト粒径が小さいと，つまり加熱温度が低いと速くなるため，焼入れに必要な冷却速度が速くなる。この点については加熱温度を900～1 000℃として検討を行ったが，この範囲ではあまり大きな差はなくどの加熱温度においても20～30℃/s程度に臨界冷却速度があった。

図3および図4および前述した他の加熱温度での実験結果からホットプレス時の鋼板の冷却速度が30℃/s以上であればどのような冷却速度をとっても十分な硬さが得られることがわかる。しかしながら，実際のプレス工程では加熱炉からプレス機への搬送とプレス開始までの間は空冷に近い冷却速度となる。

1.4mm程度の厚みの鋼板では大気雰囲気で冷却すると10～15℃/s

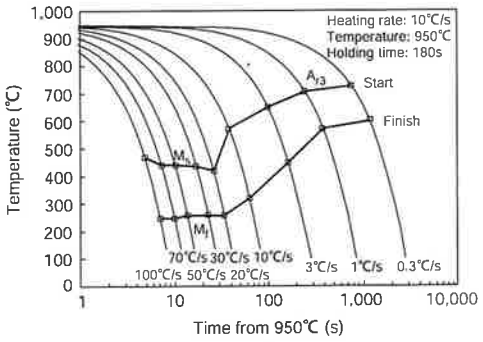


図3　CCT曲線

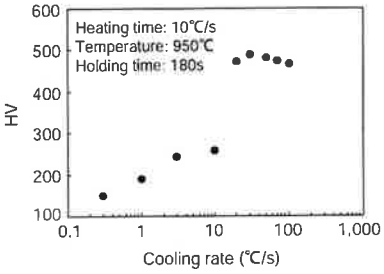


図4　硬さにおよぼす冷却速度の影響

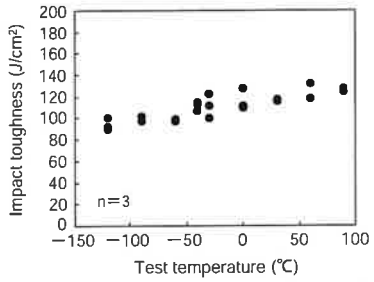


図5　シャルピー試験時の衝撃値と温度の関係

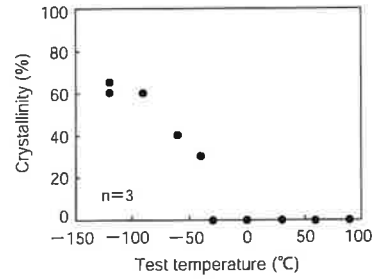


図6　シャルピー試験時の脆性破面率と温度の関係

の冷却速度となるが，この冷却速度で600℃以下まで冷却されると鋼板の強度が低下することが図3および図4からわかる。950℃から600℃までの時間は23〜35秒となり素材を炉から取り出してから23秒以内に金型での冷却を開始すれば素材を焼入れることが可能となる。なお，この関係は加熱条件，冷却中の雰囲気や周りの環境により変化するため，実際のホットプレス作業環境に応じ決定する必要がある。

4.3　靭性

焼入れによりマルテンサイト相で強度を確保した場合には靭性，特に低温での靭性が劣化する懸念がある。この点に関しシャルピー衝撃試験にて検討した結果を図5および図6に示す。図5は衝撃値と温度の関係を，図6は脆性破面率を示す。この試験は4mmの熱間圧延板を水焼入れ後に2mmUノッチ2.5mmサブサイズ衝撃試験片を作製して行った。吸収エネルギーは室温から−60℃まであまり大きな変化を示さない。一方，脆性破面率は−40℃以下で増加し，−80℃では約80%となり，遷移温度(Tr_{550})は−60℃程度である。脆性破面率は板厚が薄くなると低減する傾向にあり，2.5mmより薄い板厚の場合には遷移温度はより低下するものと考えられる。以上の結果から，この鋼板は焼入れのままのマルテンサイト相を主体とする組織で使用されるが，通常の環境下で低温になって急激に吸収エネルギーが変化したり破壊形態が変化することはないものと推定されることがわかる。

5.　スポット溶接性

めっき付着量を120g/m²とする板厚1.2mmのアルミめっき鋼板を950℃で5分加熱し，金型で両側から挟み込むことで焼入れを行いスポット溶接用サンプルとした。表層のめっき層の変化に関しては次章で説明するが，Fe-Al合金めっきとなっている。相手材としては板厚1.8mmの440MPa級の冷間圧延薄鋼板を用いた。スポット溶接は，DR6φ型のアルミナ分散銅を電極とし，通電を17サイクル(60Hz)，加圧を400kgfとして行った。図7にナゲット径と電流密度の関係を示すがナゲット径が板厚をtとして$4\sqrt{t}$となる電流値とちりが発生する電流値の範囲は約3kA存在することがわかる。図8はせん断引張強度と電流値の関係を，図9は十字引張強度と電流値の関係を示す。図10にナゲット近傍の硬さ分布を示すが，ナゲット内および母材部は約480のビッカース硬さを持ち溶接熱影響部(HAZ)にて300程度に軟化する。このような硬さ分布を持つため，ナゲット径が充分な大きさを持つ場合破断部はこのHAZとなることが多い。

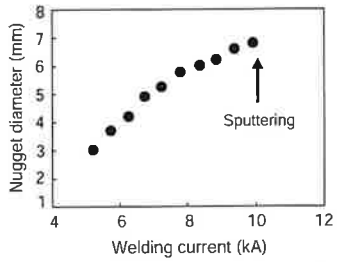


図7　スポット溶接部のナゲット径と電流値の関係

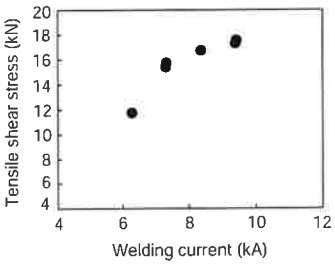


図8　スポット溶接部のせん断引張強度と電流値の関係

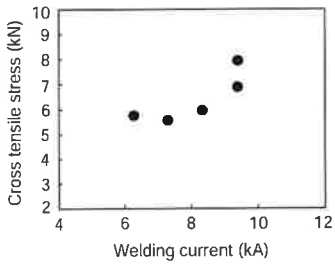


図9　スポット溶接部の十字引張強度と電流値の関係

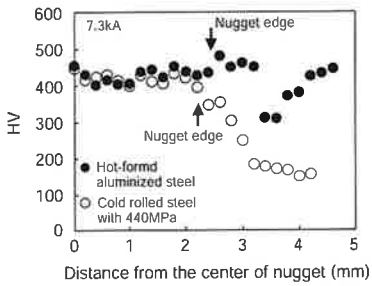


図10　ナゲット近傍の硬さ分布

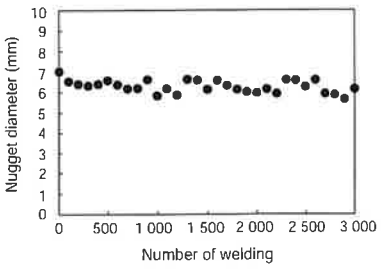


図11　連続打点によるナゲット径の変化

図11は連続打点性を評価した結果である。試験は3 000点まで行ったが，この範囲ではナゲット径の変化はあまりなく3 000点以上の連続打点も可能であると推定される。この鋼板の表層のめっき層は融点が1 000℃以上のFe-Al合金相となっているが，このことがこのような連続打点性を持つ理由と考えられる。

ここではアーク溶接性に関しては示していないが，Fe-Al合金相は沸点が2 000℃以上であり，亜鉛系のめっき鋼板で問題となるアーク溶接時のブローホールの発生は無い。

6.　めっき特性

6.1　加熱時のめっき層の合金化

本鋼板の表層めっきはSiを10％含有するアルミめっきであり，Type 1 と呼ばれているものである。このめっき層の溶融温度は約600℃であるため急速に加熱するとめっき層は一旦溶融するが，電気炉で得られる加熱速度では加熱中に融点の高いFe-Al合金層が生成し，速やかに表層まで達するため溶融物が炉材等に付着することはない。大気雰囲気中の電気炉で板厚1.6mmの素材を加熱した場合，保定温度に達するまでの時間は約２分であった。

図12に950℃で0.5分間保定した際の合金化の状況を，図13は表層のめっき層のFe，AlおよびSi濃度を板厚方向にSEM-EDSで測定した結果を示す。合金化が進行すると図に示すようなAlおよびFe濃度を持つ層状の合金相が形成される。この加熱条件下では合金相は５層からなり，Al濃度は最表層から順に約50％，30％，50％，30％，10％と変化している。４層目から母層にかけては元素濃度が連続的に変化している。

図14にThermo-calc[7]により計算したFe-Al-Si系の950℃での状態図を示す。この図に図13で示した各点の組成を重ねた。なおこの計算のFe-Al-Si系熱力学データベースはZ. Liuら[8]によるものを使用した。図14から合金層は表層からFe_2Al_5，BCC規則相，$FeAl_2$，BCC規則相，BCC不規則相と推定される。表層の合金層は保定時間が長くなるとAlが母層へと拡散していくため最表層から消滅していく。図15は保定時間を５分としたときのめっき層を示す。断面組織からは１相しか識別できなくなっているが，SEM-EDSで分析すると２相が存在していることがわかった。このときの相はBCC規則相と不規則相と考えられる。

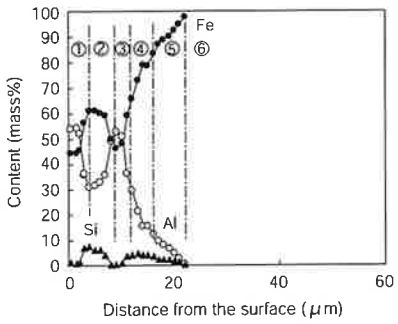


図13　図12に対応したサンプルの板厚方向のFe, Al, Si元素濃度変化

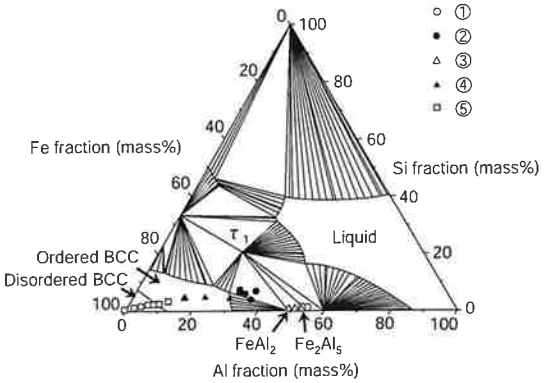


図14　Fe-Al-Si平衡状態図の950℃での等温断面図

6.2　塗装性および塗装後耐食性

鋼板は自動車への適用に際して電着塗装されて使用されるが，通常，塗装性を確保するため塗装前に化成処理が施される。化成処理は一般にりん酸亜鉛系の溶液中で行われ，表面にりん酸塩の皮膜を形成させる。この皮膜により塗装性，塗料密着性が確保されるが，Fe-Al合金相は化成処理液に浸漬してもこの化成皮膜が形成されない。これはFe-Al合金相が酸に対して非常に安定な相であるためである。しかしながら図16でわかるように加熱処理後の表面は凹凸が

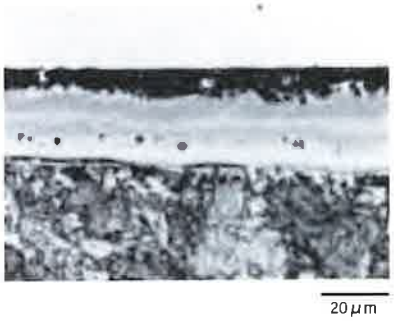


図12　950℃で30秒保定した試料のめっき層構造を示す断面光学顕微鏡写真

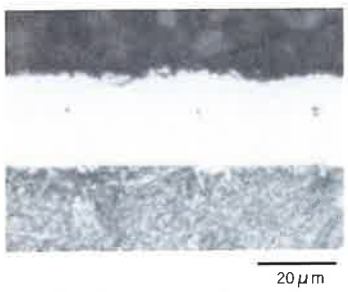


図15　950℃で５分保定後のめっき層構造を示す断面光学顕微鏡写真

ありこれによるアンカー効果で塗装性が確保される。表3は化成処理を施した試料及び施さない試料に約20μm厚みの電着塗装を行ない，塗装後の密着性を検討した結果であるが，十分な特性を確保していることがわかる。このように塗料密着性は化成処理の有無にかかわらず確保可能である。

めっき付着量を160g/m²とするアルミめっき鋼板を900℃で2分加熱することで表層をFe-Al合金めっきとした鋼板を化成処理液に浸漬し，約25μmの電着塗装後，表面の塗膜にクロス状の疵(クロスカット)を入れJASOM610に定めた複合腐食試験(CCT)を150サイクル(50日間)行った後の外観を図17に示す。JASO法CCTの試験条件を以下に示す。

塩水噴霧(5%NaCl，35℃，2h) → 乾燥(60℃，4h) → 湿潤(50℃，2h)

比較材としてめっきを施していない冷間圧延鋼板および合金化溶融亜鉛めっき鋼板(付着量片面45g/m²)を使用した。これらの材料は化成処理を施し，化成皮膜が生成していることを確認した後に試験に供した。腐食試験の途中でクロスカット部からの塗膜膨れ幅を片側最大膨れ幅として評価した結果を図18に，また150サイクル後の板厚方向への腐食深さを表面からレーザー光により1試料当たり各5点づつ測定して平均値並びに標準偏差を算出した結果を図19に示す。これらの結果から，Fe-Al合金相をめっき層とする鋼板の耐食性は剥離幅，腐食深さとも冷間圧延鋼板より優れ，合金化溶融亜鉛めっき鋼板と同等の特性を持つ事がわかる。塗装後耐食性を重視する場合にはめっき付着量を150g/m²程度とすることが望ましい。

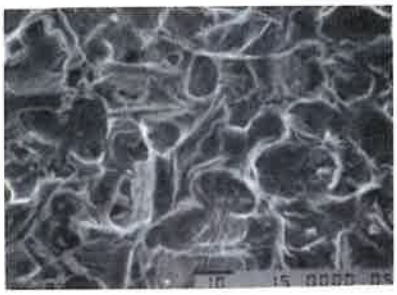


図16　950℃で5分保定後のめっき層表層形態を示すSEM写真

表3　塗料密着性評価結果

	Surface preparation	Primary adhesion*	Secondary adhesion**
Hot-formed aluminized steel	Phosphated	100/100	100/100
Hot-formed aluminized steel	Degreased	100/100	100/100
Galvannealed steel	Phosphated	100/100	100/100
Steel	Phosphated	100/100	100/100

*Primary adhesion test: 100 grid cross-cutting by 2mm and taping after painting
**Secondary test: dipping at 40℃ water for 10 days and cross-cutting and taping



図17　JASO法CCT試験50日後の試料外観

6.3　スポット溶接部の耐食性

図20はスポット溶接時に電極と接していた部分および電極と接触していなかった部分の断面組織を示す。この図から，電極と接していた部分のめっき層はスポット溶接時に温度が上昇してもほとんど変化せずスポット溶接前と同様の厚みを有していることがわかる。そのためこの部分の塗装後耐食性は平板部と全く変わらず，図21に示すように塩水噴霧試験(SST)にて2 000時間経過後においても全く

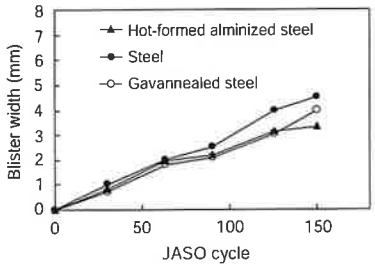


図18　JASO法CCT試験による塗膜膨れ幅の変化

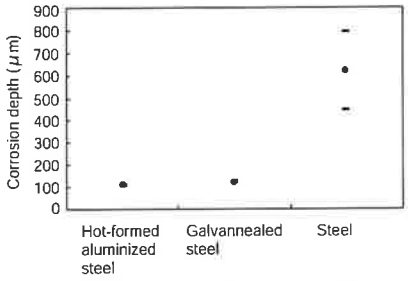


図19　JASO法CCT試験50日後の板厚方向腐食深さの変化



図20　スポット溶接後の電極直下および通常部のめっき層(腐食液：しゅう酸)

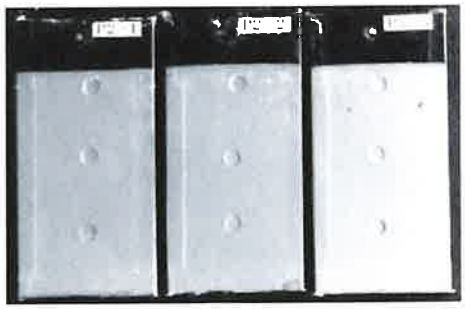


図21　スポット溶接部の塗装後耐食性のSSTによる評価，2000時間後の外観

腐食していないことがわかる。他のめっき鋼板ではスポット溶接を行った際，電極と接していた部分のめっきは溶融し電極と母材の間から押出されめっき金属が盛り上がり突起状になることがあるが，この部分は充分な塗装厚みが確保できず耐食性に問題が生じることがある。

7. 結　　言

本報告ではホットプレス用アルミめっき鋼板の母材特性および表面特性について述べた。母材特性に関しては，プレス成形時の金型焼入れで冷却速度がばらついても30℃/s以上の冷却速度が確保できれば均一な強度を有する部材が得られること，引張特性に関しては降伏強度：1 280MPa，引張強度：1 530MPa，伸び：8%が得られること，耐水素脆性にすぐれること等を述べた。スポット溶接性に関しては，表層のアルミめっきがプレス前の加熱で融点の高いFe-Al合金相となることに起因してめっき層の存在による劣化はないことや連続打点性に優れることを示した。また耐食性に関しては，Fe-Al合金相はめっきを施していない鋼板と合金化溶融亜鉛めっき鋼板の間に位置することを示した。

以上のような特徴を持つ鋼板をホットプレスに適用することで，比較的複雑な形状を持つ高強度で耐食性に優れた部材の製造が可能となる。

参考文献

1) Senuma, T.: ISIJ Int. 41, 520(2001)
2) Bano, X., Laurent, J. P.: Proc. of 39th Mechanical Working and Steel Processing Conf. Vol. XXXV, Indianapolis, 1998, p.673
3) 廣村敏樹, 内野龍一, 加藤希人, 佐藤昌彦: 自動車技術会学術講演会前刷集. 942, 1994-5, p.73
4) 例えば, アイシン高丘: 東京モーターショー. 月刊薬形材. 43, (2002)
5) Cornette, D., Hourman, T., Hudin, O., Laurent, J. P., Reynaert, A.: Proc. of SAE. 2001, p.19
6) Ronin, F.: Variant-Flexible Steel Forming in Automotive Production. 2nd Europian Practice Conf. Bad Nauheim, Frankfurt, 2002
7) Sundman, B., Jansson, B., Andersson, J.-O.: CALPHAD. 9, 153(1985)
8) Zi-kui Liu, Y. Austin Chang: Metall. Mater. Trans. A. 30A, 1081(1999)

Appendix
CHING02



archive.org

DECLARATION OF MINA CHING

1. I am a Records Request Processor at the Internet Archive. I make this declaration of my own personal knowledge.

2. The Internet Archive is a website that provides access to a digital library of Internet sites and other cultural artifacts in digital form. Like a paper library, we provide free access to researchers, historians, scholars, and the general public. The Internet Archive has partnered with and receives support from various institutions, including the Library of Congress.

3. The Internet Archive has created a service known as the Wayback Machine. The Wayback Machine makes it possible to browse more than 450 billion pages stored in the Internet Archive's web archive. Visitors to the Wayback Machine can search archives by URL (i.e., a website address). If archived records for a URL are available, the visitor will be presented with a display of available dates. The visitor may select one of those dates, and begin browsing an archived version of the Web. Links on archived files in the Wayback Machine point to other archived files (whether HTML pages or other file types), if any are found for the URL indicated by a given link. For instance, the Wayback Machine is designed such that when a visitor clicks on a hyperlink on an archived page that points to another URL, the visitor will be served the archived file found for the hyperlink's URL with the closest available date to the initial file containing the hyperlink.

4. The archived data made viewable and browseable by the Wayback Machine is obtained by use of web archiving software that automatically stores copies of files available via the Internet, each file preserved as it existed at a particular point in time.

5. The Internet Archive assigns a URL on its site to the archived files in the format http://web.archive.org/web/[Year in yyyy][Month in mm][Day in dd][Time code in hh:mm:ss]/[Archived URL] aka an "extended URL". Thus, the extended URL http://web.archive.org/web/19970126045828/http://www.archive.org/ would be the URL for the record of the Internet Archive home page HTML file (http://www.archive.org/) archived on January 26, 1997 at 4:58 a.m. and 28 seconds (1997/01/26 at 04:58:28). The date indicated by an extended URL applies to a preserved instance of a file for a given URL, but not necessarily to any other files linked therein. Thus, in the case of a page constituted by a primary HTML file and other separate files (e.g., files with images, audio, multimedia, design elements, or other embedded content) linked within that primary HTML file, the primary HTML file and the other files will each have their own respective extended URLs and may not have been archived on the same dates.



6. Attached hereto as Exhibit A are true and accurate copies of browser screenshots of the Internet Archive's records of the archived files for the URLs and the dates specified in the attached coversheet of each screenshot.

7. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

DATE: August 30, 2025

Mina Ching

EXHIBIT A

https://web.archive.org/web/20060410060141/http:/global.ihs.com/

INTERNET ARCHIVE WayBackMachine http://global.ihs.com/ Go JUL APR JAN 10 2003 2006 2008 About this capture
1,874 ca 21 Dec 19

Welcome to the IHS Standards Store

We have over 300,000 new and historical standards, specifications and codes, with over 500,000 available for immediate PDF download.

Do you need hardcopy standards right now but don't want to pay costly freight charges? Call 877-413-5184 and ask about our patented **Remote Access Printing** delivery method.

IHS The Source

Document Number | Title/Keywords | Français | Deutsch

Home | Standards | About Us | My Account | Shopping Cart | Help

Order your standards online or call 877-413-5184

Search Standards by SDO

Popular Industry Standards

- Aerospace
- Automotive
- Building Code Software
- Construction
- Electrical/Electronics
- Government/Military
- Health and Safety
- Medical
- Petrochemical/Utilities
- Quality
- Telecommunications
- Welding & Metals

Featured Products

- ADA Compliance
- API Fire & Safety
- ASME Boiler Code
- Drawing & Drafting
- ASTM Set
- 2004 AWS D1.1/D1.1M
- IHS Subscriptions
- Homeland Security
- ISO
- TIA/EIA Wiring Sets
- Overstock Sale

Services

- Abbreviations
- Customer Service
- Deposit Accounts
- Free Catalogs
- Free Newsletters
- New/Revised Docs
- Search Help
- Standing Orders
- Research Center

Currency Converter

Standards Subscriptions

- Are you struggling to keep your standards library up-to-date?
- Do you need seamless integrated access to specs & standards?
- Does your company purchase more than $3,000 in standards per year?
- Do you need automatic updates?
- Do you have multiple users accessing the same standards?

If you answered 'Yes' to these questions, contact IHS to find out how IHS can provide you immediate access to the critical information you need.

Click the button below to request a product quote

Request a Quote

ISO 9001 Registered

NEW from NEMA!
Ensure your project's success with these releases from the National Electrical Manufacturers Association!
NEMA MW 1000, 2003 - New Revision 1, 2005 - : Magnet Wire
NEMA WC 27500, Dec 2005: Standard for Aerospace and Industrial Electrical Cable
NEMA SB 30, 2005: Fire Service Annunciator and Interface

NEW from CEA!
Ensure your project's success with these releases from the Consumer Electronics Association!
CEA-310, Revision E, Dec 2005: Cabinets, Racks, Panels and Associated Equipment
CEA-556, Revision C, Dec 2005: Outer Shipping Container Label Standard
CEA-936, Revision A, Nov 2005: USB Carkit Specification

NEW from TIA!
Ensure your project's success with these releases from the Telecommunications Industry Association!
TIA/EIA-568-2, New Addendum 11, Dec 2005 : Specification of 4-Pair UTP and SCTP Cabling

TIA/EIA-568 SET Revised!

TIA/EIA Building Telecommunications Wiring Standards Revised!



New from AWS: Attention Structural Welders!
Don't forget your copy of the 2006 edition of AWS D1.1/D1.1M : Structural Welding Code - Steel

We are pleased to announce the availability of five new bundles of must-have structural welding codes to ensure compliance in your discipline. Each bundle is priced at **17% off the normal price!** Order Now and Save!

NEW from API!
Ensure your project's success with these releases from the American Petroleum Institute!
API RP 2219, 3rd Edition, Nov 2005: Safe Operation of Vacuum Trucks in Petroleum Service
API MPMS 4.9.2, 1st Edition, Dec 2005: Determination of the Volume Displacement and Tank Provers by the Withdraw Method of Calibration

NEW from ASTM!
Ensure your projects success with these releases from ASTM International!
ASTM Passport to Steel - Online database of the latest steel data for more than 50,000 steels, powered by CASTI
ASTM 01.01 - Jan 2006 : Steel - Piping, Tubing, Fittings
ASTM 01.04 - Jan 2006 : Steel - Structural, Reinforcing, Pressure Vessel, Railway



New from Plan Analyst!
Ensure your Florida building project is up to code with the new 2004 Florida Plan Analyst Building Code Software .
Order Today!

Special Announcement!
We are pleased to announce that we are now the exclusive distributor for the Aerospace Industries Association (AIA) National Aerospace Standards.
Visit our new AIA web store to see what's new in the aerospace industry.
Also, visit our Aerospace page to see the most popular standards for the aerospace industry.

Prices subject to change without notice.
Copyright 2006 IHS Inc. All rights reserved.
Worldwide Offices | News & Events | Newsletters | Privacy
Business Centers | Terms & Conditions | Site Map
If you experience technical problems, e-mail globalcustomerservice@ihs.com

Appendix
CORNETTE01

```
leader  03529cas a2200733 a 4500
001     99144336880001451
005     20251105213014.0
008     820622c19179999pau x m        0   a0eng c
010     ##$asn 86013887  $zsn 89008459  $zsn 98038298  $zsn 78006307
012     ##$i8702 $k1 $l1
016     7#$a013889600 $2Uk
019     ##$a1425242 $a3589929 $a23248474 $a664601610 $a1063376237 $a1242861728 $a1246532255
022     0#$a0148-7191 $z0096-5170 $21
023     0#$a0148-7191 $21
030     ##$aSTPSDN
035     ##$a(OCoLC)08540031 $z(OCoLC)1425242 $z(OCoLC)3589929 $z(OCoLC)23248474 $z(OCoLC)664601610 $z(OCoLC)1063376237 $z(OCoLC)1242861728 $z(OCoLC)1246532255
035     ##$a(OCoLC)ocm08540031
037     ##$bSAE, 400 Commonwealth Dr., Warrendale, PA 15096
040     ##$aAKR $beng $cAKR $dAIP $dNSD $dNST $dWAU $dMYG $dOCL $dOCLCQ $dU9S $dOCLCQ $dUKMGB $dOCLCQ $dOCLCO $dOCLCF $dWAU $dOCLCQ $dDLC $dOCLCO $dOCL $dUKIME $dOCLCL $dOCLCQ
042     ##$ansdp $apcc
049     ##$aMAIN
050     10$aCLASSED SEPARATELY
050     #4$aTL1 $b.S552
082     1#$a629 $211 $1https://id.oclc.org/worldcat/ddc/E3KyTd6cvpj4B3qWwpRBB9WkdF
210     0#$aSAE tech. pap. ser.
222     #0$aSAE technical paper series
245     00$aSAE technical paper series.
246     1#$aSociety of Automotive Engineers technical paper series
246     1#$aS.A.E. technical papers $f1917-
246     1#$aTechnical paper series $f1961-1977
260     ##$31917-1977 : $aNew York, NY : $bSociety of Automotive Engineers
260     3#$31978- : $aWarrendale, PA : $bSociety of Automotive Engineers
300     ##$avolumes ; $c28 cm
310     ##$aIrregular
336     ##$atext $btxt $2rdacontent
337     ##$aunmediated $bn $2rdamedia
338     ##$avolume $bnc $2rdacarrier
362     1#$aBegan in 1917.
550     ##$aSome papers issued jointly by: American Society of Mechanical Engineers, and also: SAE International and Society of Automotive Engineers of Japan, <2003->.
530     ##$aAlso issued on microfiche.
515     ##$aSome papers for <2003-> also bear numbering used by Society of Automotive Engineers of Japan, i.e. 2003-32-0001 also called JSAE 20034301.
588     ##$aDescription based on: 790005, published in 1979; title from cover.
588     ##$aLatest issue consulted: 2004-32-0100, also called JSAE 20044387.
650     #0$aAutomobiles $xDesign and construction.
650     #0$aMotor vehicles.
650     #0$aAutomobiles $vPeriodicals.
650     #2$aMotor Vehicles
650     #6$aAutomobiles $vPériodiques.
650     #6$aAutomobiles $xConception et construction.
650     #6$aVéhicules automobiles.
650     #7$amotor vehicles. $2aat
650     #7$aAutomobiles $2fast
650     #7$aAutomobiles $xDesign and construction $2fast
650     #7$aMotor vehicles $2fast
655     #7$aPeriodicals $2fast
710     2#$3<1979-> : $aSociety of Automotive Engineers. $1https://id.oclc.org/worldcat/entity/E39QH7JmmVtHqcdhRJFJpMKm9t
710     2#$3<2003-> : $aSAE International (Society) $1https://id.oclc.org/worldcat/entity/E39QH7JmrG8BXDfxKKJCYR3tCF
710     2#$3<2003-> : $aJidôsha Gijutsukai. $1https://id.oclc.org/worldcat/entity/E39QH7JmpXtyh4pMG3hmvDFDFg
776     08$iOnline version: $tSAE technical paper series $x2688-3627 $w(DLC)  2019202679 $w(OCoLC)565460947
776     08$iCD-ROM: $tSAE technical papers on CD-ROM $x1083-4958 $w(DLC)   97645855 $w(OCoLC)32828161
780     00$tPreprint (Society of Automotive Engineers) $w(DLC)sn 98038294 $w(OCoLC)40244561
850     ##$aAAP $aCaOTU $aInLP $aKMK $aMnU $aNcRS $aViU $aWaU
856     41$uhttps://www.sae.org/publications/technical-papers
970     ##$aSet 222 $9local
973     ##$apbooks
978     ##$a.b30475557 $9local
979     ##$aNZ Boundwith record.
994     ##$a92 $bOCACL
```

https://orbiscascade-washington.primo.exlibrisgroup.com/discovery/fulldisplay?context=L&vid=01ALLIANCE_UW:UW&search_scope=UW_EVERYTHING&tab=UW_default&docid=alma9915453265000145 January 29, 2026

UW Libraries Search

BASIC SEARCH | ADVANCED SEARCH | JOURNAL SEARCH | BROWSE SEARCH | KNOWN ISSUES | Log in for all services | Menu

Search anything | Library Resources | Articles, Books and More | ADVANCED SEARCH

ASK US!

TOP
SEND TO
GET IT
ITEM DETAILS
VIRTUAL BROWSE

PRINT BOOK

SAE technical paper series.

1917; 1917-1977 : New York, NY : Society of Automotive Engineers

Available at Engineering Library Stacks (TL1 .S552) and other locations

Send to

E-MAIL | PERMALINK | CITATION | PRINT | ENDNOTE | EASYBIB | EXPORT RIS | BIBTEX | EXPORT TO EXCEL

Get It

Please sign in to see request options and to place requests. Log in for all services

BACK TO LOCATIONS

LOCATION ITEMS

Engineering Library
May be available , Stacks ; TL1 .S552

Holdings:
Incomplete
1961 no.335-359 Bound with earlier title
1961:no.335-
View less

FIND THIS LOCATION

Filters: Engineering Library | Volume | Year | 2001 no.50-99

Clear filter

Item in place (0 requests) 2001 no.50-99
Loanable

SHOW SUMMIT LIBRARIES »

Item Details

Title	SAE technical paper series.
Author	<1979-> : Society of Automotive Engineers <2003-> : SAE International (Society) <2003-> : Jidōsha Gijutsukai.
Subjects	Automobiles – Periodicals Automobiles Automobiles – Design and construction Motor vehicles
MESH subjects	Motor Vehicles
Related Titles	Continues : Preprint (Society of Automotive Engineers)
Genre	Periodicals
Language	English
Format	volumes ; 28 cm
Alternate Title	Abbreviated title: SAE tech. pap. ser. Key title: SAE technical paper series Society of Automotive Engineers technical paper series S.A.E. technical papers 1917- Technical paper series 1961-1977
Description	**Issuing body:** Some papers issued jointly by: American Society of Mechanical Engineers, and also: SAE International and Society of Automotive

	Engineers of Japan, <2003->. Some papers for <2003-> also bear numbering used by Society of Automotive Engineers of Japan, i.e. 2003-32-0001 also called JSAE 20034301.
Publisher	1917-1977 : New York, NY : Society of Automotive Engineers
Publication Date	1917
Dates of Publication	Began in 1917.
Frequency	Irregular
Identifier	ISSN: 0148-7191 ISSN: 2688-3627 (Additional Format) ISSN: 1083-4958 (Additional Format)
OCLC Number	08540031
Alma IZ Record Number	99154532650001452
Alma NZ Record Number	99144336880001451

Virtual Browse



Links

Staff View

Appendix
CORNETTE02

https://web.archive.org/web/20010615000000*/http://catalog.lib.washington.edu/ February 2, 2026

INTERNET ARCHIVE | WEB | TEXTS | VIDEO | AUDIO | SOFTWARE | IMAGES | SIGN UP | LOG IN | UPLOAD | Search

ABOUT | BLOG | EVENTS | PROJECTS | HELP | DONATE | CONTACT | JOBS | VOLUNTEER

DONATE

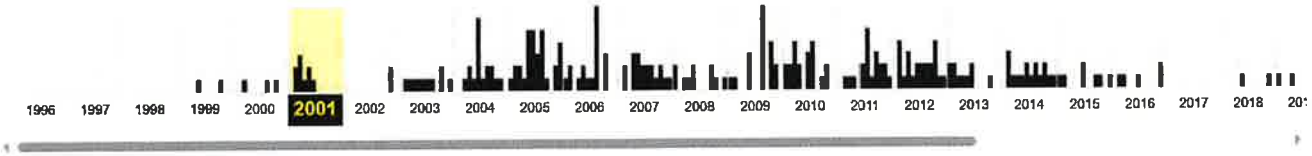
INTERNET ARCHIVE WayBack Machine

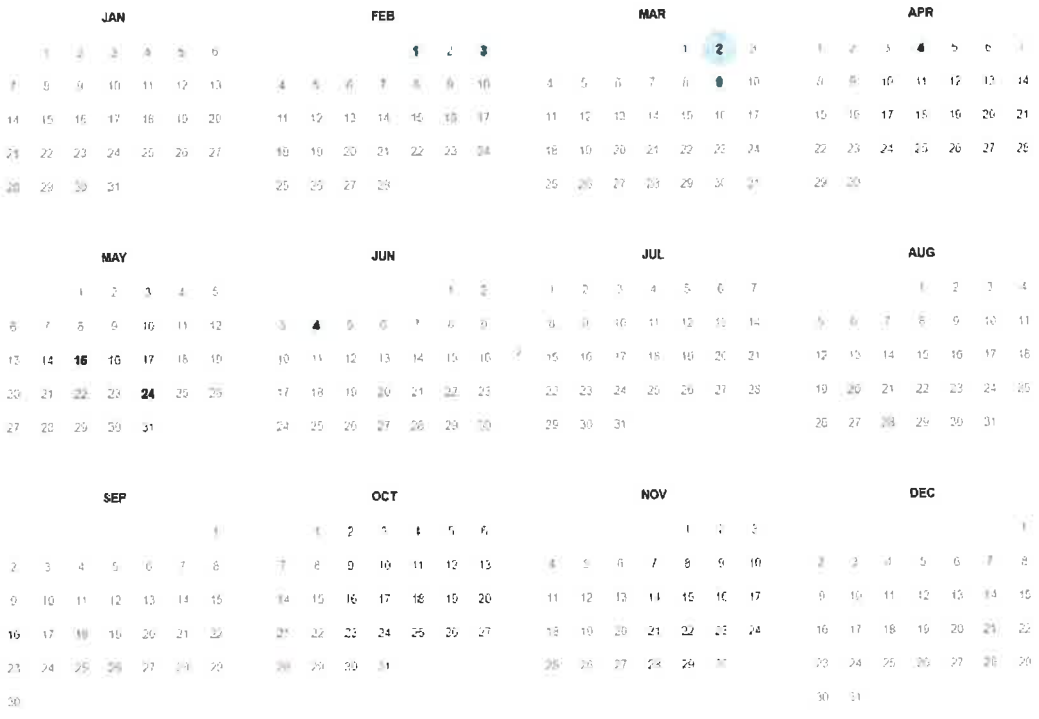
Explore more than 1 trillion web pages saved over time

http://catalog.lib.washington.edu/

Calendar · Collections · Changes · Summary · Site Map · URLs

Saved **271 times** between May 8, 1999 and May 28, 2025.





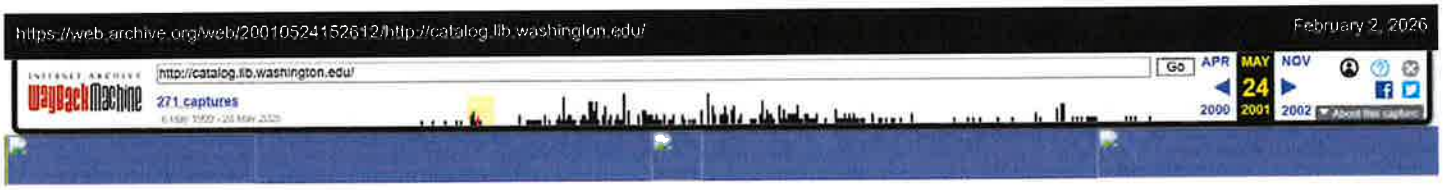
Note

This calendar view maps the number of times **http://catalog.lib.washington.edu/** was crawled by the Wayback Machine, *not* how many times the site was actually updated. More info in the FAQ.

FAQ | Contact Us | Terms of Service (Dec 31, 2014)

The Wayback Machine is an initiative of the Internet Archive, a 501(c)(3) non-profit building a digital library of Internet sites and other cultural artifacts in digital form. Other projects include Open Library & archive-it.org.

Your use of the Wayback Machine is subject to the Internet Archive's Terms of Use.



Search the UW Libraries Catalog

Author
Title
Keywords
Call Numbers &
Other Numbers

Subjects:
Library of Congress
Medical

Course Reserves:
By Course
By Professor

Change search to:

All UW | UW Center | UW | Journals

Go to:

Cascade
Includes Law Library

View Your

Change type of catalog to:

Telnet Catalog | Z39.50 Character Set | MARC Character Set

Libraries Information Gateway | UW Home

Appendix
CORNETTE03

https://web.archive.org/web/20050615000000*/http://catalog.lib.washington.edu/search/t January 29, 2026

INTERNET ARCHIVE | WEB | TEXTS | VIDEO | AUDIO | SOFTWARE | IMAGES | SIGN UP | LOG IN | UPLOAD | Search

ABOUT | BLOG | EVENTS | PROJECTS | HELP | DONATE | CONTACT | JOBS | VOLUNTEER

DONATE

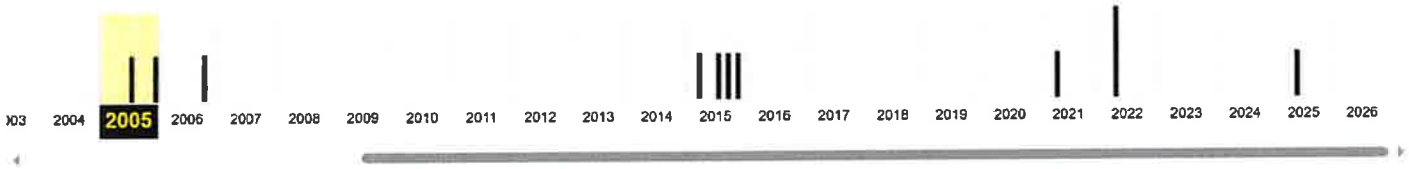
INTERNET ARCHIVE WayBackMachine

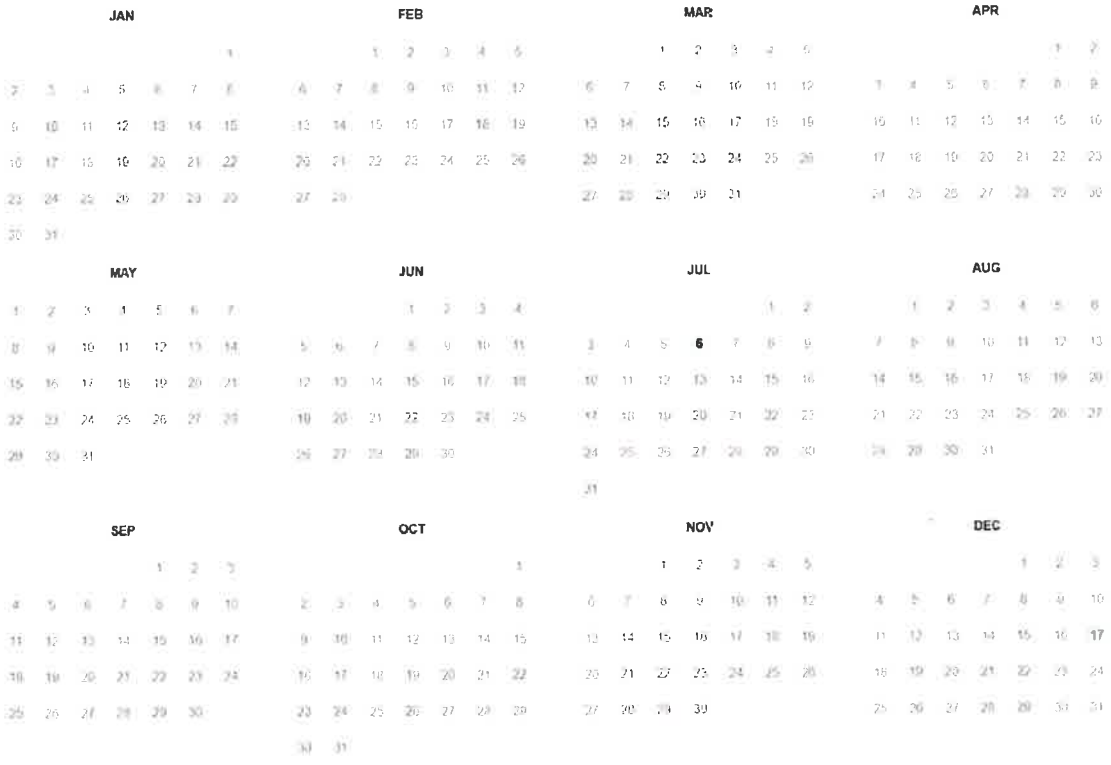
Explore more than 1 trillion web pages saved over time

http://catalog.lib.washington.edu/search/t

Calendar · Collections · Changes · Summary · Site Map · URLs

Saved **11 times** between July 6, 2005 and May 28, 2025.





Note

This calendar view maps the number of times **http://catalog.lib.washington.edu/search/t** was crawled by the Wayback Machine, *not* how many times the site was actually updated. More info in the FAQ.

FAQ | Contact Us | Terms of Service (Dec 31, 2014)

The Wayback Machine is an initiative of the Internet Archive, a 501(c)(3) non-profit, building a digital library of Internet sites and other cultural artifacts in digital form. Other projects include Open Library & archive-it.org

Your use of the Wayback Machine is subject to the Internet Archive's Terms of Use.

https://web.archive.org/web/20050706043648/http://catalog.lib.washington.edu/search/t January 29, 2026
http://catalog.lib.washington.edu/search/t Go JUN JUL DEC
11 captures 06
2004 2005 2006

Text version of the UW Catalog via telnet

UW Libraries Catalog

University of Washington Libraries

UW Libraries Home | UW Catalog Home | Your Library Account | Catalog Help

Off-Campus Access

Search Summit | Start Over

- Author
- LC Subject
- Title
- Medical Subject
- Keywords
- Genre/Form
- Call Numbers
- ISBN & Other Numbers

Title Search

Title | Entire Collection | Search

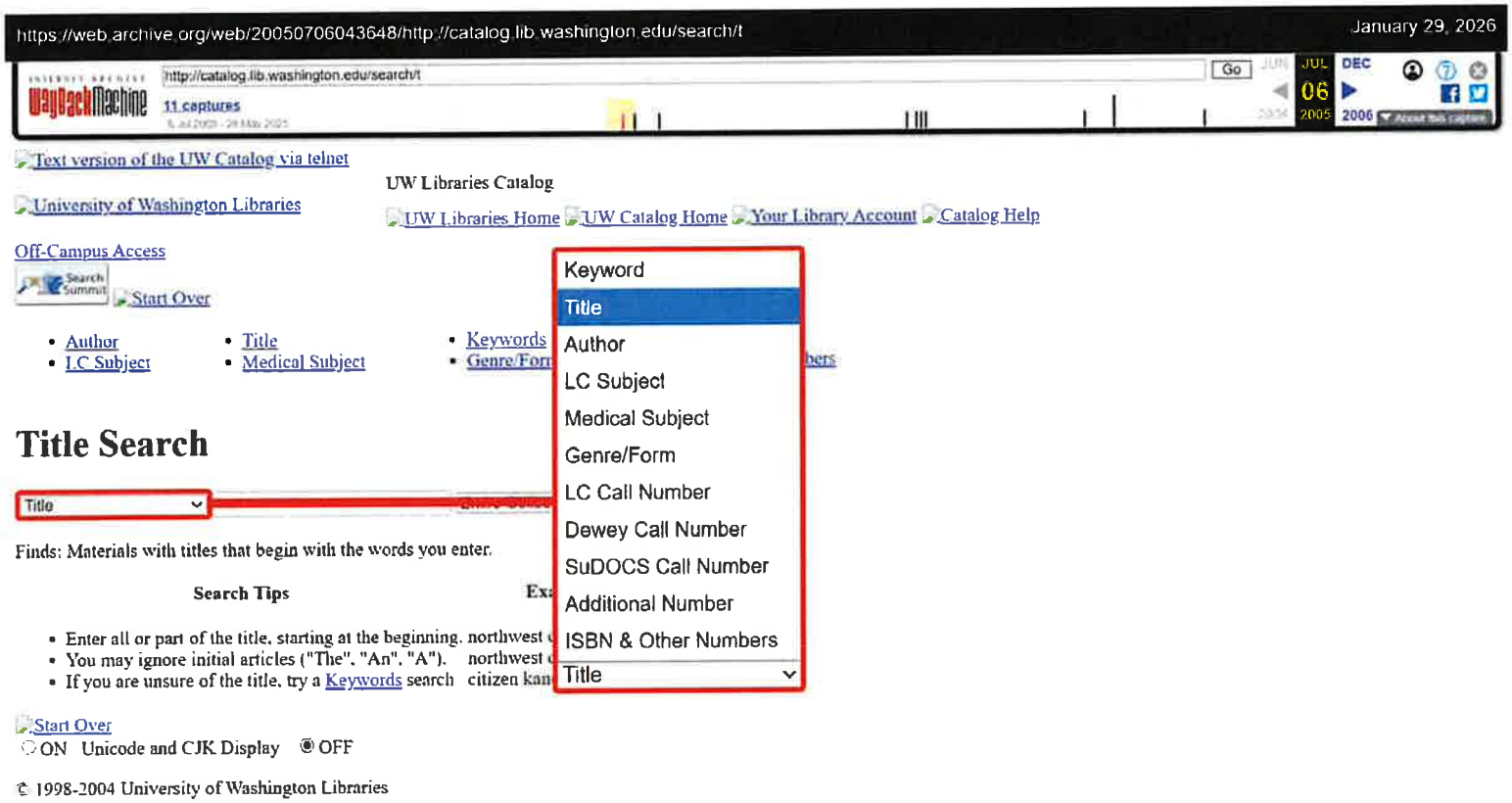
Finds: Materials with titles that begin with the words you enter.

Search Tips	Examples
• Enter all or part of the title, starting at the beginning.	northwest coast indian art
• You may ignore initial articles ("The", "An", "A").	northwest coast indian
• If you are unsure of the title, try a Keywords search	citizen kane

Start Over

○ ON Unicode and CJK Display ◉ OFF

© 1998-2004 University of Washington Libraries


https://web.archive.org/web/20050706043648/http://catalog.lib.washington.edu/search/t
January 29, 2026
http://catalog.lib.washington.edu/search/t
Go
11 captures
JUL
DEC
06
2005
2006
Text version of the UW Catalog via telnet
UW Libraries Catalog
University of Washington Libraries
UW Libraries Home
UW Catalog Home
Your Library Account
Catalog Help
Off-Campus Access
Start Over
Author
LC Subject
Title
Medical Subject
Keywords
Genre/Form
Keyword
Title
Author
LC Subject
Medical Subject
Genre/Form
LC Call Number
Dewey Call Number
SuDOCS Call Number
Additional Number
ISBN & Other Numbers
Title
Title Search
Finds: Materials with titles that begin with the words you enter.
Search Tips
Enter all or part of the title, starting at the beginning.
You may ignore initial articles ("The", "An", "A").
If you are unsure of the title, try a Keywords search
Start Over
ON Unicode and CJK Display
OFF
© 1998-2004 University of Washington Libraries

Appendix
CORNETTE04

https://web.archive.org/web/20060901000000*/http://catalog.lib.washington.edu/search/X

January 29, 2026

INTERNET ARCHIVE | WEB | TEXTS | VIDEO | AUDIO | SOFTWARE | IMAGES | SIGN UP | LOG IN | UPLOAD | Search

ABOUT | BLOG | EVENTS | PROJECTS | HELP | DONATE | CONTACT | JOBS | VOLUNTEER

DONATE

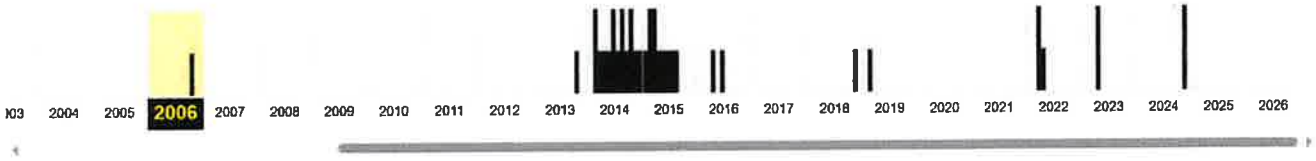
INTERNET ARCHIVE WayBack Machine

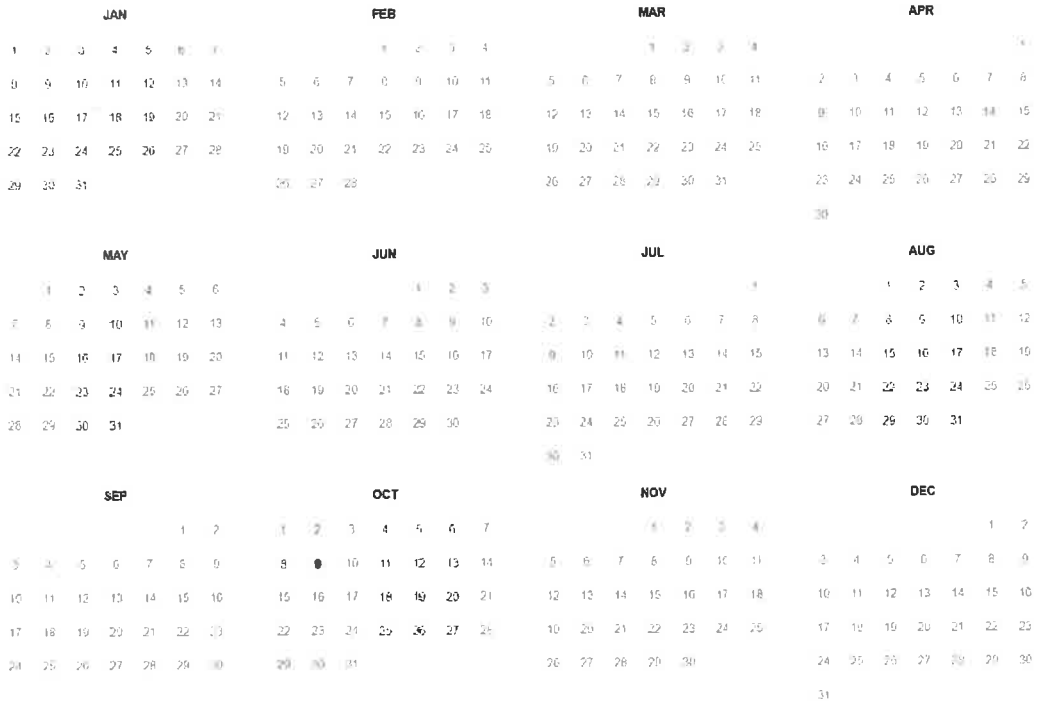
Explore more than 1 trillion web pages saved over time

http://catalog.lib.washington.edu/search/X

Calendar · Collections · Changes · Summary · Site Map · URLs

Saved **38 times** between October 9, 2006 and November 23, 2024.





Note

This calendar view maps the number of times **http://catalog.lib.washington.edu/search/X** was crawled by the Wayback Machine, *not* how many times the site was actually updated. More info in the FAQ.

FAQ | Contact Us | Terms of Service (Dec 31, 2014)

The Wayback Machine is an initiative of the Internet Archive, a 501(c)(3) non-profit, building a digital library of Internet sites and other cultural artifacts in digital form. Other projects include Open Library & archive-it.org

Your use of the Wayback Machine is subject to the Internet Archive's Terms of Use.



Text version of the UW Catalog via telnet

University of Washington Libraries

UW Libraries Catalog

ask us

UW Libraries Home | UW Catalog Home | Your Library Account | Catalog Help | chat | phone

off-campus access (log in)

Search Summit | Start Over

- Author
- LC Subject
- Title
- Medical Subject
- Advanced Keywords
- Genre/Form
- Call Numbers
- ISBN & Other Numbers

Advanced Keyword Search

Any Field: And
Any Field: And
Any Field: And
Any Field:

Entire Collection

Language: ANY

Publication Type: ANY

Location: ANY

Search and Sort: sorted by date

Year: After and Before

Illustrations: ANY

Search

Feature:	Search Tips:	Examples:
Adjacency	Multiple words are searched together as one phrase.	United States supreme court
Truncation	Words may be right-hand truncated using * (for 1-5 characters). Use ** for unlimited truncation.	environment* polic* magneto**
Operators	Use "and" or "or" to specify multiple words in any field, any order. Use "and not" to exclude words.	(annotated bibliography) and child* (alaska or canada) and (adventure and not vacation)
	Note that you can use these clauses in combination with selections from the operator pulldown menu (as indicated in brackets).	History [And] Naples or Napoli [And] Borgia or Alexander
Proximity	Use "near" to specify words close to each other, in any order.	California near university
Field limits	Specify fields to search using the Field pulldown menu (as indicated in brackets).	[Author] Doctorow

Start Over

ON Unicode and CJK Display OFF

© 1998-2004 University of Washington Libraries

Appendix
CORNETTE05

A Review and Analysis of Library Availability Studies

By Thomas E. Nisonger

The concept of availability (can a library patron locate a desired item on a library's shelves?) and Kantor's branching method for identifying barriers to availability (acquisition, circulation, library operations, and the user) are described. A literature review identifies more than fifty investigations of availability reported in journal articles, dissertations, theses, or conference presentations during the last quarter century. The mean availability rates for known-item searches by actual patrons of 61.3 percent or 63.1 percent (depending on the calculation method) are quite similar to the 61 percent found in an earlier review covering the years 1934 to 1984. Analysis of availability in Kantor's branches shows variation among libraries, but no branch standing out as a major barrier. The paper concludes with the argument that the traditional availability measure can be modified for use as an objective, user-centered evaluative tool in the electronic environment.

Libraries and the library and information science (LIS) discipline are in the midst of a rapid paradigm shift, calling for new research approaches and evaluative measures. During the twentieth century a host of library evaluation techniques that generally focused on the collection itself, including the checklist approach, circulation studies, and the Conspectus, were developed for a relatively stable, mostly print environment. See Lockett for a synopsis of the major approaches.[1] The Association of Research Libraries (ARL) New Measures Initiative and LibQual, among several possible examples, illustrate how the discipline is now searching for new, user-centered evaluation strategies suitable for a more complex, hybrid print-electronic environment, which may soon morph into an all-electronic environment. This paper concludes with the suggestion that a proven library evaluation technique that has been used for more than seven decades, usually termed an "availability study," can be modified to help meet the evaluation challenges in the emerging environment.

The word "availability" can have a wide variety of meanings, including a politician's availability as a candidate for office or someone's availability for a Saturday night date. Within LIS, the term has been applied to a variety of contexts, including the holding of a journal title by a library or the ability to obtain a book in the out-of-print market, among numerous credible examples.[2] Yet, availability has a well-established and fairly specific meaning as a library performance or collection evaluation measure. It has been defined as "the extent to which patron needs for specific documents are promptly satisfied" and "immediate access to known-items sought."[3] In essence, availability tests whether a library patron can immediately find whatever document he or she is seeking in the library. The terms "shelf availability study," "failure study," or "frustration study" have alternatively been used for this method or variations upon it.

Thomas E. Nisonger (nisonge@indiana.edu) is Professor, School of Library and Information Science, Indiana University.

The author gratefully acknowledges the efforts of his graduate assistants at Indiana University's School of Library and Information Science, Rebecca Kennedy, Sara Franks, and Catherine Hall, who at various times provided clerical support for the writing of this paper. He also thanks the staff of Indiana University's School of Library and Information Science Library for their excellent service.

Availability is often considered a measure of library effectiveness or overall performance. As White stated, "The user doesn't care that the library owns a million books if he can't find the one he wants."[4] Availability studies have been compared to systems analysis because they view the library as a system for providing documents demanded by patrons and can identify which subsystem, such as acquisitions or circulation, is responsible for failure.[5] Investigation of availability constitutes an established LIS research approach that has been used in doctoral dissertations, master's theses, and many refereed journal articles.

The majority of availability studies have been "real," as they were based on surveying actual library patrons during designated time periods, usually asking them to complete a questionnaire reporting the items sought and whether they were found. Some studies have been simulated with library staff checking the shelf availability for a list of citations. A few studies have used log records of patron OPAC searches.[6] A number of investigations have taken a macro approach, simply calculating an overall availability rate. Many have been conducted at a micro level, using Kantor's branching technique (as will be explained further in this paper) to analyze why books and articles were not available. This macro-micro distinction is based on Lancaster's work.[7]

A number of sources have reviewed the advantages and disadvantages of availability studies, including Lockett, and Bachmann-Derthick and Spurlock.[8] The advantages of the approach include: provision of objective data concerning the library's ability to meet patron need, use of a well-established methodology, and repeatability at later or even regular intervals allowing longitudinal comparison. Also, bottlenecks can be identified and policy changes or appropriate corrective actions can be made.

The disadvantages associated with availability tests are their design and implementation can be relatively complex and time-consuming; user cooperation is required; users may not accurately report the necessary information; the needs of nonusers are not addressed; and, because they are based on a sample, they only provide an estimate of overall availability.

This paper's purpose is to review and tabulate the results of more than thirty-five studies reporting more than fifty availability tests conducted or published since the early 1980s, focusing on overall availability rates and the reasons items were not available to patrons. The potential applicability of the availability concept to the electronic environment is then advocated.

A Brief Historical Sketch of Availability Studies

Studies of availability have appeared in the literature for at least seven decades. Gaskill, Dunbar, and Brown's 1934 use survey at the Iowa State College library calculated the percentage of time both undergraduate students and graduate students "obtained what they sought" and identified eleven reasons for failure to locate the sought-after book or magazine.[9] In 1975, Buckland's major monograph, *Book Availability and the Library User*, based on research at the University of Lancaster, reported that circulation was the major barrier to book availability, and recommended variable loan periods and purchase of duplicate copies to increase availability.[10]

At least forty availability studies were published between the 1930s and the mid-1980s, according to a seminal literature review and analysis published in 1986 by Mansbridge.[11] He discovered that most investigations were based on known-item searches conducted in academic libraries, while two-thirds were based on real users, and the remaining third used a set of citations simulating user needs. This literature review will only mention the most seminal items included in Mansbridge, while focusing on research published later or not covered by him.

Kantor's Branching Method

"The branching method," developed by Kantor during the 1970s, is probably the best-known availability technique and the one most frequently employed in research. Kantor's original 1976 article, which reported results at Case Western University's Freiberger Library, outlined four branches or barriers to patron "satisfaction" in obtaining a desired book, which are generally termed: "acquisitions"—it was not acquired; "circulation"—it is checked out to another patron; "library operations"—it is not in the correct shelf location; and "the user"—it can not be located when correctly shelved.[12] Later modifications added a "bibliographic" branch—the user did not have the correct citation—and a "catalog" branch—the user could not locate the book in the catalog and record the correct call number.[13] Rashid used a "collection development policy" branch (actually a subdivision of the acquisitions branch), whereby the desired title was not covered by the collection development policy's scope.[14] Two additional branches have been used in the small number of studies of subject searching—i.e., the patron is seeking a book on a particular subject rather than a specific title—"appropriate title," in which the patron deems a book listed in the catalog inappropriate due to such factors as age, language, or reading level; and "matched query," in which the client fails to find a subject heading in the catalog matching his or her information need.[15]

Numerous permutations of branches have been used in the studies based on Kantor's methodology. The three most frequently used sets of branches for known-item searches by patrons are

- Acquisitions, Circulation, Library Operations, User;
- Acquisitions, Catalog, Circulation, Library Operations, User; and
- Bibliographic, Acquisitions, Catalog, Circulation, Library Operations, User.[16]

Other less frequently employed permutations include "Acquisitions, Catalog, Circulation, and Library"—because the investigation took place in a closed stack library; "Bibliographic, Collection Development, Acquisitions, Catalog, Circulation, Library Operations, and User"; and "Acquisitions, "On-the-Shelf."[17] Some studies have combined branches, such as circulation and library operations.[18] Variant terminology has occasionally been used—e.g., "selection" for "acquisitions" or "retrieval" for the "user" finding the document on the shelf.[19] Each of the branches described above represents a barrier to the user locating a sought-after book or item. Failures in different branches have been variously termed as "dissatisfactions," "errors," or "malfunctions" throughout the literature.

ARL published a detailed manual by Kantor explaining the implementation of his branching method, and some collection evaluation and library performance guides or textbooks, such as one by Hall, have provided succinct summaries of the technique.[20] During the 1980s, doctoral dissertations using Kantor's method were completed at Case Western Reserve University by Kuraim, Ajlan, Abduljalil, and Rashid, as well as at Rutgers by Ciliberti.[21] Kantor's branching analysis has also been applied in master's papers or theses written at the University of North Carolina at Chapel Hill by Roberts and Chandler, the University of the Punjab in Pakistan by Bashir, and the University College of Wales by Salter.[22]

The fact that Kantor's branching method has been implemented in the United States, Europe, Africa, Asia, the Middle East, and Australia testifies to its wide international acceptance. In the United States, not counting studies already covered in Mansbridge's literature review, it has been used at

- the University of Illinois Health Sciences Center by Kolner and Welch;
- the William Patterson College Library by Ciliberti et al., and Mitchell, Radford, and Hegg;
- the University of California at Santa Cruz Library by Ferl and Robinson; and
- the San Jose State University by Thorne and Whitlatch.[23]

Internationally, it has been utilized at

- a Tokyo city library system in Japan in a severely modified form by Tamura and Sakai;
- Liverpool Polytechnic Library Service in the United Kingdom twice by Revill;
- the Friesland Provincial Library in the Netherlands by Lieshout;
- the University of the Punjab in Pakistan by Rehman and Bashir;
- the University of Western Australia by Harris and Garner;
- the University of Münster in Germany by Boekhorst;
- the International Islamic University in Malaysia by Rehman, Arif, and Chaudhry;
- the King Fahd University of Petroleum and Minerals in Saudi Arabia by Chaudhry and Ashoor;
- the University of Zululand in South Africa by Zondi;
- four universities in the state of Tamil Nadu in India by Urs and Dominic; and
- a simulated study at the University of Cape Town Medical Library by Steynberg and Rossouw.[24]

Kantor's method has been primarily used for known-item searches by actual patrons in academic libraries, although it also has been employed in

- the Shaker Heights Senior High School and Cleveland Heights High School libraries in Ohio by Abduljalil;
- the Cleveland Heights-University Heights Main Public Library by Wood, Bremer, and Saraidaridis and by Kuraim;
- the Cameron Village Regional Library in North Carolina in a simulated study by Chandler; and
- a Tokyo city library system by Tamura and Sakai.[25]

While the method has primarily been used to measure book availability to actual patrons, it has also tested the availability of

- journal articles at the University of New Mexico by Bachmann-Derthick and Spurlock;
- journal articles at Adelphi University by Ciliberti et al.;
- journal articles at the University of North Carolina Health Sciences Library by Shaw-Kokot and Varre;
- both books and articles at the University of Western Australia by Harris and Garner; and
- both books and articles at the King Fahd University of Petroleum and Minerals by Chaudhry and Ashoor.[26]

Kantor's method has also been employed for analysis of subject searching at William Patterson College by Ciliberti et al., plus Mitchell, Radford, and Hegg; and at Adelphi University by Cilibert et al.[27]

Other Approaches to the Study of Availability

Various availability tests have been developed as performance or so-called "output" measures for public libraries. *Performance Measures for Public Libraries*, by De Prospo, Altman, and Beasley, proposed and tested in twenty U.S. public libraries a simulated shelf availability measure using samples of book titles from the *American Book Publishing Record* and each library's shelflist plus periodical articles selected from leading indexes.[28] *Output Measures for Public Libraries*, by Van House et al., includes three availability measures according to type of search: the Title Fill Rate, the Subject and Author Fill Rate, and the Browsers' Fill Rate.[29] The "title fill rate," as a known-item search, is essentially equivalent to the author-title searches generally used by those implementing Kantor's method. *Output Measures for Public Library Service to Children*, by Walter, contains a "children's fill rate," "homework fill rate," and "picture book fill rate."[30] Its companion volume of output measures for young adult services incorporates a "young adult fill rate" and a "homework fill rate."[31] While some public libraries have simply posted availability scores on the Web without reporting details of the study, this review is limited to formal research reports (e.g., Simpson at the Pikes Peak Library District and Thompson at Augustana College Library).[32]

A few studies have calculated availability based on patron known-item searches without using Kantor's branching analysis or explicit "fill rates," such as those conducted at Macquarie University in Australia by Knox and Wivell, and at Cardiff University in the United Kingdom by Wall and Williams.[33] Simulated availability studies not involving actual patrons have been conducted at the University of Illinois at Urbana-Champaign by Stelk and Lancaster, the University of Cape Town by Steynberg and Rossouw, and the Cameron Village Regional Library in North Carolina by Chandler.[34] In addition, simulated investigations have supplemented "real" studies at the Cleveland Heights-University Heights Main Public Library by Kuraim, and the King Faud University of Petroleum and Minerals by Chaudhry and Ashoor.[35]

Accessibility Studies

Related, yet distinct from availability, is the concept of accessibility, which measures the amount of time required to obtain a document (from either internal or external resources) rather than its immediate availability. Similar to availability, the term "accessibility" is sometimes used inconsistently in the literature. The best-known accessibility measure was developed during the late 1960s and early 1970s, and has entered LIS lore as "Orr's Document Delivery Test" (DDT).[36] In this technique, the time required to obtain a sample of approximately 300 documents is used to calculate a Capability Index ranging from 0—no documents available within a week—to 100—all documents available within 10 minutes—which would be considered availability. Orr's test has been implemented in 92 U.S. medical libraries by Orr and Schless; 2 Canadian LIS libraries by Penner; 13 California secondary school libraries by Greenberg; and 7 South African medical libraries by Steynberg and Rossouw.[37] Although Orr's DDT was not used, the comparative accessibility of books through recall or interlibrary loan was recently investigated at Iowa State University by Gregory and Pedersen.[38] Tangential to document delivery tests are the numerous performance evaluations of interlibrary loan and commercial document delivery, which include "turnaround" or delivery time as an important variable. This author tabulated the results from approximately 30 such studies published during the 1990s.[39] It is beyond this paper's scope to analyze the results of accessibility studies.

An Analysis of Availability Studies Conducted During the Previous 20 to 25 Years

This section analyzes the results of the availability studies issued since Mansbridge's literature review (the cutoff date was 1984) as well as a small number of studies published between 1980 and 1984 not included in Mansbridge—mainly Ph.D. dissertations, a format he did not address. Appendix A summarizes 46 investigations of availability based on actual clients conducting known-item searches that were published from 1980 to 2001, listing the author, publication date (or degree date for dissertations), institution, sample size, the number of successful searches, and the overall availability rate. For the purpose of consistency and accurate comparison, the availability percentages have been calculated by the author to the first decimal point based on the data reported by the original researchers. Recalculation of the initially reported percentage was sometimes necessary due to inconsistent practice in rounding off numbers by some researchers, inexplicable errors in the originally reported percentage, or cases in which the researchers derived a final percentage by multiplying the percentage results at each branch (the method used by Kantor) rather than by simply dividing the number of successes by the total number of searches. Instances in which the percentage in appendix A differs by more than half a percentage from that which was initially reported are noted in footnotes to the appendix.

Examination of appendix A reveals that overall availability ranged from 33.8 percent at the University of Münster to 83.8 percent at Cardiff University. The high rate at the latter can probably be attributed to the study's focus on "short loan," items—i.e., "reserve" in North American terminology. Twenty-nine of the 46 reported results showed an availability rate in the 50s or 60s percentage range. The unweighted mean availability rate (with each of the 46 percentages

counting equally) is 61.3 percent, a figure remarkably similar to the 61 percent reported by Mansbridge, who used this method for calculating the mean.[40] However, Mansbridge found a larger range in the results from different studies (8 to 89 percent).[41] This literature review's weighted mean (a calculation method not used by Mansbridge that factors in the size of each investigation) was 63.1 percent (17,801.3 successes in 28,207 searches) for 43 investigations. Excluded from calculation of the weighted mean were Simpson's two surveys at the Pikes Peak Library District (for which the raw data is unavailable) as well as Jacobs and Young's University of Sussex research, where the 99,778 searches would badly skew the overall average. The 61 or 63 percent mean availability rates found in this review are a bit higher than the general 50 to 60 percent range cited by Bachmann-Derthick and Spurlock; Lieshout; Ciliberti et al.; and Chandler.[42]

The three cases focusing exclusively on serial or journal articles, Bachmann-Derthick at the University of New Mexico, Roberts at East Tennessee State, and Ciliberti et al. at Adelphi University, found lower-than-average availability rates, 55.7 percent, 54.5 percent, and 44.9 percent, respectively.[43] Among the investigations addressing multiple formats, Chaudhry and Ashoor's study at King Fahd University reported a 58.6 percent availability rate for journal articles, while Harris and Garner found a 54 percent serials availability rate at the University of Western Australia.[44] While these data might lead to a facile assumption of a lower general availability rate for serials (and a confirmation of the longstanding perception that serials cause difficulties), in the final analysis, the number of cases involving serials is too small to allow firm conclusions.

As indicated in appendix A's footnotes, three studies measured the availability rate before and after librarian intervention. (Note that the vast majority of availability studies have not included librarian assistance as a factor in the equation, so only the initial result is included in appendix A's final column.) A librarian's help increased availability at the Cleveland Heights-University Heights library from 52.4 to 60.8 percent (Kuraim's study), at the Cleveland Health Sciences Library from 59.6 to 63.5 percent (Rashid's study), and from 62.8 to 68.5 percent at the King Fahd University of Petroleum and Minerals (Chaudhry and Ashoor's study).[45] These investigations suggest, as one would intuitively think, that librarian assistance does result in somewhat higher availability.

The small number of subject-based availability studies (not tabulated in appendix A) display less variation in their availability rates than was apparent in the known-item searches, although the results were comparable. Overall availability was 56.8 percent (108 of 190 searches) and 62 percent (31 of 50 searches) at William Patterson College and 62.2 percent (153 of 246 searches) at Adelphi University or 60 percent, as reported by Ciliberti et al., if the availability rates at each of Kantor's branches are multiplied by each other.[46]

Following appendix A's format, appendixes B through G summarize availability at each of Kantor's branches, covering respectively, the bibliographic citation, acquisitions, the catalog, circulation, library operations, and the user. While the fractional results occasionally reported in these appendixes may seem counterintuitive, they are easily explained by the location of one volume of a multivolume title, or the use (in a few studies) of a "correction factor" to distribute proportionately among the branches failed searches for which the precise cause could not be determined. Not represented in these appendixes are the investigations that did not employ Kantor's branching technique plus the reports by Zondi as well as Thorne and Whitlatch, where useable data were not presented.[47]

Appendix B shows a consistently high level of availability at the bibliographic branch, ranging from 94.9 to 100 percent. The unweighted mean availability for the nine reported cases is 97.1 percent, while the weighted mean is 97.7 percent (6,990 of 7,154 searches were successful). Failures in this branch were usually due to incorrect citations for the author or the title.

Appendix C tabulates 33 reported cases of availability at the acquisitions branch—the branch most frequently included in studies employing Kantor's methodology. While availability ranged from 66.1 to 97.2 percent, it exceeded 90 percent in the majority of instances (17 of 33) and was more than 80 percent on all but six occasions. It is noteworthy that the two lowest availability rates, 68 percent and 66.1 percent, appear in studies of journal articles by Roberts at East Tennessee State University and Ciliberti et al. at William Patterson College.[48] However, the findings from the other two studies focusing on journal articles, Bachmann-Derthick and Spulock at the University of New Mexico (85.2 percent) and Shaw-Kokot and Varre at the University of North Carolina at Chapel Hill (94.4 percent), are generally consistent with the other results in the appended table.[49] The unweighted mean availability rate for these 33 reported results at the acquisitions branch is 87.1 percent and the weighted mean for 32 cases (all but Revill's 1988 study at the Liverpool Polytechnic Library Service, which reported availability percentages but no raw data for the branches) is 89.6 percent with 19,080 successes among 21,299.9 sought-after items.[50] At the sub-branch level, the predominant reason for failure was the fact the library had not acquired the item. Other causes of acquisitions failure included weeding, cancellation, the sought-after item's location in a different branch, the item having been declared missing, and an "on order" title having not been received.

Appendix D demonstrates a high success rate at the catalog branch, with the reported availability percentages running from 86.4 to 99.6 percent. Indeed, the rate was

more than 90 percent in 20 of 21 instances and more than 95 percent in more than half the cases (11 of 21). The unweighted mean availability rate was 94.7 percent and the weighted mean 96.5 percent (13,328.4 of 13,806). Appendix D's footnotes show that librarian assistance increased availability at this branch at the Cleveland Heights-University Heights Public Library from 93.4 to 98.8 percent (Kuraim's study) and at the Cleveland Health Science Library from 96.9 to 98.6 percent (Rashid's study).[51] Frequent reasons for catalog branch failure were inability to locate the record in the catalog as well as transcription of an incorrect call number or an incorrect location.

Despite early studies identifying circulation as a major barrier to book availability, success rates in the circulation branch, presented in appendix E, exceeded 80 percent in all but four instances, ranging from 66.2 to 100 percent. The circulation branch's unweighted mean availability rate for 31 reported results was 87.9 percent and the weighted mean for 30 cases, excluding Revill's 1988 study, was 87.4 percent (16,899.73 of 19,337.7).[52] It is noteworthy that each of the three investigations of journal articles found high availability rates in this branch: Bachmann-Derthick and Spurlock (96.7 percent), Roberts (97.5 percent), and Ciliberti et al. (100 percent), possibly reflecting the fact that journals are less likely to circulate.[53] As would be expected, the overwhelming majority of circulation failures were attributable to the item being checked out by a patron while another reason was checkout for interlibrary loan purposes.

Appendix F's tabulation of 31 availability rates in the library operations branch shows a range from 65.7 to 98.9 percent with more than half (18) exceeding 90 percent and only four less than 80 percent. This branch's unweighted mean availability rate is 88.8 percent, and the mean weighted rate, for one less case with the 1988 Revill study not counted, stands at 89.9 percent (15,185.6 successes in 16,889.73 attempts).[54] Of library branch failures, major causes of error were missing items, bindery operations, reshelving operations, misshelved items, and items in technical processing.

Appendix G tabulates success rates at the user branch as defined and reported by the original investigators. This branch almost always includes user failure to locate the item on the shelf, but may also include user failure with the bibliographic citation or in the catalog. Ranging from 77.7 to 96.6 percent, the user success rate exceeded 90 percent in 18 of the 32 reported results and was less than 80 percent only once. Both the unweighted means (32 instances) and the weighted means (31 instances with 13,833 satisfactions out of 15,413.8 searches) equal 89.7 percent. A high proportion of user errors was due to the inability to locate the item on the shelf, while another cause of failure was the user not understanding the classification system.

Whereas appendixes B through G summarize success rates in each branch, appendix H analyzes failures by branch, indicating for the various studies the number and percentage of failures attributed to each branch. In order to provide a more accurate estimation of total user failure, appendix H's user column combines the results from appendix B (user bibliographic failure), appendix D (user failure at the catalog), and appendix G (user failure at the shelf or overall user failure). The findings have been calculated by the author from the original researchers' raw data.

Within each branch, appendix H shows wide variation in the proportion of failures attributable to the branch, ranging from 5.9 to 70.4 percent in acquisitions; 0 to 50 percent in circulation; 1.4 to 46.4 percent in library operations; and 6.7 to 42.9 percent for the user. Of 8,991.7 total failures, 25.3 percent were in the acquisitions branch; 27.1 percent in circulation; 19.0 percent in library operations; 24.7 percent by the user; and 3.9 percent were not solely attributable to any of these branches. Disregarding the four investigations (Wood, Bremer, and Saraidaridis; Kuraim; Tamura and Sakai; and Jacobs' fall survey) that did not include all of these branches, the largest portion of failures was caused by the circulation branch in eleven cases; the acquisitions branch in eight cases; and library operations and the user in five cases each.[55] While Mansbridge concluded that circulation and library operations were the largest source of book unavailability in academic libraries, this analysis found that the highest percentages of total failures were in the acquisitions and user branches, and that the circulation and acquisitions branches were the largest cause of failures in the most cases.[56] However, it is apparent from careful review of the data that no branch emerges as the major obstacle to availability.

Appendix I summarizes the results of simulated studies that did not involve actual patrons. Note that Kuraim as well as Chaudhry and Ashoor included both real and simulated components in their research projects.[57] Availability ranged from 13 to 84 percent with an unweighted mean of 61.8 percent and a weighted mean of 60.6 percent (2,010 successes out of 3,315)—figures quite similar to the averages for real studies. One would intuitively anticipate a higher availability rate in a simulated study because user errors would be eliminated and, when a shelflist sample is being used, the items would already have been acquired by the library. Indeed, when the one outlier (the 13 percent availability in Kuraim's sample from the *American Book Publishing Record*) is disregarded, the mean availability rates increase to 68.8 percent (unweighted) and 69.1 percent (weighted with 1,945 of 2,815 on the shelf).[58]

Finally, many of these studies have addressed subsidiary issues beyond the scope of this analysis, such as

- whether user type (student or faculty, full or part-time student, and so on) is a variable influencing the ability to locate items;
- comparison of the performance of different libraries; and

- longitudinal comparisons within a single library.[59]

Summary

This literature review and analysis of more than fifty specific investigations of availability found that the majority used Kantor's branching method (but numerous combinations of branches), were implemented in academic libraries (with some in public and school libraries), and were for known-item searches by actual patrons. About half the studies were conducted in U.S. libraries with the remainder carried out in ten other countries.

There is considerable variation among libraries in overall availability as well as availability in different branches. One of the values of these studies is the identification of reasons for lack of availability in a specific library context. Branch-level analysis shows that availability at each branch only occasionally falls below 80 percent and frequently exceeds 90 percent. Moreover, no branch stands out as the major bottleneck or barrier to availability. This study, in conjunction with Mansbridge's review, demonstrates that, in a print environment, patrons on average find what they are looking for only slightly more than 60 percent of the time. An obvious question concerns what the availability rate would be for electronic resources on the Web or licensed by a library.

A New Definition of Availability

More than a decade ago, Kaske argued that the availability concept was no longer applicable to the then current environment because user needs were often met through externally-procured print items. He advocated the development of a new availability model that would incorporate the searching of multiple libraries and the time the user could wait to obtain the item.[60]

Expanding upon Kaske, this paper maintains that the traditional availability concept reviewed here can be adopted with modification for an electronic environment to measure user success in immediately obtaining sought-after items on the Web or in the proprietary e-resources licensed by a particular library. While many patrons may no longer expect the immediate gratification of finding an item on a library shelf, they may nevertheless expect immediate gratification in locating it electronically. The extent to which they are successful in doing so can serve as an objective, user-centered evaluation and performance measure in the newly emerging electronic environment. Such tests could also identify barriers to user success and facilitate the design of better electronic systems.

A detailed outline of the procedures for conducting an electronic availability study is beyond this paper's scope. As with traditional availability studies, the method would work best for known-item searches by real users, although a simulated study would be a possibility.

Future Research

Future research issues regarding electronic availability studies include

- development of a method for measuring availability of electronic resources;
- determination of an expected standard for availability rates in an electronic environment;
- comparison of electronic availability rates with those reported in the numerous studies conducted in traditional print environments; and
- identification of the major barriers to electronic availability and the relative success rates at the various barriers.

One might hypothesize the following potential barriers or branches: the item is not on the Web; the URL has changed; the item is only available in a proprietary database that is not licensed by the user's library; the maximum licensed number of simultaneous users are logged on; technological failure, such as a server is down or the local power off; and the user is unable to locate an otherwise available item. Many of the issues that have been investigated in typical availability studies could be addressed in an electronic availability study. Examples would include

- comparative availability among different user groups;
- comparative availability among libraries;
- longitudinal comparison within a library;
- the impact of professional assistance to the user upon availability; and
- the impact of policy changes on availability.

Finally, one could design and conduct electronic accessibility tests, modeled on Orr's DDT, to ascertain the time requited to obtain electronic documents.

Conclusions

While availability studies are sometimes viewed as a research approach from the 1970s and 1980s, this literature review has demonstrated their continued use on an international scale throughout the 1990s and into the twenty-first century.[61] Although developed for a print environment, the issues

investigated in an availability study are equally relevant to an electronic environment. Mansbridge contended that an availability study could be used for nonlibrary purposes, such as analyzing the availability of audio-visual equipment in an academic setting.[62] If, at some future point, libraries cease to exist or are radically transformed into now unrecognizable entities, an electronic availability study could still be employed in an academic institution as an objective, user-centered evaluation measure to help assess how effectively faculty and student information needs are being met.

References and Notes

1. Barbara Lockett, *Guide to the Evaluation of Library Collections* (Chicago and London: ALA, 1989).
2. A. N. Zainab and S. L. Ng, "Availability and Overlap of Quality Computer Science Journal Holdings in Selected University Libraries in Malaysia," *Malaysian Journal of Library & Information Science* 8, no. 1 (Jul. 2003): 45–63; John Mutter, Jim Milliot, and Karen Holt, "What Price Used Books?" *Publishers Weekly* 251, no. 39 (Sept. 27, 2004): 31–34.
3. Paul B. Kantor, *Objective Performance Measures for Academic and Research Libraries* (Washington, D.C.: ARL, 1984), v.; D. H. Revill, "An Availability Survey in Cooperation with a School of Librarianship and Information Studies," *Library Review* 37, no. 1 (1988): 17.
4. An approximate quotation from Herbert S. White's presentation at Indiana University's School of Library and Information Science, May 9, 2003.
5. Lynn B. Chandler, "Book Availability in the Cameron Village Regional Library" (master's paper, University of North Carolina at Chapel Hill, 1998), 2.
6. N. A. Jacobs and R. C. Young, "Measuring Book Availability in an Academic Library: A Methodological Comparison," *Journal of Documentation* 51, no. 3 (Sept. 1995): 281–90; Anne Ciliberti et al., "Empty Handed? A Material Availability Study and Transaction Log Analysis Verification," *Journal of Academic Librarianship* 24, no. 4 (Jul. 1998): 282–89.
7. F. W. Lancaster, *If You Want to Evaluate Your Library . . .*, 2nd ed. (Champaign, Ill.: University of Illinois, Graduate School of Library and Information Science, 1993), 222.
8. Lockett, *Guide to the Evaluation of Library Collections*, 11–12; Jan Bachmann-Derthick and Sandra Spurlock, "Journal Availability at the University of New Mexico," in *Advances in Serials Management*, vol. 3, eds. Jean G. Cook and Marcia Tuttle (Greenwich, Conn.: JAI Pr., 1989), 174.
9. H. V. Gaskill, R. M. Dunbar, and C. H. Brown, "An Analytical Study of the Use of a College Library," *Library Quarterly* 4, no. 4 (Oct. 1934): 581.
10. Michael K. Buckland, *Book Availability and the Library User* (New York: Pergamon, 1975).
11. John Mansbridge, "Availability Studies in Libraries," *Library & Information Science Research* 8, no. 4 (Oct./Dec. 1986): 299–314.
12. Paul B. Kantor, "Availability Analysis," *Journal of the American Society for Information Science* 27 (Sept./Oct. 1976): 311–19.
13. Judith B. Wood, Julius J. Bremer, and Susan A. Saraidaridis, "Measurement of Service at a Public Library," *Public Library Quarterly* 2, no. 2 (Summer 1980): 49–57; Faraj Mohamed Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library" (Ph.D. diss., Case Western Reserve University, 1983).
14. Haseeb F. Rashid, "Book Availability as a Performance Measure of a Library: An Analysis of the Effectiveness of a Health Sciences Library," *Journal of the American Society for Information Science* 41, no. 7 (Oct. 1990): 501–7.
15. Anne C. Ciliberti et al., "Materials Availability: A Study of Academic Library Performance," *College & Research Libraries* 48, no. 6 (Nov. 1987): 513–27; Eugene S. Mitchell, Marie L. Radford, and Judith L. Hegg, "Book Availability: Academic Library Assessment," *College & Research Libraries* 55, no. 1 (Jan. 1994): 47–55; Ciliberti et al., "Empty Handed? A Material Availability Study."
16. Stuart J. Kolner and Eric C. Welch, "The Book Availability Study as an Objective Measure of Performance in a Health Sciences Library," *Bulletin of the Medical Library Association* 73, no. 2 (Apr. 1985): 121–31; D. H. Revill, "'Availability' as a Performance Measure for Academic Libraries," *Journal of Librarianship* 19, no. 1 (Jan. 1987): 14–30; Elaine Salter, "How Good is the Library Provision in FE Colleges?" *Library Association Record* 95 (June 1993): 348–49; Abdus Sattar Chaudhry and Saleh Ashoor, "Comprehensive Materials Availability Studies in Academic Libraries," *Journal of Academic Librarianship* 20, no. 5–6 (Nov. 1994): 300–305; Lindiwe E. Zondi, "Measuring Availability and Nonavailability Rates at the University of Zululand Library," *South African Journal of Library & Information Science* 64, no. 2 (June 1996): 108–13; Shalini R. Urs and J. Dominic, "Quality in Collection Management: Measuring Book Availability Performance of Academic Libraries" (paper presented at the DRTC Workshop on Information Management, 6–8 January 1999), http://64.233.167.104/search?q=cache:l6vCnbBnB-gJ:https://drtc.isibang.ac.in/retrieve/257/Papah.pdf+Kantor++branching&hl=en (accessed Sept. 20, 2005); Mohamed Fituri Abduljalil, "Book Availability and User Satisfaction in School Libraries: A Case Study of Shaker Heights Senior High School and Cleveland Heights High School" (Ph.D. diss., Case Western Reserve University, 1985); Terry Ellen Ferl and Margaret G. Robinson, "Book Availability at the University of California, Santa Cruz," *College & Research Libraries* 47, no. 5 (Sept. 1986): 501–8; Bachmann-Derthick and Spurlock, "Journal Availability at the University of New Mexico"; Jennifer Eugenie Roberts, "Journal Availability Study" (master's paper, University of North Carolina at Chapel Hill, 1989); Melanie Harris and Imogen Garner, "Using an Availability Survey to Improve Service at a University Library," *Australian Academic & Research Libraries* 23, no. 1 (Mar. 1992): 25–34; Sajjad Ur Rehman and Shaneena Bashir, "Comparative Measurement of Book Availability in Academic Libraries," *International Information & Library Review* 25 (Sept. 1993): 183–93; Sajjad Ur Rehman, Kokab Arif, and Abdus Sattar Chaudhry, "Availability Analysis: Conduct, Comparison and Applications," *Australian Academic & Research Libraries*

25 (Mar. 1994): 19–26; Alan M. Ajlan, "The Effectiveness of Two Academic Libraries in Saudi Arabia: An Enquiry into the Main Factors Affecting Their Services" (Ph.D. diss., Case Western Reserve University, 1985); Ciliberti et al., "Materials Availability: A Study of Academic Library Performance"; N. A. Jacobs, "The Evaluation and Improvement of Book Availability in an Academic Library," *New Review of Academic Librarianship* 1 (1995): 41–55; Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment"; Julia Shaw-Kokot and Claire de la Varre, "Using a Journal Availability Study to Improve Access," *Bulletin of the Medical Library Association* 89, no. 1 (Jan. 2001): 21–28.

17. B. M. M. Lieshout, "Over de Beschikbaarheid van Literatuur: Verslag van een Availability Studie, Uitgevoerd in de Provinciale Bibliotheek van Friesland," *Open* 24 (Mar. 1992): 86–89; Rashid, "Book Availability as a Performance Measure of a Library: An Analysis of the Effectiveness of a Health Sciences Library;" Shunsaku Tamura and Yumiko Sakai, "Materials Availability Study in Public Libraries," *Library & Information Science* 21 (1983): 49–69.
18. Wood, Bremer, and Saraidaridis, "Measurement of Service at a Public Library;" Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library."
19. Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment"; Ciliberti et al., "Materials Availability: A Study of Academic Library Performance"; Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment."
20. Kantor, *Objective Performance Measures for Academic and Research Libraries*; Blaine H. Hall, *Collection Assessment Manual for College and University Libraries* (Phoenix, Ariz.: Oryx, 1985): 43–51.
21. Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Ajlan, "The Effectiveness of Two Academic Libraries in Saudi Arabia"; Abduljalil, "Book Availability and User Satisfaction in School Libraries"; Haseeb F. Rashid, "Factors Affecting User Satisfaction in a Medical Library and a Comparison with other Types of Libraries" (Ph.D. diss., Case Western Reserve University, 1985). This paper analyzes data from Rashid, "Book Availability as a Performance Measure of a Library: An Analysis of the Effectiveness of a Health Sciences Library," which was based on this dissertation; Anne C. Ciliberti, "The Development and Methodological Study of an Instrument for Measuring Material Availability in Libraries" (Ph.D. diss., Rutgers, the State University of New Jersey, 1985). This paper analyzes data from Ciliberti et al., "Materials Availability: A Study of Academic Library Performance," which was apparently based on this dissertation.
22. Roberts, "Journal Availability Study"; Chandler, "Book Availability in the Cameron Village Regional Library"; Shaneena Bashir, "Measurement of Book Availability at the Punjab University Library" (master's thesis, University of the Punjab, 1991) This item was not examined by the author. This paper analyzes data from Rehman and Bashir, "Comparative Measurement of Book Availability in Academic Libraries," which was apparently based on Rehman's thesis; Elaine Salter, "The Evaluation of Library Service Effectiveness with Particular Reference to Further Education" (mlib. thesis, University College of Wales, 1992). This item was not examined by the author. This paper analyzes data from Salter, "How Good is the Library Provision in FE Colleges?", which was based on her thesis.
23. Kolner and Welch, "The Book Availability Study as an Objective Measure of Performance in a Health Sciences Library"; Ciliberti et al., "Materials Availability: A Study of Academic Library Performance"; Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment"; Ferl and Robinson, "Book Availability at the University of California, Santa Cruz"; Rosemary Thorne and Jo Bell Whitlatch, "Patron Online Catalog Success," *College & Research Libraries* 55, no. 6 (Nov. 1994): 479–97.
24. Tamura and Sakai, "Materials Availability Study in Public Libraries"; Revill, "'Availability' as a Performance Measure for Academic Libraries"; Revill, "An Availability Survey in Cooperation with a School of Librarianship and Information Studies," 17–34; Lieshout, "Over de Beschikbaarheid van Literatuur"; Rehman and Bashir, "Comparative Measurement of Book Availability"; Harris and Garner, "Using an Availability Survey to Improve Service at a University Library"; Peter te Boekhorst, "Methoden der Leistungsmessung in Bibliotheken: Die Durchführung einer Verfügbarkeitstudie an der UB Munster," *Bibliothek Forschung und Praxis* 16, no. 2 (1992): 153–61; Rehman, Arif, and Chaudhry, "Availability Analysis: Conduct, Comparison and Applications"; Chaudhry and Ashoor, "Comprehensive Materials Availability Studies"; Zondi, "Measuring Availability and Nonavailability Rates at the University of Zululand Library"; Urs and Dominic, "Quality in Collection Management"; S. Steynberg and S. F. Rossouw, "The Availability of Research Journals in South African Academic Medical Libraries," *South African Medical Journal* 83 (Nov. 1993): 837–39.
25. Abduljalil, "Book Availability and User Satisfaction in School Libraries"; Wood, Bremer, and Saraidaridis, "Measurement of Service at a Public Library"; Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Chandler, "Book Availability in the Cameron Village Regional Library"; Tamura and Sakai, "Materials Availability Study in Public Libraries."
26. Bachmann-Derthick and Spurlock, "Journal Availability at the University of New Mexico"; Ciliberti et al., "Empty Handed? A Material Availability Study"; Shaw-Kokot and Varre, "Using a Journal Availability Study"; Harris and Garner, "Using an Availability Survey to Improve Service at a University Library"; Chaudhry and Ashoor, "Comprehensive Materials Availability Studies."
27. Ciliberti et al., "Materials Availability: A Study of Academic Library Performance"; Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment"; Ciliberti et al., "Empty Handed? A Material Availability Study."
28. Ernest R. DeProspo, Ellen Altman, and Kenneth E. Beasley, *Performance Measures for Public Libraries* (Chicago: PLA, 1973), 31–36.

29. Nancy A. Van House et al., *Output Measures for Public Libraries: A Manual of Standardized Procedures*, 2nd ed. (Chicago: ALA, 1987), 59–62.
30. Virginia A. Walter, *Output Measures for Public Library Service to Children: A Manual of Standardized Procedures* (Chicago: ALA, 1992), 42–50.
31. Virginia A. Walter, *Output Measures and More: Planning and Evaluating Public Library Services for Young Adults* (Chicago: ALA, 1995), 61–67.
32. Susan Simpson, "Materials Availability/Fill-Rate Study at Pikes Peak Library District," *Colorado Libraries* 16, no. 1 (Mar. 1990): 18–19; Ronelle K. H. Thompson, "How Are We Doing? Using a Materials Availability Survey in an Academic Library," in *Libraries and the Literacy Challenge: The Frontier of the 90s; Proceedings of the Mountain Plains Library Association Academic Library Section Research Forum; MPLA/NDLA/SDLA Joint Conference*, Sept. 23–26, 1987, Bismarck, ND, ed. V. Sue Hatfield (Emporia, Kans.: Emporia State Univ., 1987), 17–30.
33. Jeanette Knox and Carolyn Wivell, "Success Rates at Macquarie University Library," *Australian Academic & Research Libraries* 19, no. 1 (Mar. 1988): 25–31; Terry Wall and Jan Williams, "Availability, Accessibility, and Demand for Recommended Books in Academic Libraries," *Journal of Librarianship & Information Science* 31, no. 3 (Sept. 1999): 145–51.
34. Roger Edward Stelk and F. W. Lancaster, "The Use of Shelflist Samples in Studies of Book Availability," *Collection Management* 13, no. 4 (1990): 19–24; Steynberg and Rossouw, "The Availability of Research Journals;" Chandler, "Book Availability in the Cameron Village Regional Library."
35. Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Chaudhry and Ashoor, "Comprehensive Materials Availability Studies."
36. Richard H. Orr et al., "Development of Methodologic Tools for Planning and Managing Library Services, II: Measuring a Library's Capability for Providing Documents," *Bulletin of the Medical Library Association* 56, no. 3 (Jul. 1968): 241–67; Richard H. Orr and Arthur P. Schless, "Document Delivery Capabilities of Major Biomedical Libraries in 1968: Results of a National Survey Employing Standardized Tests," *Bulletin of the Medical Library Association* 60, no. 3 (Jul. 1972): 382–422.
37. Ibid.; Rudolf Jacob Penner, "Measuring a Library's Capability," *Journal of Education for Librarianship* 13, no. 1 (Summer 1972): 17–30; Marilyn Werstein Greenberg, "Availability of Library Materials in Thirteen Secondary Schools" (Ph. D. diss., Univ. of Chicago, 1981); Steynberg and Rossouw, "The Availability of Research Journals"; Susan Steynberg and S. F. Rossouw, "Testing Orr's Document Delivery Test on Biomedical Journals in South Africa," *Bulletin of the Medical Library Association* 83, no. 1 (Jan. 1995): 78–84.
38. David J. Gregory and Wayne A. Pedersen, "Book Availability Revisited: Turnaround Time for Recalls versus Interlibrary Loans," *College & Research Libraries* 64, no. 4 (Jul. 2003): 283–99.
39. Thomas E. Nisonger, "Accessing Information: The Evaluation Research," *Collection Management* 26, no. 1 (2001): 1–23.
40. Mansbridge, "Availability Studies in Libraries," 307.
41. Ibid., 305.
42. Bachmann-Derthick and Spurlock, "Journal Availability at the University of New Mexico," 173; Lieshout, "Over de Beschikbaarheid van Literatuur," 88; Ciliberti et al., "Empty Handed? A Material Availability Study," 282; Chandler, "Book Availability in the Cameron Village Regional Library," 1.
43. Bachmann-Derthick, "Journal Availability"; Roberts, "Journal Availability Study"; Ciliberti et al., "Empty Handed? A Material Availability Study."
44. Chaudhry and Ashoor, "Comprehensive Materials Availability Studies," 302; Harris and Garner, "Using an Availability Survey to Improve Service at a University Library," 28.
45. Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Rashid, "Book Availability as a Performance Measure of a Library: An Analysis of the Effectiveness of a Health Sciences Library"; Chaudhry and Ashoor, "Comprehensive Materials Availability Studies."
46. Ciliberti et al., "Materials Availability: A Study of Academic Library Performance," 521; Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment," 51; Ciliberti et al., "Empty Handed? A Material Availability Study," 284.
47. Zondi, "Measuring Availability and Nonavailability Rates at the University of Zululand Library"; Thorne and Whitlatch, "Patron Online Catalog Success."
48. Roberts, "Journal Availability Study"; Ciliberti et al., "Materials Availability: A Study of Academic Library Performance."
49. Bachmann-Derthick and Spurlock, "Journal Availability at the University of New Mexico"; Shaw-Kokot and Varre, "Using a Journal Availability Study."
50. Revill, "An Availability Survey in Cooperation with a School of Librarianship and Information Studies."
51. Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Rashid, "Book Availability as a Performance Measure of a Library: An Analysis of the Effectiveness of a Health Sciences Library."
52. Revill, "An Availability Survey in Cooperation with a School of Librarianship and Information Studies."
53. Bachmann-Derthick and Spurlock, "Journal Availability at the University of New Mexico"; Roberts, "Journal Availability Study"; Ciliberti et al., "Materials Availability: A Study of Academic Library Performance."
54. Revill, "An Availability Survey in Cooperation with a School of Librarianship and Information Studies."
55. Wood, Bermer, and Saraidaridis, "Measurement of Service at a Public Library"; Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Tamura and Saki, "Materials Availability Study"; Jacobs, "The Evolution and Improvement of Book Availability in an Academic Library."
56. Mansbridge, "Availability Studies in Libraries," 304.
57. Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library"; Chaudhry and Ashoor, "Comprehensive Materials Availability Studies."
58. Kuraim, "The Principal Factors Causing Reader Frustration in a Public Library."
59. Mansbridge, "Availability Studies in Libraries"; Roberts, "Journal Availability Study"; Zondi, "Measuring Availability

and Nonavailability Rates at the University of Zululand Library"; Abduljalil, "Book Availability and User Satisfaction in School Libraries"; Ajlan, "The Effectiveness of Two Academic Libraries in Saudi Arabia"; Simpson, "Materials Availability/ Fill-Rate Study at Pikes Peak Library District"; Jacobs, "The Evaluation and Improvement of Book Availability"; Mitchell, Radford, and Hegg, "Book Availability: Academic Library Assessment."

60. Neal K. Kaske, "Materials Availability Model and the Internet," *Journal of Academic Librarianship* 20, no. 5–6 (Nov. 1994): 317–18.
61. Gregory and Pedersen, "Book Availability Revisited," 284.
62. Mansbridge, "Availability Studies in Libraries," 312.

Appendix A. Known-Item Search Availability Rates in Studies Incorporating Library Patrons

Authors	Pub. Year	Library	Number of Searches	Successes	Percent Available
Wood, Bremer, and Saraidaridis[1]	1980	Cleveland Heights-University Heights Main Public Library	350	132	37.7
Kuraim[2]	1983	Cleveland Heights-University Heights Main Public Library	500	262[3]	52.4
Tamura and Sakai[4]	1983	a Tokyo city library system	68	54	79.4
Abduljalil	1985	Cleveland High School	432	203	47.0
Abduljalil	1985	Shaker Heights High School	432	236	54.6
Ajlan	1985	King Saud U., Saudi Arabia	500	265	53.0
Ajlan	1985	U. of Petroleum and Minerals, Saudi Arabia	500	268	53.6
Kolner and Welch	1985	U. of Illinois Health Sci. Lib.-Peoria	760	447	58.8
Kolner and Welch	1985	U. of Illinois Health Sci. Lib.-Rockford	65	35	53.8
Kolner and Welch	1985	U. of Illinois Health Sci. Lib.-Chicago	60	44	73.3
Ferl and Robinson	1986	U. of California, Santa Cruz	408	250	61.3
Ciliberti et al.	1987	Willaim Patterson College	211	107	50.7[5]
Revill	1987	9 site libraries of Liverpool Polytechnic Library Services, U.K.	1,458	1,003	68.8
Thompson	1987	Augustana College, 1986 survey	364	258	70.9
Thompson	1987	Augustana College, 1987 survey	235	190	80.9
Knox and Wivell	1988	Macquarie U., Australia Oct. 9, 1986 survey	384	312	81.3[6]
Knox and Wivell	1988	Macquarie U., Australia Oct. 26, 1986 survey	290	240	82.8
Revill	1988	9 site libraries of Liverpool Polytechnic Library Services, U.K.	2,064	1,548	75
Bachmann-Derthick and Spulock[7]	1989	U. of New Mexico	483	269	55.7
Roberts[8]	1989	East Tennessee U., College of Medicine	297	162	54.5
Rashid	1990	Cleveland Health Sciences Lib.	1,000	596[9]	59.6
Simpson	1990	Pikes Peak Library District, 1988 survey	Not reported	Not reported	66
Simpson	1990	Pikes Peak Library District, 1989 survey	Not reported	Not reported	59
Boekhorst	1992	U. of Munster, Germany	751	254	33.8
Harris and Garner	1992	U. of Western Australia, Australia	589[10]	259	44.0

Authors	Pub. Year	Library	Number of Searches	Successes	Percent Available
Lieshout	1992	Friesland Provincial Lib., Netherlands	401	227.3	56.7
Rehman and Bashir	1993	U. of Punjab, Pakistan	300	124	41.3
Salter	1993	Acton College, U.K	124[11]	86	69.4
Chaudhry and Ashoor	1994	King Fahd U. of Petroleum and Minerals, Saudi Arabia	607[12]	381[13]	62.8
Mitchell, Radford, and Hegg	1994	William Patterson College	61	40	65.6[14]
Rehman, Arif, and Chaudhry	1994	International Islamic U., Malaysia	441	233	52.8
Thorne and Whitlatch[15]	1994	San Jose State U., April 1993	93	61	65.6
Thorne and Whitlatch	1994	San Jose State U., April 1988	499	270	54.1
Thorne and Whitlatch	1994	San Jose State U., April 1983	350	239	68.3
Jacobs	1995	U. of Sussex, U.K., spring 1994 survey	4,103	2,566	62.5
Jacobs	1995	U. of Sussex, U.K., fall 1994 survey	1,585	1,136	71.7
Jacobs and Young	1995	U. of Sussex, U.K.	99,778[16]	75,126	75.3[17]
Zondi	1996	U. of Zululand, South Africa	353	178	50.4
Ciliberti, et al.	1998	Adelphi U.	195	119	61.0[18]
Ciliberti, et al. (journal articles in CD-ROM index)	1998	Adelphi U.	127[19]	57	44.9
Urs and Dominic	1999	Anna U., India	1,254	855	68.2[20]
Urs and Dominic	1999	Bharathiar U., India	870	460	52.9[21]
Urs and Dominic	1999	Bharathidasan U., India	957	544	56.8[22]
Urs and Dominic	1999	Tamilnadu Agricultural U., India-	1,150	766	66.6[23]
Wall and Willaims	1999	Cardiff U., U.K.	480[24]	402	83.8
Shaw-Kokot and Varre[25]	2001	U. of North Carolina-Chapel Hill-Health Sciences Lib.	2,056	1,663	80.9

Notes

1. Although earlier than the 1984 end point for Mansbridge's literature review, this item was not covered in the review.
2. Not covered in Mansbridge's review.
3. There were 262 successes and a 52.4 percent success rate without librarian assistance increasing to 304 and a 60.8 percent success rate with librarian assistance.
4. Not covered in Mansbridge's review.
5. Overall availability was 53.6 percent for 401 searches, when 190 subject searches were considered.
6. Based on calculation from the raw data of the researchers, who reported a 76.8 percent availability.
7. Journal articles.
8. Journal articles.
9. There were 596 successes and a 59.6 percent success rate without librarian assistance increasing to 635 and a 63.5 percent success rate with librarian assistance.
10. Includes books, reserve items, and serial articles.
11. Results for one day for which complete data was reported. 500 forms were distributed during 5 days, but the number of titles sought is not reported. The five-day availability rate was 70 percent.
12. Includes books and journal articles. When 600 simulated items were also considered, availability was 63.8 percent for 1,207 items.
13. There were 381 successes and a 62.8 percent success rate without librarian assistance increasing to 416 and a 68.5 percent success rate with librarian assistance.
14. Overall availability was 64.0 percent for 111 searches, when 50 subject searches were considered.
15. Thorne and Whitlatch also reported results from April 1979 and April 1976 which are not summarized here because they precede this review's 1980 cut-off point.
16. Patron searches in an online public access catalog.
17. Measured whether books searched for in the OPAC were available for circulation without addressing whether the patron actually located them on the shelf.
18. The overall availability rate was 57.9 percent for 568 attempts when subject searches and searches in a CD-ROM journal index are included.
19. Searches for articles in a CD-ROM journal index.
20. Corrected percentage calculated by author from raw data of Urs and Dominic, who reported 66 percent based on multiplying the success rate percentages at the 4 branches.
21. Corrected percentage calculated by author from raw data of Urs and Dominic, who reported 52 percent based on multiplying the success rate percentages at the 4 branches.
22. Corrected percentage calculated by author from raw data of Urs and Dominic, who reported 55 percent based on multiplying the success rate percentages at the 4 branches.
23. Corrected percentage calculated by author from raw data of Urs and Dominic, who reported 64 percent based on multiplying the success rate percentages at the 4 branches.
24. "Short loan" (i.e., reserve) books.
25. Journal articles.

Appendix B. Availability Rates in Kantor's Bibliographic Branch

Authors	Pub. Year	Number of Searches	Successes	Percent Available
Kuraim	1983	500	500	100
Ajlan, King Saud U.	1985	500	491	98.2
Ajlan, Petroleum and Minerals U.	1985	500	476	95.2
Ciliberti et al.	1987	211	206	97.6
Rashid	1990	1,000	949	94.9
Mitchell, Radford, and Hegg	1994	61	59	96.7
Jacobs, spring 1994 survey[1]	1995	4,103	4,038	98.4
Ciliberti et al.	1998	195	191	97.9
Cilberti el al., journal articles	1998	84	80	95.2

Note

1. The term "mis-citations" was used for the bibliographic branch.

Appendix C. Availability Rates in Kantor's Acquisitions Branch

Authors	Pub. Year	Number of Searches	Successes	Percent Available
Wood, Bremer, and Saraidaridis	1980	350	287	82.0
Kuraim	1883	500	486	97.2
Tamura and Sakai	1983	68	63	92.6
Abduljalil, Cleveland Heights	1985	432	389	90.0
Abduljalil, Shaker Heights	1985	432	393	91.0
Ajlan, King Saud U.	1985	491	414	84.3
Ajlan, Petroleum and Minerals U.	1985	476	450	94.5
Kolner and Welch, Illinois-Chicago	1985	760	711.5	93.6
Kolner and Welch, Illinois-Peoria	1985	65	56	86.2
Kolner and Welch, Illinois-Rockford	1985	60	55	91.7
Ferl and Robinson	1986	408	368	90.2
Ciliberti et al.	1987	206	185	89.8
Revill	1987	1,458	1,347.5	92.4
Revill	1988	Not Reported	Not Reported	92.0
Bachmann-Derthick and Spurlock[1]	1989	483.2	411.8[2]	85.2
Roberts[3]	1989	297	202	68.0
Rashid	1990	899[4]	800	89.0
Boekhorst	1992	751	521	69.4[5]
Harris and Garner	1992	589[6]	478	81.2
Lieshout	1992	401	293.5	73.2
Rehman and Bashir	1993	299.4	250.4[7]	83.6
Salter	1993	124[8]	117	94.4[9]
Chaudhry and Ashoor	1994	606[10]	555	91.6[11]
Mitchell, Radford, and Hegg[12]	1994	59	55	93.2
Rehman, Arif, and Chaudhry	1994	441	390	88.4
Jacobs, spring 1994 survey	1995	4,038[13]	3,921	97.1
Ciliberti et al.	1998	191	171	89.5
Ciliberti et al., journal articles	1998	127	84	66.1
Urs and Dominic, Anna U.	1999	1,254	1,195	95.3
Urs and Dominic, Bharathiar U.	1999	870	660	75.9
Urs and Dominic, Bharathidasan U.	1999	957	751	78.5
Urs and Dominic, Tamilnadu U.	1999	1,150	1,078	93.7[14]
Shaw-Kokot and Varre[15]	2001	2,057.30	1,941.3[16]	94.4

Notes

1. Journal articles.
2. Data includes a built-in correction factor for the 31 cases where it was impossible to determine the cause of unavailability.
3. Journal articles.
4. If data for collection development policy failure (i.e., the policy did not call for the book's acquisition), which Rashid used as a separate branch, is included, 800 of 949 attempts were successful for an 84.3 percent availability rate.
5. The availability rate is 68.3 percent if the 8 items received but not cataloged (which Boekhorst used as a separate branch) are considered. 607 (80.8 percent) were acquired by the library system, but not necessarily available in the main library.
6. Includes books, reserve items, and serial articles.
7. Data includes a built-in correction factor for the 4 cases where it was impossible to determine the cause of unavailability.
8. Based on the one day for which complete data was presented of a five-day study.
9. Calculated by the author from Salter's raw data.
10. Includes books and journal articles. The reason for unavailability could not be determined for 1 item in the 607 item sample.
11. This percentage calculated by the author from Chaudhry and Ashoor's raw data, who erroneously reported 88.1 percent as a result of applying Kantor's branches in reverse order.
12. The term "selection" was used for the acquisitions branch.
13. Calculated by the author from Jacobs' raw data.
14. Urs and Dominic reported 93 percent.
15. Journal articles.
16. Data includes a built-in correction factor for 50 failures due to bibliographic error, bad citations, or undetermined reasons.

Appendix D. Availability Rates in Kantor's Catalog Branch

Authors	Pub. Year	Number of Searches	Successes	Percent Available
Wood, Bremer, and Saraidaridis	1980	287	264.7	92.2
Kuraim	1983	486	454[1]	93.4
Abduljalil, Cleveland Heights	1985	389	365	93.8
Abduljalil, Shaker Heights	1985	393	375	95.4
Ajlan, King Saud U.	1985	414	377[2]	91.1
Ajlan, Petroleum and Minerals U.	1985	450	430	95.6
Ferl and Robinson	1986	368	346	94.0
Ciliberti et al.	1987	185	170	91.9
Bachmann-Derthick and Spurlock[3]	1989	411.8	355.6[4]	86.4
Rashid	1990	800	775[5]	96.9
Boekhorst	1992	513	488	95.1
Harris and Garner	1992	478[6]	433	90.6
Lieshout	1992	293.5	272.3	92.8
Rehman and Bashir	1993	250.4	249.4[7]	99.6
Mitchell, Radford, and Hegg	1994	55	54	98.2
Rehman, Arif, and Chaudhry	1994	390	375	96.2
Jacobs, spring 1994 survey	1995	3,921[8]	3,881	99.0
Jacobs, fall 1994 survey	1995	1,529[9]	1,517	99.2
Ciliberti et al.	1998	171	158	92.4
Ciliberti et al., journal articles	1998	80	77	96.3
Shaw-Kokot and Varre[10]	2001	1,941.3	1,911.4[11]	98.5

Notes

1. There were 454 successes and a 93.4 percent success rate without librarian assistance increasing to 480 and a 98.8 percent success rate with librarian assistance.
2. Ajlan reported 374, but analysis of the raw data and reported percentages indicates 377 is the correct number.
3. Journal articles.
4. Data includes a built-in correction factor for the 31 cases where it was impossible to determine the cause of unavailability.
5. There were 775 successes and a 96.9 percent success rate without librarian assistance increasing to 789 and a 98.6 percent success rate with librarian assistance.
6. Includes books, reserve items, and serial articles.
7. Data includes a built-in correction factor for the 4 cases where it was impossible to determine the cause of unavailability.
8. Calculated by the author from Jacobs' raw data.
9. Calculated by the author from Jacobs' raw data.
10. Journal articles.
11. Data includes a built-in correction factor for 50 failures due to bibliographic error, bad citations, or undetermined reasons.

Appendix E. Availability Rates in Kantor's Circulation Branch

Authors	Pub. Year	Number of Searches	Successes	Percent Available
Abduljalil, Cleveland Heights	1985	365	346	94.8
Abduljalil, Shaker Heights	1985	375	359	95.7
Ajlan, King Saud U.	1985	377	343[1]	91.0
Ajlan, Petroleum and Minerals U.	1985	430	336	78.1
Kolner and Welch, Illinois-Chicago	1985	711.5	596.5	83.8
Kolner and Welch, Illinois-Peoria	1985	56	44.33	79.2
Kolner and Welch, Illinois-Rockford	1985	55	47	85.5
Ferl and Robinson	1986	346	284	82.1
Ciliberti et al.	1987	170	155	91.2
Revill	1987	1,347.5	1,187	88.1
Revill	1988	Not Reported	Not Reported	91
Bachmann-Derthick and Spurlock[2]	1989	355.6	343.9[3]	96.7
Roberts[4]	1989	202	197	97.5
Rashid	1990	775[5]	692[6]	89.3
Boekhorst	1992	488	323	66.2
Harris and Garner	1992	433[7]	342	79.0
Lieshout	1992	272.3	229.8	84.4
Rehman and Bashir	1993	249.4	229[8]	91.8
Salter	1993	117[9]	102	87.2[10]
Chaudhry and Ashoor	1994	555[11]	493	88.8[12]
Mitchell, Radford, and Hegg	1994	54	53	98.1
Rehman, Arif, and Chaudhry	1994	375	309	82.4
Jacobs, spring 1994 survey	1995	3,881[13]	3,260	84.0
Jacobs, fall 1994 survey	1995	1,517[14]	1,341	88.4
Ciliberti et al.	1998	158	139	88.0
Ciliberti et al., journal articles	1998	77	77	100.0
Urs and Dominic, Anna U.	1999	1,195[15]	1,049	87.8[16]
Urs and Dominic, Bharathiar U.	1999	660	550	83.3
Urs and Dominic, Bharathidasan U.	1999	751	616	82.0
Urs and Dominic, Tamilnadu U.	1999	1,078	962	89.2
Shaw-Kokot and Varre[17]	2001	1,911.4	1894.2[18]	99.1

Notes

1. Ajlan reported 340 successes in 374 searches, but analysis of the raw data and reported percentages indicates the correct figures are 343 successes in 377 searches.
2. Journal articles.
3. Data includes a built-in correction factor for the 31 cases where it was impossible to determine the cause of unavailability.
4. Journal articles.
5. 775 attempts without librarian assistance, 789 with librarian assistance.
6. There were 692 successes and a 89.3 percent success rate without librarian assistance increasing to 706 and a 89.5 percent success rate with librarian assistance.
7. Includes books, reserve items, and serial articles.
8. Data includes a built-in correction factor for the 4 cases where it was impossible to determine the cause of unavailability.
9. Based on the one day for which complete data was presented of a five-day study.
10. Calculated by the author from Salter's raw data.
11. Includes books and journal articles. Number calculated by author from Chaudhry and Ashoor's raw data.
12. This percentage calculated by the author from Chaudhry and Ashoor's raw data, who erroneously reported 87.4 percent as a result of applying Kantor's branches in reverse order.
13. Calculated by the author from Jacobs' raw data. Jacobs also included items "on order" and declared missing in this branch.
14. Calculated by the author from Jacobs' raw data. Jacobs also included items "on order" and declared missing in this branch.
15. Corrected number calculated by author from raw data of Urs and Dominic.
16. Urs and Dominic reported 87 percent.
17. Journal articles.
18. Data includes a built-in correction factor for 50 failures due to bibliographic error, bad citations, or undetermined reasons.

Appendix F. Availability Rates in Kantor's Library Operations Branch

Authors	Pub. Year	Number of Searches	Successes	Percent Available
Abduljalil, Cleveland Heights	1985	346	243	70.2
Abduljalil, Shaker Heights	1985	359	268	74.7
Ajlan, King Saud U.	1985	343[1]	315	91.8
Ajlan, Petroleum and Minerals U.	1985	336	286	85.1
Kolner and Welch, Illinois-Chicago	1985	596.5	491.5	82.4
Kolner and Welch, Illinois-Peoria	1985	44.33	37	83.5
Kolner and Welch, Illinois-Rockford	1985	47	46	97.9
Ferl and Robinson	1986	284	259	91.2
Ciliberti et al.	1987	155	115	74.2
Revill	1987	1,187	1,122.5	94.6
Revill	1988	Not Reported	Not Reported	97
Bachmann-Derthick and Spurlock[2]	1989	343.9	297.1[3]	86.4
Roberts[4]	1989	197	183	92.9
Rashid	1990	692[5]	643[6]	92.9
Boekhorst	1992	323	315	97.5
Harris and Garner	1992	342[7]	283	82.7
Lieshout	1992	229.8	227.3	98.9
Rehman and Bashir	1993	229	150.5[8]	65.7
Salter	1993	102[9]	92	90.2[10]
Chaudhry and Ashoor	1994	493[11]	438	88.8[12]
Mitchell, Radford, Hegg	1994	53	46	86.8
Rehman, Arif, and Chaudhry	1994	309	300	97.1
Jacobs, spring 1994 survey	1995	3,260[13]	2,939	90.2[14]
Jacobs, fall 1994 survey	1995	1,341[15]	1,257	93.7[16]
Ciliberti et al.	1998	139	127	91.4
Ciliberti et al., journal articles	1998	67	57	85.1
Urs and Dominic, Anna U.	1999	1,049	956	91.1
Urs and Dominic, Bharathiar U.	1999	550	511	92.9
Urs and Dominic, Bharathidasan U.	1999	616	594	96.4
Urs and Dominic, Tamilnadu U.	1999	962	865	89.9[17]
Shaw-Kokot and Varre[18]	2001	1,894.2	1,721.7[19]	90.9

Notes

1. Ajlan reported 315 successes in 340 searches, but analysis of the raw data and reported percentages indicates the correct figures are 315 successes in 343 searches.
2. Journal articles.
3. Data includes a built-in correction factor for the 31 cases where it was impossible to determine the cause of unavailability.
4. Journal articles.
5. 692 attempts without librarian assistance, 706 with assistance.
6. There were 643 successes and a 92.9 percent success rate without librarian assistance increasing to 657 and a 93.1 percent success rate with librarian assistance.
7. Includes books, reserve items, and serial articles.
8. Data includes a built-in correction factor for the four cases where it was impossible to determine the cause of unavailability.
9. Based on the one day for which complete data was presented of a five-day study.
10. Calculated by the author from Salter's raw data.
11. Includes books and journal articles. Number calculated by author from Chaudhry and Ashoor's raw data.
12. This percentage calculated by the author from Chaudhry and Ashoor's raw data, who erroneously reported 89.9 percent as a result of applying Kantor's branches in reverse order.
13. Calculated by the author from Jacobs' raw data. Jacobs created separate branches for "mislaid," temporarily absent," and "slightly misfiled."
14. Calculated by the author from Jacobs' raw data.
15. Calculated by the author from Jacobs' raw data. Jacobs created separate branches for "mislaid," temporarily absent," and "slightly misfiled."
16. Calculated by the author from Jacobs' raw data.
17. Urs and Dominic reported 89 percent.
18. Journal articles.
19. Data includes a built-in correction factor for 50 failures due to bibliographic error, bad citations, or undetermined reasons.

Appendix G. Availability Rates in Kantor's User Branch as Defined and Reported by Original Investigators

Authors	Pub. Year	Number of Searches	Successes	Percent Available
Wood, Bremer, and Saraidaridis	1980	144.5	132	91.3
Kuraim	1983	291[1]	262[2]	90.0
Abduljalil, Cleveland Heights	1985	243	203	83.5
Abduljalil, Shaker Heights	1985	268	236	88.1
Ajlan, King Saud U.	1985	315	265	84.1
Ajlan, Petroleum and Minerals U.	1985	286	268	93.7
Kolner and Welch, Illinois-Chicago	1985	491.5	447	90.9
Kolner and Welch, Illinois-Peoria	1985	37	35	94.6
Kolner and Welch, Illinois-Rockford	1985	46	44	95.7
Ferl and Robinson	1986	259	250	96.5
Ciliberti et al.	1987	115	107	93.0
Revill	1987	1,122.5	1,003	89.4
Revill	1988	Not Reported	Not Reported	92
Bachmann-Derthick and Spurlock[3]	1989	297.1	269[4]	90.5
Roberts[5]	1989	183	162	88.5
Rashid	1990	643[6]	596[7]	92.7
Boekhorst	1992	315	254	80.6[8]
Harris and Garner	1992	283[9]	259	91.5
Rehman and Bashir	1993	150.5	124[10]	82.4
Salter	1993	92[11]	86	93.5[12]
Chaudhry and Ashoor	1994	438[13]	381	87.0[14]
Mitchell, Radford, and Hegg[15]	1994	46	40	87.0
Rehman, Arif, and Chaudhry	1994	300	233	77.7
Jacobs, spring 1994 survey	1995	2,939[16]	2,566	87.3
Jacobs, fall 1994 survey	1995	1,257[17]	1,136	90.4
Ciliberti et al.[18]	1998	127	119	93.7
Ciliberti et al., journal articles[19]	1998	77	68	88.3
Urs and Dominic, Anna U.	1999	956	855	89.4
Urs and Dominic, Bharathiar U.	1999	511	460	90.0
Urs and Dominic, Bharathidasan U.	1999	594	544	91.6[20]
Urs and Dominic 1999, Tamilnadu U.	1999	865	766	88.6[21]
Shaw-Kokot and Varre[22]	2001	1,721.7	1,663[23]	96.6

Notes

1. 291 without librarian assistance, 311 with assistance.
2. There were 262 successes and a 90.0 percent success rate without librarian assistance increasing to 304 and a 97.7 percent success rate with librarian assistance.
3. Journal articles.
4. Data includes a built-in correction factor for the 31 cases where it was impossible to determine the cause of unavailability.
5. Journal articles.
6. 643 attempts without librarian assistance; 657 with assistance.
7. There were 596 successes and a 92.7 percent success rate without librarian assistance increasing to 657 and a 96.7 percent success rate with librarian assistance.
8. Calculated by author from the original researcher's raw data, who reported 86.2 percent.
9. Includes books, reserve items, and serial articles.
10. Data includes a built-in correction factor for the four cases where it was impossible to determine the cause of unavailability.
11. Based on the one day for which complete data was presented of a five-day study.
12. Calculated by the author from Salter's raw data.
13. Includes books and journal articles. Number calculated by author from Chaudhry and Ashoor's raw data.
14. This percentage calculated by the author from Chaudhry and Ashoor's raw data, who erroneously reported 90.6 percent as a result of applying Kantor's branches in reverse order.
15. The term "retrieval" was used for the user at the shelf branch.
16. Calculated by the author from Jacobs' raw data.
17. Calculated by the author from Jacobs' raw data.
18. Used term "retrieval" for this branch.
19. Used term "patron retrieval" for this branch.
20. Urs and Dominic reported 91 percent.
21. Urs and Dominic reported 88 percent.
22. Journal articles.
23. Data includes a built-in correction factor for 50 failures due to bibliographic error, bad citations, or undetermined reasons.

Appendix H. Analysis of Failures in Kantor's Branches (All User Failures Combined)

(The percentage of total failures in the study attributed to each branch is indicated in parentheses)

Authors	Pub. Year	Acquisitions	Circulation	Library	User	Total
Wood, Bremer, and Saraidaridis	1980	63 (28.9%)	[1]		34.8 (16.0%)	218
Kuraim	1983	14 (5.9%)	[2]		61 (25.6%)	238
Tamura and Sakai	1983	5 (35.7%)[3]	[3]			14
Abduljalil, Cleveland Heights	1985	43 (18.8%)	19 (8.3%)	103 (45.0%)	64 (27.9%)	229
Abduljalil, Shaker Heights	1985	39 (19.9%)	16 (8.2%)	91 (46.4%)	50 (25.5%)	196
Ajlan, King Saud U.	1985	77 (32.8%)	34 (14.5%)	28 (11.9%)	96(40.9%)	235
Ajlan, Petroleum and Minerals U.	1985	26 (11.2%)	94 (40.5%)	50 (21.6%)	62(26.7%)	232
Kolner and Welch, Illinois-Chicago	1985	48.5 (15.5%)	115 (36.7%)	105 (33.5%)	44.5(14.2%)	313
Kolner and Welch, Illinois-Peoria	1985	9 (30.0%)	11.67 (38.9%)	7.33 (24.4%)	2 (6.7%)	30
Kolner and Welch, Illinois-Rockford	1985	5 (31.3%)	8 (50.0%)	1 (6.25%)	2(12.5%)	16
Ferl and Robinson	1986	40 (25.3%)	62 (39.2%)	25 (15.8%)	31 (19.6%)	158
Ciliberti et al.	1987	21 (20.2%)	15 (14.4%)	40 (38.5%)	28 (26.9%)	104
Revill	1987	110.5 (24.3%)	160.5 (35.3%)	64.5 (14.2%)	119.5 (26.3%)	455
Bachmann-Derthick and Spurlock	1989	71.4 (33.4%)	11.7 (5.5%)	46.8 (21.9%)	84.3 (39.4%)	214[4]
Roberts	1989	95 (70.4%)	5 (3.7%)	14 (10.4%)	21 (15.6%)	135
Rashid	1990	149[5] (36.9%)	83 (20.5%)	49 (12.1%)	123 (30.4%)	404
Boekhorst	1992	238 (47.9%)[6]	165 (33.2%)	8 (1.6%)	86 (17.3%)	497
Harris and Garner	1992	111 (33.6%)	91 (27.6%)	59 (17.9%)	69 (20.9%)	330
Lieshout	1992	107.5 (61.9%)	42.5 (24.5%)	2.5 (1.4%)	21.2 (12.2%)	173.7
Rehman and Bashir	1993	49 (27.8%)	20.4 (11.6%)	78.5 (44.6%)	27.5 (15.6%)	176[7]
Salter	1993	7 (18.4%)	15 (39.5%)	10 (26.3%)	6 (15.8%)	38
Chaudhry and Ashoor	1994	51 (22.6%)	62 (27.4%)	55 (24.3%)	57 (25.2%)	226[8]
Mitchell, Radford, and Hegg	1994	4 (19.0%)	1 (4.8%)	7 (33.3%)	9 (42.9%)	21
Rehman, Arif, and Chaudhry	1994	51 (24.5%)	66 (31.7%)	9 (4.3%)	82 (39.4%)	208
Jacobs, spring 1994 survey	1995	117 (7.6%)	621 (40.4%)	321 (20.9%)	478 (31.1%)	1,537
Jacobs, fall 1994 survey	1995	[9]	176 (39.2%)	84 (18.7%)	133 (29.6%)	449
Ciliberti et al.	1998	20 (26.3%)	19 (25.0%)	12 (15.8%)	25 (32.9%)	76
Ciliberti et al., Journal articles	1998	43 (61.4%)	0 (0%)	10 (14.3%)	16 (22.9%)	70[10]
Urs and Dominic, Anna U.	1999	59 (14.8%)	146 (36.6%)	93 (23.3%)	101 (25.3%)	399
Urs and Dominic, Bharathiar U.	1999	210 (51.2%)	110 (26.8%)	39 (9.5%)	51 (12.4%)	410
Urs and Dominic, Bharathidasan U.	1999	206 (49.9%)	135 (32.7%)	22 (5.3%)	50 (12.1%)	413
Urs and Dominic, Tamilnadu U.	1999	72 (18.8%)	116 (30.2%)	97 (25.3%)	99 (25.8%)	384
Shaw-Kokot and Varre	2001	116 (29.5%)	17.2 (4.4%)	172.5 (43.9%)	88.6 (22.5%)	393[11]
Total Number		**2,277.9**	**2,437.97**	**1,704.13**	**2,222.4**	**8991.7**[12]
Total Percentage		**25.3%**	**27.1%**	**19.0%**	**24.7%**	

Notes

1. Circulation and library operations were combined into a single branch accounting for 120.2 failures, 55.1 percent of total.
2. Circulation and library operations were combined into a single branch accounting for 163 failures, 68.5 percent of total.
3. Circulation, library operations, and the user were combined into a single branch accounting for 9 failures, 64.3 percent of the total.
4. This row adds to 214.2 due to the correction factor used by Bachmann-Derthick and Spurlock, but the actual number of failed searches was 214.
5. Total for collection development and acquisitions branches combined.
6. Includes titles received but not cataloged, which Boekhorst used as a separate branch.
7. This row adds to 175.4 due to the correction factor used by Rehman and Bashir, but the actual number of failed searches was 176.
8. This row adds to 225 because the cause of 1 unsuccessful search could not be determined, but the actual number of failed searches was 226.
9. The bibliographic and acquisitions branches were combined, accounting for 56 failures, 12.5 percent of the total.
10. The row adds to 69 because 1 failure at a "library retrieval" branch is included in this total.
11. This row adds to 394.3 due to the correction factor used by Shaw-Kokot and Varre, but the actual number of failed searches was 393.
12. There were 8,991.7 failures, including 350.2 (3.9 percent of total failures) that could not be directly attributed to one of the four main branches (usually due to combining branches).

Appendix I. Availability Rates in Simulated Studies Not Involving Actual Patrons

Authors	Pub. Yr	Library	Number of Searches	Successes	Percent Available
Kuraim	1983	Cleveland Heights-University Heights Main Public Library	500[1]	65	13.0
Kuraim	1983	Cleveland Heights-University Heights Main Public Library	500[2]	321	64.2
Stelk and Lancaster	1990	University of Illinois, Undergrad. Library	450[3]	360	80.0
Stelk and Lancaster	1990	University of Illinois, Undergrad. Library	450[4]	316	70.2
Steynberg and Rossouw	1993	University of Cape Town, South Africa	307[5]	213	69.4
Chaudhry and Ashoor	1994	King Fahd University of Petroleum and Minerals, Saudi Arabia	300[6]	138	46.0
Chaudhry and Ashoor	1994	King Fahd University of Petroleum and Minerals, Saudi Arabia	300[7]	252	84.0
Chandler	1998	Cameron Village Regional Library[8]	508[9]	345	67.9

Notes

1. Sample from the last five volumes of the *American Book Publishing Record*.
2. A shelf list sample.
3. A shelf list sample.
4. A sample of items previously charged out.
5. Citations to journal articles published by South African biomedical researchers.
6. 200 books from *Scientific and Technical Books* and 100 serials from *Magazines for Libraries*.
7. A shelf list sample.
8. In the Wake County Public Library system in North Carolina.
9. A sample of recently circulating materials.

Appendix
CORNETTE06

StatCounter RSS Add to Google

Library Philosophy and Practice 2010

ISSN 1522-0222

The Use of the Library Catalogue by Undergraduates

Md. Maidul Islam
Graduate Student of Information Science and Library Management
Faculty of Arts
University of Dhaka, Dhaka-1000
Bangladesh

Introduction

An information institution or a library tends to be prominent or popular for its organized rich collection and effective services. Organization of resources is attained through cataloguing and classification. Classification is a part of cataloguing. Effective and modern cataloguing by a person emanates from devoted, keen interests, long, arduous experience, and studies and knowledge in modern international developments obtaining in the field. This is, otherwise, called specialized up-to-date technical knowledge (Saiful-Islam, 2008). Academic libraries collect material to support the teaching and research objectives of their parent bodies. The library serves both the teaching and non teaching staff of the university, researchers from other academic institutions, and students. Experience has shown that the majority of users of academic libraries are students (Ebiwolate, 2010).The library collection is organized to give easy access to material. According to Maloney (2004) the role of the library is to organize information resources and services in a way that supports user needs. Cataloguing and classification are basic processes in organizing information. Cataloguing is the process of describing material so it can be identified, while classification is the assignment of a call number that places material in order by subject. According to Opaleke, Olayemi, and Aina (2006) classification is a necessary device in organization. It directs the users to a specific subject, and groups books on the same or related subjects. The library catalogue is an essential tool. It is an index or a key to the collection, containing an entry representing each item (Clark, 2000). The catalogue also tells where in the library a book is located (Apotiade, 2002).

Background of the Study

The Dhaka University Library (DUL), established in 1921 with its parent organization, is the largest academic library of the country holding over half a million books on different subjects. To provide better and faster access to library collections, DUL started the Dhaka University Library Automation Project (DULAP) in 1998. As part of the project, the Library has installed an integrated library software GLAS (Graphical Library Automation System). *Presently, "Interim Solution" is used for automation program. Consequently, this program will bring a greater benefit for students, researchers, faculty members and staff as well as the whole nation?????*

Literature Review

A catalogue is record or list of books, periodicals, journals, pamphlets, monographs, audio-visual aids and other materials of a particular library, or a group of libraries (when union catalogue), or a private collection containing specified items of bibliographical information, viz. author, title, edition, imprint, collation, etc. in automated, microfiche, card or printed form arranged in classified or alphabetical order according to any standard catalogue code or rules, i.e. AACR, ALA, LC, etc. (Rowley, 1998). A catalogue is a list of things exhibited, articles for sale, school courses offered, etc., usually with descriptive comments and often illustration. A library catalogue serves the same purpose. It is a file of records for a library's collection (List 1998, cited by Ojedokun 2007). It is important to both library users and library staff. Its functions include giving a comprehensive record of materials owned by the library, listing what the library possesses by a certain author, on a given subject, and with a certain title, and enabling library materials to be located easily (Clark, 2000). The catalogue provides multiple access points to the library's collection (Osiode, 1987).

In spite of these purposes and characteristics, the use of the catalogue is very poor in most Bangladeshi university libraries. Fister (1992) states that undergraduates find the university library threatening and doing research intimidating because they do not have library skills. The only solution to this problem is prolonged and intensive user education and current awareness services. According to Kakai, Ikoja-Odongo, and Kigongo-Bukenya (2004), the university library faces a number of challenges in its user instruction program, yet it is through user education that librarians' work is made easy and students' effort reduced. If the library is for the use of all, then all must be able to use the catalogue to access the library materials. According to Ranganathan, libraries are for use. Therefore we must be sure that whatever we do serves the ultimate purpose of the library (Littlefield 2008).

Objectives of the Study

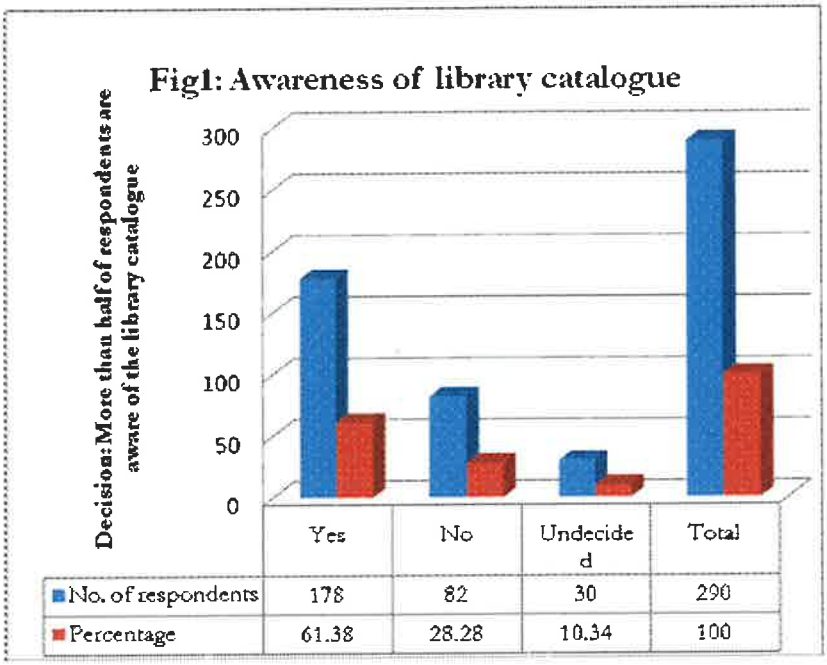
This study aims:

1. To determine the extent of use of use of the catalogue by undergraduate students to locate and retrieve books in the Dhaka University Library (DUL).
2. To discover problems and constraints militating against the use of the catalogue by the undergraduate students of DUL.
3. To discover why undergraduate students preferred to search for materials directly in the shelves.
4. To discover ways to make the use of the catalogue easier for undergraduate students.

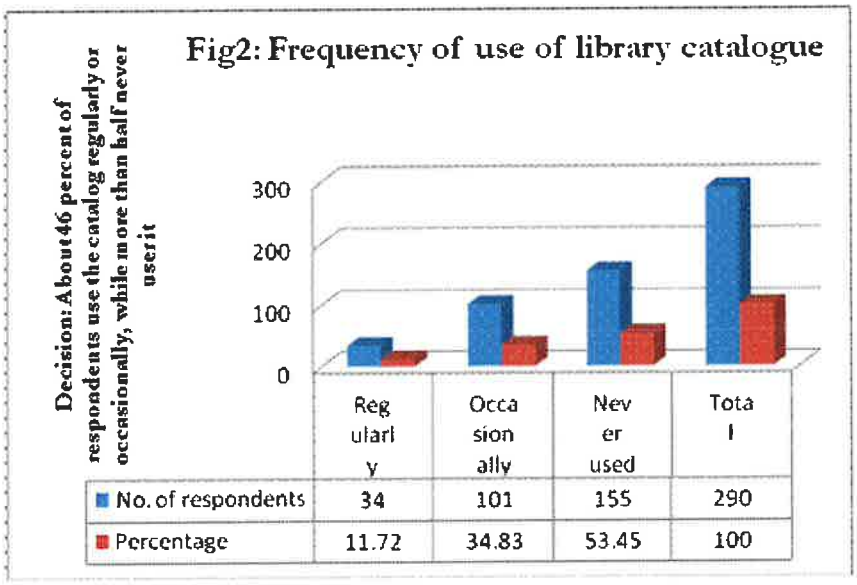
Methodology

This study was conducted at Dhaka University Library, Bangladesh. The study employed descriptive research, using a questionnaire as instrument for eliciting information on the use of the library catalogue among students. A total of 300 questionnaires were distributed randomly, of which 290 were returned and used for the analysis. Simple percentages were use

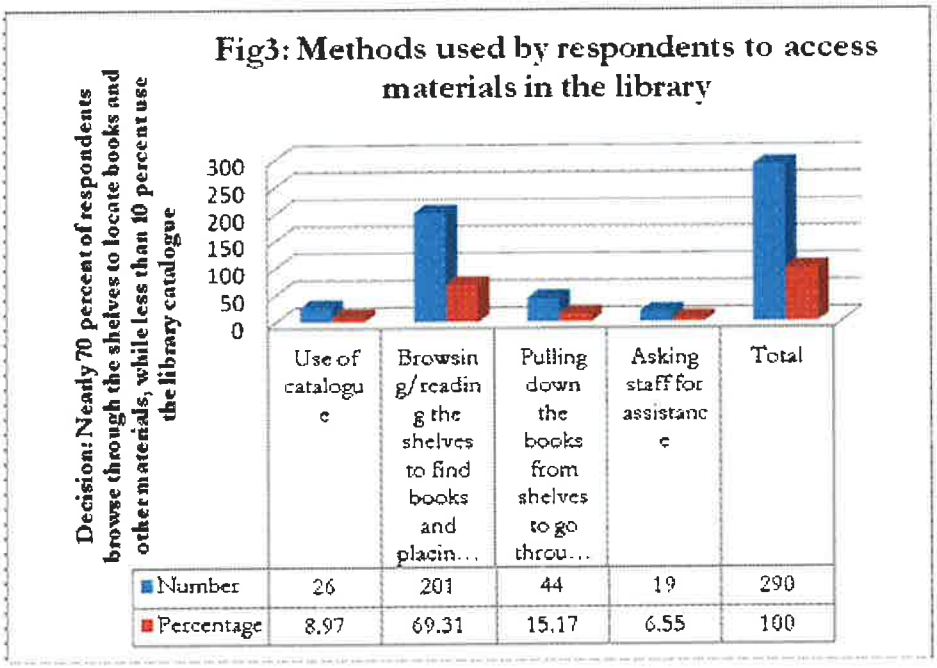
Findings and Discussion



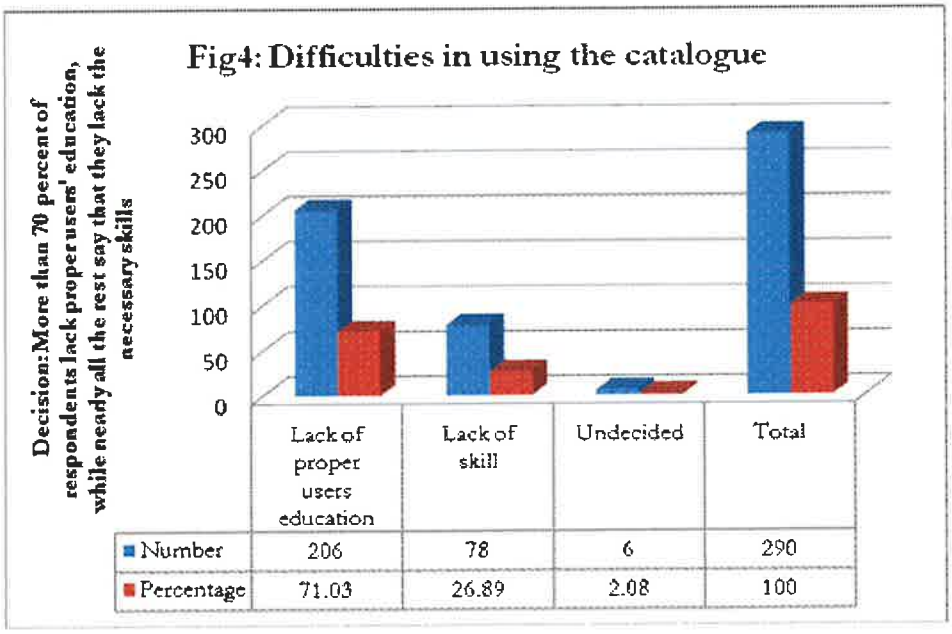
The above Figure1 shows that 61.38% (178) students are aware of the library catalogue, 28.28% (82) are not aware of the library catalogue and 10.34% (30) are undecided of the library catalogue. Finally we can decide that more than half of respondents are aware of the library catalogue.



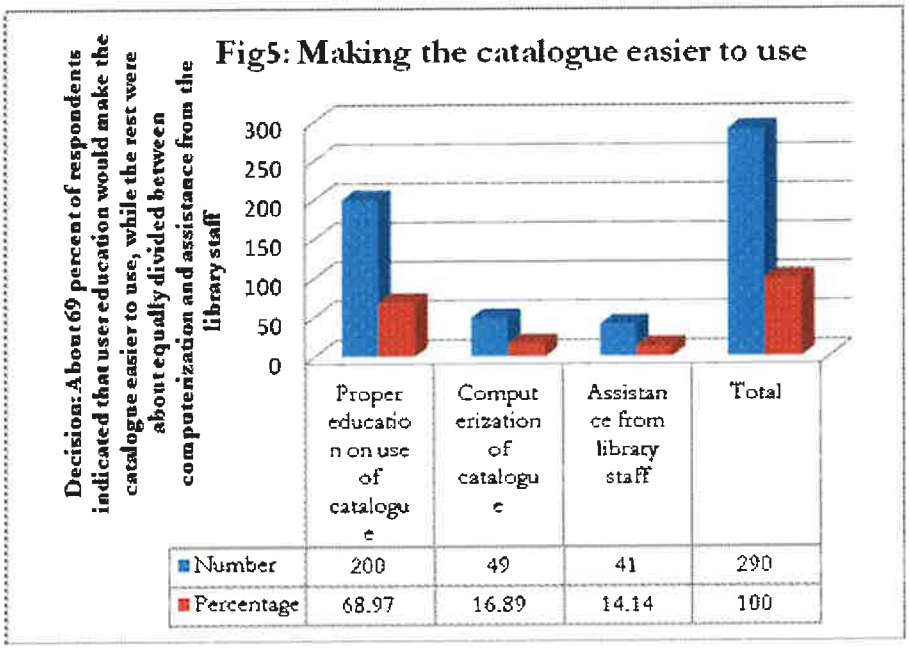
The above Figure2 shows that 11.72% (34) students are use the library catalogue regularly, 34.83% (101) are use the library catalogue occasionally and 53.45% (53.45) are never used the library catalogue. So, it is clear that about 46% of respondents use the catalog regularly or occasionally, while more than half never user it.



From the above Figure3 we can say that 8.97% (26) of students use the catalogue to access materials in the library, 69.31% (69.31) students browsing/ reading the shelves to find books and placing back in the shelves, 15.17% (44) students pulling down the books from shelves to go through them and 6.55% (19) students asking staff for assistance in the library. That's why it is evident, nearly 70% of respondents browse through the shelves to locate books and other materials, while less than 10% use the library catalogue.



In the above Figure4 there are 71.03% (206) students have lack of proper users' education, 26.89% (78) have lack of skill and 2.08% (6) are undecided. Finally we can say that more than 70% of respondents lack proper users' education, while nearly all the rest say that they lack the necessary skills. This corroborates Ezomo (1988), who attributed lack of use to users not given the necessary user education. It also supports the finding of Fister (1992) who found that students do not have library skills.



The above Figure5 shows that about 69% (200) of respondents indicated that user education would make the catalogue easier to use, while the rest were about equally divided between computerization and assistance from the library staff. This corroborates Kakai, Ikoja-Odongo, and Kigongo-Bukenya (2004), who found that, while university libraries face a number of challenges in user instruction programs, the benefits are worth it.

Recommendations

The following recommendations are made for improvement in the use of the catalogue in Dhaka University Library.

1. A proper user education program on the use of catalogue for the retrieval of books and other information sources should be organized and made mandatory for all users. Such a program should be coordinated by the university librarian and other qualified librarians in the institution.
2. A regular orientation program should be organized, including guidelines on using the catalogue.
3. The university librarian should organize demonstrations on the use of the catalogue every semester and wide publicity should be give to create awareness among users.
4. University authorities should see that only qualified librarians provide library user education.
5. Guidelines on use of the catalogue should be prepared and displayed where users can easily see them.

Conclusion

The study reveals that a majority of the students are not aware of the library catalogue and its uses. As a result, a majority of respondents have never used the catalogue. Students preferred browsing through the shelves to locate books, which can lead to frustration and which has caused many to view the library as just a reading place. High quality user education is the solution to the problems encountered by students in using the catalogue. As revealed in the study there is no proper user education program in place at the Dhaka University Library. A majority of students are in favor of user education to ease and facilitate the use of the catalogue.

References

Apotiade, J. K. (2002). Ibadan distance learning centre series: LSE 302 cataloguing and classification. Ibadan: Distance learning centre University of Ibadan. Pp. 5

Clark, S. O. (2000). *Fundamentals of library science*. Warri: COEA puplishers.

Ebiwolate, Posigha Bassil (2010). The Use of the Library Catalogue by Undergraduate Students in Niger Delta University Library. *The Library Philosophy and Practice.*

Fister, B. (1992). The research process of undergraduate students. *Journal of Academic Librarianship 18* (3):163-169.

Kakai M., Ikoja-Odongo, R., & Kigongo-Bukenya, I. M. N. (2004). A study of the information seeking behavior of undergraduate students of Makerere University, Uganda. *World Libraries 14*(1): 1-24.

Littlefield, J. (2008). A cataloguing carol. Available: http://www.librarystudentjournal.org/index

Ojedokun, A. A. (2007). *Information literacy for tertiary education students in Africa* . Ibadan: Third World Information Services Limited.

Okorafor, C. N. (2006). Using library catalogue as access to academic library collection in Nigeria. Journal of the Nigerian Library Association, *Imo State Chapter 4* (1&2): 37- 43.

Opaleke, J. S. (2006). *Study on non-print resources in Nigerian libraries*. Ilorin: Nathadex Publishers.

Osiobe, S. (1987). Use and relevance of information on the card catalogue for undergraduate students. *Library Review 36* (4): 261-267.

Opaleke, J. S., Olayemi T. K., & Aina, R. (2006). *School library management for teacher librarian*. Ilorin: Nathadex publishers.

Rowley, Jennifer E. (1998). *Computers for libraries*. 4th rev. ed. London: Library association publishing, Pp 224.

Saiful-Islam, K. M. (2008). *Essentials of cataloguing and classification*. Dhaka: New progati prokashani.

Appendix
CORNETTE07

University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

The Marvin and Virginia Schmid Law Library | Law, College of

Summer 2003

Reflections on Ranganathan's *Five Laws of Library Science*

Richard Leiter

Follow this and additional works at: https://digitalcommons.unl.edu/lawlibrary

 Part of the Law Librarianship Commons, Legal Profession Commons, and the Legal Studies Commons

This Article is brought to you for free and open access by the Law, College of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in The Marvin and Virginia Schmid Law Library by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

95:3 Law Library Journal 411 (Summer 2003).

Reflections on Ranganathan's *Five Laws of Library Science*[*]

Richard A. Leiter[**]

Professor Leiter reminds readers of the first principles of librarianship as enunciated by S.R. Ranganathan, the great Indian library theorist, and explores their meaning for law libraries in the digital age.

¶1 This article is adapted from a column that I wrote for *Legal Assistant Today* in 1996.[1] The column's audience was legal assistants, some of whom, I discovered over my seven years as a columnist for the publication, had responsibility for managing law firm libraries or library resources in addition to their other duties. So from time to time my column drifted into advice about managing libraries. This particular column came about at a time when I was mentoring some younger librarians and discovered to my surprise that they did not know of Ranganathan's *Five Laws of Library Science*.[2] When I expressed concern about this to professional colleagues, I was even more surprised to find that many of them hadn't heard of or couldn't remember the great Indian library theorist's five laws either.

¶2 I have returned to the subject for several reasons. First, at the time I wrote the original column, I also wanted to share my thoughts on the five laws with my law library peers in a source they were more likely to read than *Legal Assistant Today*. Such are the vagaries of life that it has taken seven years to finally write directly for my peers. Second, Richard Danner mentioned my earlier column in a provocative article he wrote about the law library profession,[3] noting that it deserved wider circulation. At the time, two years after publication of the column, I made a mental note to get busy and follow through with my initial urge to write on the subject for *Law Library Journal*. Again, time slipped away.

¶3 But above all, Ranganathan's five laws deserve repeating, frequently and regularly. It is my wish that those not familiar with Ranganathan will become

---

* © Richard A. Leiter, 2003.

** Law Library Director and Professor of Law, University of Nebraska-Lincoln, Marvin & Virginia Schmid Law Library, Lincoln, Nebraska.

1. Richard A. Leiter, *The Five Laws of Library Science*, LEGAL ASSISTANT TODAY, Nov.-Dec. 1996, at 72.
2. S.R. RANGANATHAN, THE FIVE LAWS OF LIBRARY SCIENCE (Sarada Ranganathan Endowment for Library Sci. 1988) (1931).
3. Richard A. Danner, *Redefining a Profession*, 90 LAW LIBR. J. 315, 336 (1998). Thanks for your interest, Dick. How you happened to run across this column is anyone's guess! By the way, though it already enjoys wide circulation, Danner's article deserves another reading. In my opinion, it is one of the seminal articles of our modern professional literature.

interested in his work, and that those who recognize the name but have not reflected on the five laws lately (or who have forgotten them entirely) will have their interest rekindled and, in the process, have their professional enthusiasm and inspiration rejuvenated as well.

Toward A(nother) Philosophy of Our Profession[4]

¶4 Perhaps I should not be so quick to admit this, but in my opinion these laws are sublime and worthy of our professional devotion. I have the five laws prominently displayed on my desktop as a daily reminder of what I believe to be the essential nature of my work. As we struggle to reconcile seemingly conflicting forces like bricks and mortar, bears and bulls, and quills and CPUs, it is easy to forget why we are really here. These forces can draw our attention away from the great work that we as librarians perform on a daily basis. As we lose this focus, we run the risk of losing our enthusiasm, our creativity, our professional soul. This affliction is particularly common (and often acutely felt) among library directors, but it is one that affects the library specialist, too. Catalogers, for example, run the risk of being so taken for granted that they forget how significant they are to the health of the library organism.

¶5 But this is the curse of our profession. Most libraries function so well that our users come to take us for granted, frequently so much so that we become nearly invisible to them. Our professional orientation is toward service—always—and as we strive for (and often achieve) excellence in service, it is not surprising that we are taken for granted! For what kind of a library would we be if our patrons had to *contract* for every use of the library's collection or for every reference question? Have you never wondered at the fact that free-standing for-profit libraries are practically anathema? Access to libraries is considered a right of such fundamental first principles that it is itself taken for granted.

¶6 By focusing on Ranganathan, I do not mean to deflect attention from Morris Cohen's philosophy of law librarianship. In his excellent article,[5] Cohen presents his own six laws or principles that are uniquely applicable to law libraries. The attempt is noteworthy and instructive for all law librarians—and trustees, boards, deans, and senior partners for that matter! The importance of this article cannot be understated as an essential source for newer law librarians to read and explore. In fact, any law librarian who wishes to succeed must learn these principles well. But Cohen's principles function more as charges *to* librarians about what they should *do* to be excellent law librarians, and not truly as a philosophy of the profession.

4. In a groundbreaking article that probed the "bigger" picture of law librarianship, Morris Cohen described the five laws as "elegant." Morris Cohen, *Towards a Philosophy of Law Librarianship*, 64 LAW LIBR. J. 1, 4 (1971). He also acknowledged that "some librarians consider them profound, but many others find them trite and vacuous." *Id.* at 1. I clearly fall in the former category.
5. Cohen, *supra* note 4.

Ranganathan's five laws, on the other hand, provide a paradigm of how libraries function, how they grow and serve, how they *live*, and so provide for us a framework through which to examine our professional lives and our libraries.

Why Study a Philosophy of Law Librarianship?

¶7 While it is true that you need not know all of the principles of internal combustion engines to drive a car successfully, it is necessary that the driver be acquainted with some basic principles about operating a car. For example, if you don't understand that your car must have unleaded gasoline, or that your tires must be properly inflated, you may well suffer problems down the road. In the same way, it is necessary to understand a little of the science of libraries to properly manage or make the best use of one.

¶8 Many people see a library simply as a bunch of books on the shelf, most with numbers and letters on their spines. They also understand that there are rules regarding checkout and other procedures. Both the call numbers and the rules usually are seen as manifestations of librarians' near-compulsive capacity for organization. Cynics may believe that librarians themselves are the prime beneficiaries of all the absurd rules. But the truth is that the rules are for the benefit of patrons and follow logically from the laws of library science. Any collection of books that is effective, functional, or useful abides by the laws of library science. Otherwise, you have chaos.

¶9 In about 1928, S.R. Ranganathan, then involved in the development of the great library at the University of Madras, first contemplated and began to articulate the ideas that soon would be enunciated in *The Five Laws of Library Science*. This was a period in library history when the world was grappling with fundamental questions. What is a library? What is library service? Libraries were just developing systems of classification and organization, and no one had yet dealt with a unified philosophy that attempted to define the purposes and functions of a library. The principles enunciated in Ranganathan's *Five Laws* were the first and, to date, the only clear definition of a library's functions and responsibilities.

The Five Laws

¶10 First of all, like any philosophy, it is important to realize that merely stating the five laws—or even understanding the words—will not automatically lead to enlightenment about the function of libraries. Although simply stated, the laws demand contemplation and experience before the richness and import of their meaning will be revealed. They are the first principles of library science only, and, hence, do not immediately yield practical application. However, contemplating them as we go about our business in our libraries will provide us with basic tenets to guide us in performing work that fulfills our mission as keepers of the knowledge of our culture.

¶11 The five laws are:

1. Books are for use.
2. Every reader his or her book.
3. Every book its reader.
4. Save the time of the reader.
5. The library is a growing organism.

¶12 What do these laws mean? Why do they sound so silly? It bears repeating—the laws are meant to be elemental, to capture essential meaning and convey a deep understanding of libraries.

"Books Are for Use"

¶13 Just as Newton's first law of motion ("A body at rest remains at rest unless acted upon by an outside force") is a statement of the obvious, the first law of library science also puts forth an obvious and elemental principle. But even so, it is a law that is often violated in the practice and use of libraries. Medieval libraries, as an extreme example, were chained libraries. The books literally were attached to the shelves with brass chains and could only be used in a single location. Obviously, this was done primarily for preservation of the books rather than to facilitate their use. (On the other hand, it might be argued that this method of controlling access helped prevent theft and thereby *facilitated* use!)

¶14 But you don't have to go all the way back to medieval times to find ways by which librarians can obstruct the use of library materials. Maintaining special collections with limited access; storing materials off-site; restricting access to libraries based on memberships, fees, or even by selecting materials under contracts that limit use to particular classes of patrons (such as when a public library, or a library that is open to the public, eliminates print resources in favor of an electronic version of the material that is only accessible to certain patrons with passwords) are all modern equivalents of chaining books to the shelves. And all bring into question whether the library is adhering to the first law: "Books are for use."

¶15 This first law gives definition both to the concept of an open stack library and to a library that is appointed with tools and furnishings that make the books it contains useful. This law dictates the development of systems that accommodate the use of library materials. For instance, proper and regular shelving of library materials facilitates the use of books. Logical, topical arrangement of materials also facilitates their use. To sum up what we should take from this first law, care must be taken to provide a facility and an organized collection that invite and promote the *use* of its resources. Simple? Yes. Important? Critical!

"Every Reader His or Her Book"

¶16 This law has many important implications for the library. The fundamental issue it reveals is the tension between the cost of materials and the basic right of all persons to have access to the materials they need. In providing a library for the

use of books, one must always be mindful of the fact that since no one individual can own all the available books, one of the library's primary obligations is to acquire a body of literature or research materials that will benefit each of its readers and researchers. A library must formulate policies that ensure that the collection it is building and maintaining is adequate to fulfill the expectations of its community of users. In other words, the collection must be appropriate to the library's mission. A public law library, for instance, must contain a body of work appropriate to the needs of *all* its patrons, nonlawyers as well as lawyers.

¶17 Similarly, policies must be formulated to ensure that the library has an access policy that is appropriate. Any library that limits access in any way must ensure that this restriction does not prevent adequate access to the collection by the people that the library was created to serve. Access policies also have implications for interlibrary loan, cooperative acquisitions, and consortia to which the library may belong. One must also be concerned with programs that provide for the preservation of materials in alternative formats, such as microfiche, CD-ROM, and other electronic formats. The questions here are: Which formats are appropriate? Which will be most useful to the patrons/readers? What software or hardware materials must be acquired to facilitate their usage? Who may enjoy access? Attendant questions involve access to printing privileges, passwords, network access, etc. In public libraries or public academic libraries that serve the public, such questions are not easy to address.

¶18 But there is an even more practical aspect to this law. Librarians must know their readers well if they are to provide them with the materials they need for their research or that they wish to read. Librarians must know the subject matter and the bibliography of the subject, and must ensure that readers know the material, its uses, and how to use it. A responsibility, therefore, of any librarian is to instruct and guide patrons in the process of research or in searching for materials they need for enjoyment or education.

¶19 Finally, reference service gains its legitimacy and its purpose from this law. The importance of reference service cannot be overstated. For many patrons, particularly in a law library, it is through the reference department that they gain knowledge of the materials necessary for satisfying their particular information need. This is particularly true in a law library where most public patrons, law students, and even younger (and tragically inexperienced) lawyers and law professors conduct research with little or no understanding of what the "law" is in its fundamental bibliographic sense. Many legal researchers—especially novices—are overwhelmed by the volume of books required to contain the law. A major part of the reference function is getting our users familiar with the bibliographic structure, or form, of the law. In other words, in helping patrons to do research, we teach.

¶20 In his description of this second law, which is by far the longest of the five laws in the book, Ranganathan explains that the reference function is critical. He observes that it is the business of librarians "to know the reader, to know the books,

and to actively help in the finding by every person of his or her book."[6] Reference librarians are trained to bring readers to their books either through formal research instruction, informally in a one-on-one "reference interview," or by the production of bibliographies, research guides, exhibits, etc. In a sense, patrons "use" the skill of the reference librarian to find the library materials they need.

"Every Book Its Reader"

¶21 This principle addresses the fundamental issue of access. If a book is obtained by a library but is secretly processed and placed arbitrarily on a shelf, or systematically shelved but its acquisition otherwise kept secret, the book may not be readily discovered until the moment when the reader has reached a crisis in his or her research. At such a moment, a frustrated researcher may seek out a librarian or someone else with knowledge of the needed book's existence, or may simply stumble upon it. While either scenario may represent a happy ending for the researcher, they are not the preferred model of library service. And in the worst case, the book may remain hidden indefinitely.

¶22 How can the librarian find a reader for every book? There are many ways: distribution of acquisitions lists, new book exhibits, providing research guides and bibliographies to patrons at an information counter, newsletters, etc., are ways that a library can aggressively work to connect its resources with its users. But there are more traditional, practical ways employed by all libraries that are not always recognized for the important function they serve in the science of libraries.

¶23 Using a structured, well-thought-out indexing and classification system is the most common. Standard schemes, such as the Library of Congress classification schedules, ensure uniformity of treatment of various materials on similar topics and thereby help books end up in the hands of the readers who need them. Appropriate arrangement of materials in open stacks also is an important means of achieving this objective of the third law. Misshelving a book can make it all but invisible and, for all practical purposes, lost.

¶24 The challenges presented for this law by the emergence of electronic resources cannot be overstated. For instance, what are law librarians to do with electronic databases? How can we convey to patrons entering the library information about the electronic resources that are available "within" (even if not as readily visible as books sitting on shelves)? And what about the "cyber visitors" who use a library's Web site for research? How, too, do our answers to these questions affect the contracts that we negotiate and the products to which we choose to subscribe? In the digital age, getting the "book" to its reader presents us with unique and tantalizing challenges.

---

6. RANGANATHAN, *supra* note 1, ¶ 471, at 246.

"Save the Time of the Reader"

¶25 This is my second favorite law. It presents the biggest challenge to the library administrator. Policies always must be formulated with the needs of the library user in mind. Hours of operation must be set so as to ensure the most appropriate and convenient access to the patrons who rely on the library for their research and reading needs. The collection must be arranged in an inviting, clear, and obvious way so as not to waste the time of patrons as they search for the materials they need.

¶26 Attention also must be given to the variety of formats in which information is provided. When a library subscribes to electronic resources, appropriate access to them must be provided. In the case of databases available to the public, public access terminals and printing resources should be made available. This presupposes, too, making the best use of available IP and networking technology. If materials must be placed in off-site storage, provision must be made for easy retrieval of those materials. If materials are available only in microfiche format, readers and reader-printers should be available (and preferably stationed nearby).

¶27 There are other ways to satisfy this law. Well-planned and executed library handbooks, stack guides, and library tours, or research instruction sessions serve the goal of saving the time of the reader. Adequate staffing of reference, information, and circulation desks, as well as telephone reference, also helps patrons find needed materials quickly. Employing the best available technologies to provide quick access to materials or using an online catalog also saves the time of the reader.

¶28 Saving the time of the reader means providing efficient, thorough access to materials. It means satisfied library users. This is the prime measure of a library's success; frustrated or disappointed users mean that the library has failed in its duty and its responsibility. This law might be restated as: "Serve the patron, and serve him or her well."

"The Library Is a Growing Organism"

¶29 This is my favorite of Ranganahan's five laws. Nowhere is this law more true than in a law library. A law library takes in materials regularly and frequently, it assimilates what it needs, and it discharges its waste. If the public services function of a library is the soul of a library, and administration is its mind, technical services is the body.

¶30 The technical services function of a library is charged with keeping a collection healthy. It must receive a steady diet of "nutrients and supplements" (information resources) to keep all of the library's parts healthy and reliable. There is perhaps no function in a law library that is more important. Should a subscription be mistakenly canceled or a loose-leaf service misfiled, these titles become "sick" and the whole library suffers because its overall integrity is lost. Therefore, it is necessary that technical services librarians take their responsibility very seriously. (Administrators, too, must take them seriously, giving generous support and

encouragement.) Each subscription must be accounted for, supplementation recorded and checked against prior receipts of similar material, invoices checked, and materials promptly processed and accurately shelved. If the goal of a law library is to provide a collection that can be relied upon for timeliness and accuracy, then, arguably, this is the most important function of a law library. The irony is that it is also the library function that is most easily taken for granted.

¶31 It is a common fallacy among many administrators (professionals and non-librarians alike) who exercise control over library budgets that one way to save money is to merely cancel groups of subscriptions and then restart them after a year or so. The problem with this general approach is that, in a living organism, if food and nutrients are cut off for any length of time, the overall health of the organism will suffer—think of what happens if you stop eating. But libraries do not eat money, they consume information. A law library is a delicately balanced organization of knowledge that builds and grows continually each time a legislature meets, a court convenes, or an academic writes. Cutting a library off from this resource at any arbitrary point surely will make it ill, even if only temporarily or mildly, and, in the worst case, will kill it.

Conclusion

¶32 What should we learn from this whirlwind study of Ranganathan's *Five Laws of Library Science*? It is my hope that the reader has gained two things from this essay. First, a greater (or in some cases new) appreciation for the work of the great Indian librarian. Second, a renewed appreciation and perspective on our work as librarians. As we struggle through the myriad crises that challenge our budgets, our resources, our physical space—indeed, in some cases our very existence—it is easy to forget that at the heart of every library beats a basic tenet derived from Ranganathan's first principles: to unite patrons with information.

Appendix
CORNETTE08


Pergamon

Library Collections, Acquisitions, & Technical Services 27 (2003) 73–96

Library Collections, Acquisitions, & Technical Services

Weed to achieve: a fundamental part of the public library mission?

Juris Dilevko*, Lisa Gottlieb

Faculty of Information Studies, University of Toronto, Toronto, Ontario, Canada M5S 3G6

Abstract

Weeding or deselection of materials has become an integral part of library management. Based on a nineteen-question survey about weeding practices in public libraries, this article discusses the personal perspectives of public librarians on weeding as well as the weeding practices of their institutions. The three most common criteria for weeding are circulation, physical condition, and accuracy of information. Librarians overwhelmingly believe that weeding increases use of books and patron satisfaction. In addition, the public library was framed as a venue that offers safe, clean, and fresh "product lines" with various natural life cycles and expiry dates. This discursive formation raises questions about the extent to which public libraries and their collections are becoming commodified, homogenized, and ephemeral, and whether such ephemeralness and homogenization serve the interests of all community members. © 2003 Elsevier Science Inc. All rights reserved.

Keywords: Weeding; Deselection; Collection management; Public libraries

1. Introduction

The question of whether a public library collection should be weeded has long been a controversial topic in the field of librarianship, generating lively arguments about the advantages or disadvantages of weeding. As Loriene Roy summarizes, the weeding debate can be traced back to Charles Francis Adams, Jr. and the Quincy Plan. Adams served as a library trustee for the Crane Memorial Public Library in Quincy, Massachusetts, which was built by Henry Hobson Richardson in 1882 [1]. Richardson's designs, Roy reports, were notorious for not taking into account future growth of the collection, and the Quincy library

* Corresponding author. Tel.: +416-978-7089; fax: +416-971-1399.
E-mail address: dilevko@fis.utoronto.ca (J. Dilevko).

1464-9055/03/$ – see front matter © 2003 Elsevier Science Inc. All rights reserved.
doi:10.1016/S1464-9055(02)00308-1

was no exception. By 1892, there were 19,000 volumes in the collection, but the total projected capacity was only 20,000. Dire measures therefore had to be taken, and the so-called Quincy Plan—weeding all but the most popular materials, producing finding aids for readers, and transferring research materials to locations that were more convenient for potential users—was born. The plan caused great consternation, and heated discussion about it ensued at the 1893 American Library Association (ALA) convention. For example, William Poole, a founding member of the ALA, wrote that a concerted program of weeding would ensure that the library will have "no books which will interest persons with an intellectual range above that of clod-hoppers and market gardeners." Rather than weeding, libraries should adopt a policy of "adding the books which elevate the literary and historical taste of the public, in meeting . . . the wants of scholarly readers, and not neglecting to provide the books for the young and the less educated class" [2]. Poole's comments about weeding were part of his campaign for better-designed and more capacious library buildings. In his mind, architects of libraries were overly concerned with aesthetic matters to the detriment of practical considerations such as sufficient space for books. He therefore wanted librarians to take the lead in developing new library buildings and floor plans, thus keeping a tight rein on the proclivity of architects for fanciful excesses [3]. If buildings were larger, weeding pressures would disappear or be mitigated.

In the 20th century, the debate about weeding followed, for all intents and purposes, the contours of the controversy surrounding the Quincy Plan. On one side are those who believe that weeding is all about space: space must be made for current, useful materials that will actually circulate and make the library more appealing. On the opposing side are those who believe that other considerations beyond mere numbers must be taken into account when operating a public library. J. Wesley Miller, for instance, laments that librarians are "throwing away books with enough vigor to make book burnings under the Inquisition look like a hotdog roast at a Methodist Sunday-school picnic." Arguing that "antique books are not a renewable resource" and that "the enormous strength of the historic preservation and collectibles movement belie claims that there is no demand for worthwhile old books and authors," Miller suggests that "every public library should establish a substantial American Heritage collection containing the whole works of classic authors of Anglo-American culture up to 1900" and that, if any weeding is to be done, it must be left "to the most learned, experienced, and conservative of multidisciplinary information specialists" simply because "it takes a great deal of learning to know just how important minor authors are" [4]. Of course, a distinction should be made between the library's role with regard to retaining research materials and weeding of general collections. Central branches of systems often serve a research function, and thus the question of weeding in such research-oriented public units should likely be applied on a different basis than in non-research oriented units.

Another consistent feature of the weeding debate is that almost all of the literature about weeding is advocacy-based and prescriptive in nature, with a few controlled studies about whether weeding fulfils its goal of increasing circulation [5]. There is, for example, Joseph P. Segal's *Evaluating and Weeding Collections in Medium and Small-Sized Public Libraries: The CREW Method*, which provides a model for integrating weeding into the entire selection and acquisitions process. Segal suggests that books have "useful careers," but once these careers are over, they should be "retired" using a systematic approach that "streamlin[es]

your collection for efficient and reliable use . . . making it easier and faster for the people of your community to find the facts, phrases, and stories they need" [6]. His approach includes three components: the number of years since the book's latest copyright data; the number of years since its last recorded circulation; and the presence of various factors he labels as "musty"—misleading, ugly, superseded, trivial, irrelevant to a particular library's collection [7]. Stanley J. Slotes's *Weeding Library Collections: Library Weeding Methods*, published in a fourth edition in 1997, proposes that a variable called "shelf-time period," defined as the "time a book remains on the shelf between successive uses," is the best way to create "a smaller core collection that would satisfy a given level of predicted future use" [8]. Less formal approaches based on personal preferences are also prevalent. For instance, Cathy Carey advocates "survival weeding": "When going down an aisle in search of a history of Korea, pull those two tattered books on China. It takes only a second" [9]. Merle Jacob supplies "a handy rule of thumb for the types of books I weed" in the fiction collection, describing a process where she focuses on, among others, older single title authors, obscure foreign authors, earlier or lesser works of authors who have died, series books when titles are missing, and less important titles of classic authors [10].

Three examples of controlled studies about weeding in public libraries provided mixed results about the positive effect of weeding on circulation. Penelope McKee, after using the Slote method, observed that there was "a strong positive relationship between declining stock [due to weeding] and increasing circulation" [11]. Carolyn Moore found that, after weeding, the "use factor" of the photography section increased from 25% to 33%, but that the "use factor" of the travel section remained at 9% [12]. Loriene Roy, after four rural Illinois libraries were weeded of 10% of their circulating adult collection, noted that there was "no significant increase in stock turnover rate, total circulation, or adult circulation" [13].

Even rarer are surveys about how and why libraries—whether public or academic—weed. In the early 1970s Roscoe Rouse surveyed public and academic libraries about whether they practiced weeding, how many books they sent to storage, and how many books they discarded, but his main purpose was to determine the extent to which libraries use additional within-library space (e.g., various shelving techniques, storage areas, and annexes) to cope with weeded materials [14]. Elizabeth Futas and Jonathan Tyron, after surveying 60 public and academic libraries in Rhode Island, determined that more than 75% of the institutions had or were developing written policies (including retention schedules) for reference materials [15]. Carol Truett found that only two of her 14 surveyed libraries had written policies for weeding reference materials, although most of the libraries conducted systematic evaluations of their reference collections, paying special attention to age and use [16]. Perhaps the most wide-ranging survey was conducted by Eugene Engeldinger, who found that only 77 of 370 academic libraries (20.8%) had a written policy about weeding reference materials [17]. Engeldinger also asked questions about the frequency of weeding reference materials, reasons for weeding, the number of volumes weeded annually, and the percentage of reference volumes transferred to the circulating stacks or discarded.

2. Purpose

In light of the relatively few surveys about weeding practices in libraries, the purpose of this article is to determine current weeding practices of public libraries in North America with regard to their general (circulating) collections of fiction and non-fiction print materials through a set of survey questions touching upon both institutional and personal perspectives on weeding. The survey included the following issues: Is weeding considered as something that is an important part of library work? How frequently is it done? Why and how is it conducted? Are there any problems involved in weeding? What is done with weeded materials? What are the personal beliefs of librarians about weeding? Are there any improvements that can be brought to the weeding process? In what terms do librarians talk about weeding, and what do these terms suggest about the role of the library? In sum, this article presents an overview picture of weeding practices, beliefs, and issues in public libraries at the beginning of the 21st century.

3. Method

In November 2000, graduate students enrolled in the course "Collection Development and Evaluation" at a library and information science program at a major North American university were given a class assignment in which they were asked to send a survey consisting of a set of 19 questions about weeding procedures to randomly-selected public libraries in the United States and the nine English-speaking provinces of Canada (see Table 1). There were 19 students in the class (see Appendix A for the names of participating students). Each student was assigned a page range from the *American Library Directory* (*ALD*) and was then asked to randomly choose the names of about 40 public libraries from the assigned page ranges. All the pages in Volume I of the *ALD* (covering the United States) were assigned as well as the appropriate pages covering Canada in Volume II.

In broad terms, the *ALD* lists libraries by state or province. Within each state or province, libraries are listed in alphabetical order of the town or city name within that state or province. Public libraries are designated by the letter **P**. In general, the more libraries in a particular state, the larger the page range of library listings for that state or province in the *ALD*. Students were requested to devise a systematic random sampling technique for their assigned page ranges. Each student was instructed to count the total number of **P** designations in her/his assigned *ALD* pages and then pick, after a random number start, every x^{th} public library such that each listed public library had an equal probability of being selected. Students were also told not to select branch libraries.

Students then contacted their randomly selected public libraries by e-mail. An introductory e-mail was sent informing libraries about the nature of the survey and requesting their participation. The e-mail was addressed to the attention of the person who was in charge of collection development or the person responsible for weeding. In the case of small public libraries, the message was addressed to the Head Librarian. Librarians were offered a chance to decline to receive the survey by sending a return e-mail expressing their unwillingness to

Table 1
Text of survey questions (all questions except #1 refer to the general [circulating] book collection of public libraries [fiction and non-fiction] but do not refer to reference collections)

1. How many total print book volumes are currently in your public library?
2. What are the reasons that you weed the print material contained in your library's general book collection? Please list all the reasons why your library weeds.
3. Are there any factors that discourage the weeding of the print material in the general book collection of your library?
4. What are the criteria that you use to weed the print material in the general book collection of your library? Name all the criteria that you use, and indicate which criteria are the most important for your library.
5. How often do you weed the print material of the general book collection of your library? Is it on a regular basis, or irregular? If regular, what is the usual frequency of weeding? If irregular, when were the last two times that the general collection of your library was weeded?
6. What do you do with the weeded print material from the general book collection? For example, is it sold, discarded, does it go into storage, or do you do something else with it?
7. What are the position titles of the people who participate in the weeding process? For example, is it generally one person or a collective team effort? How does this process work? Give as much detail as possible.
8. Is there a chance for other members of the library staff or members of the community to review material that has been designated as "to be weeded" before it actually is finally weeded? How does this review process work? For example, is there one level of review or multiple review levels?
9. What is the position title of the person who has the final say on any weeded print book material?
10. Have you ever personally saved a book or books that should have been weeded, i.e., met your library's criteria for weeding? If so, why did you save this book or books?
11. Please give details regarding any complaints from members of the general public about weeded books.
12. Do you personally believe that weeding increases book usage? If yes, what is your reason for thinking this? If no, why not?
13. Do you personally believe that weeding increases the satisfaction of your patrons? If yes, what is your reason for thinking this? If no, why not?
14. Do you personally believe that weeding saves staff time? If yes, what is your reason for thinking this? If no, why not?
15. Do you personally think that weeding is necessary in order to make room for new technologies? If yes, what is your reason for thinking this? If no, why not?
16. Not taking into account the procedures that your library actually follows in weeding, what is your *personal* philosophy about weeding?
17. If you could *personally* make changes in your procedures for weeding books in your general collection, what aspects of your weeding procedure would you like to change and why?
18. In a perfect world, what would you *personally* do with the print material that your library designates for weeding?
19. Does your library follow any written guidelines for weeding the print material of the general book collection of your library? If so, what are these guidelines?

participate. If no expression of unwillingness was received within five working days, the actual survey was then sent to that public library.

All survey questions (except the first one) were open-ended. The survey itself was an e-mail message that contained the text of the 19 questions. In other words, survey respondents could answer the questions from within their own e-mail package without going to an external web site. Respondents could return their surveys simply by pressing the "reply" button on their e-mail packages. A total of 849 initial messages was sent out by the 19 students enrolled in the class. Twenty-six libraries declined to participate. Accordingly, 823

surveys were sent to randomly chosen public libraries in the United States and the nine English-speaking provinces of Canada. Completed surveys were received from 294 libraries, for a response rate of 35.7%. As a means of self-identification, respondents were asked how many print volumes their libraries possessed. Of the 294 reporting libraries, 287 provided this information. Libraries fell into the following categories: 52 libraries (18.1%) had less than 20,000 print volumes; 64 (22.3%) had between 20,000 and 49,999; 63 (22%) had between 50,000 and 99,999; another 63 (22%) had between 100,000 and 249,999; 28 (9.8%) had between 250,000 and 499,999; 10 (3.5%) had between 500,000 and 999,999; and seven libraries (2.4%) had more than 1 million print volumes. In other words, 62.4% of responding libraries (179 out of 287) had fewer than 100,000 print volumes, and 84.3% of libraries (242 out of 287) had fewer than 250,000 print volumes. Answers were received from 38 states and eight Canadian provinces. The states and provinces not represented in the survey were: Alaska; Colorado; Connecticut; Delaware; Hawaii; North Dakota; Pennsylvania; Prince Edward Island; South Dakota; Tennessee; West Virginia; Wisconsin; and Wyoming.

Students submitted a written overview of their individual results for grading and class credit. That is, on average, each student received about 15 or 16 returned surveys, and wrote a brief 1,000 word essay about any trends that he/she was able to identify among his/her set of returned surveys. They were also asked to submit, in printed spreadsheet form, the complete texts of answers provided by their survey respondents to the 19 survey questions. For the purposes of the present study, answers from all 294 respondents were collocated and subsequently entered into electronic spreadsheet and word processing software programs. A content analysis of the responses for each of the 19 questions was then performed, and categories were developed to obtain the quantitative results presented below. In the presentation of results, quantitative results are supplemented and enriched by the verbatim comments of survey respondents. The text of the 19 questions used in this survey is provided in Table 1.

4. Results

4.1. Frequency of weeding

As shown in Table 2, a plurality of the surveyed libraries (33%, or 97 libraries) weeded on an "irregular" basis as the need arose, while 23.8% (70 libraries) identified themselves as weeding on an ongoing continuous basis. If those libraries that indicated that they weed daily, weekly, or monthly are added to the "ongoing" category (70 + 14 + 12), then 32.7% of surveyed libraries weed on an ongoing basis. Only a very small percentage of libraries weeded every three, four, or five years—14 libraries in total fell into these three categories (4.8%).

Answers provided by many of the libraries indicated that weeding is often a herculean task. A common sentiment was that "[w]e are never done" weeding. For example, one librarian wrote that "we weed continuously. It takes us approximately 1.5 to 2 years to completely do the non-fiction collection. Then we start over again." Another noted that "staff are supposed to be weeding continuously . . . and the extent of weeding is a factor in work performance evaluations and in branch visits by the coordinators of adult and youth services." Another respondent observed that "each reference librarian is assigned a range of Dewey

Table 2
Frequency of weeding (n = 294)

Irregular (when needed)	97 (33%)
Ongoing (continuous)	70 (23.8%)
Yearly	48 (16.3%)
Every two years	18 (6.1%)
Monthly	14 (4.8%)
Weekly or daily	12 (4.1%)
Bi-annually	8 (2.7%)
Every three years	7 (2.4%)
Every five years	4 (1.4%)
Every four years	3 (1%)
Uncategorizable or no answer	13 (4.4%)

numbers that he/she is responsible for weeding and collection development on an ongoing basis." Still another explained that all "returned books are checked for condition and set aside for weeding on a daily basis." Finally, one library mentioned that the establishment of biannual Friends of Library book sales—one in the spring and the other in the fall—is a strong impetus for regular weeding.

Many libraries have adopted what could best be described as a mechanistic and quantitative approach to weeding. Consider the following example.

> The more new materials we buy for a certain collection, the more shelf space we will need. We accession approximately 33,000 new items every year. If we use 10 books per foot as an average, that would mean we need 3,300 linear feet of available shelf space every year just for the new materials. That would average out to 157 bays of shelving (if you estimate 7 shelves of the standard 3 feet in each bay). If we didn't weed every year . . . we [would] get into trouble fast.

To avoid getting into "trouble fast," many libraries rely on automated computer reports that identify low circulating items or items that have not circulated at all in the past *x* years. These items are then reviewed and an assessment is made about whether they should be retained. Two libraries reported that they had quotas for weeding, whereby a certain percentage of the collection must be evaluated on an annual basis. Other librarians make periodic trips through the stacks on the lookout for overcrowded shelves or trust shelvers, pages, and patrons to alert them to overcrowded areas. Once spotted, these shelves then undergo rigorous weeding. One library has introduced annual shelf reading parties, where "a group of volunteers is introduced to basic shelf reading [principles] and our CREW deselecting method and we go through the whole collection." Another library system has set up a mailing list that alerts its staff on a regular basis about new editions and outdated materials. To say the least, weeding is taken seriously as an important component of library life.

4.2. Reasons for weeding and criteria used

The primary reason for weeding print collections was the need to ensure accuracy of information, followed by the physical condition of the item, space constraints, and low circulation (see Table 3).

Table 3
Reasons for weeding*

Need to maintain accuracy of information	240
Physical condition of item	208
Space considerations	188
Low circulation of item	169
Duplicate copies exist	76
Need to keep the library as a current and vital resource	74
Age/copyright dates	26
Superseded editions	25
Gain more knowledge of library collection	17
Beyond collection scope of library	8
Availability of item in alternate format	6
Increases circulation and turnover rate	5
Unacceptable stereotypes or sexist terminology	3

* Multiple answers allowed.

Other reasons included duplicate copies, the availability of the item in an alternate format, and the desire to eliminate unacceptable stereotypes and sexist terminology. To a great extent, these are self-explanatory reasons. Less obvious, though inherently logical, reasons for weeding were also offered.

One such reason—touched upon by 74 respondents—is the desire to present the library as a vital, vibrant, and up-to-date community resource. In the words of one survey participant, weeding "gets rid of that stereotype that the library is a dusty archives." Another commented that weeding "enhances the library's reputation" for currency and overall significance in the community. A third respondent noted that "our mandate, as a medium sized public library, is not to be that of an archive—we can only stock items of continuing and current interest to our patrons."

In addition, 17 respondents indicated that weeding increases knowledge of the collection as a whole. Weeding, one librarian wrote, is the "best way to go book by book and be reminded of what is in my collection. I get to see first hand [not only] what materials are damaged, need updating, or need to be replaced [but] I can also see what people are reading the most and where their real interests are." Another librarian explained that weeding helps "to become familiar with authors and their works." It also allows librarians "to gather information on collection strengths and weaknesses." Finally, it functions as "an integral part [of library work] in meeting assessed community needs." Weeding, in other words, not only discards items, but also awakens librarians to the hidden and forgotten resources that their shelves contain. In sum, systematic weeding is considered by many to be "a public service" that is the very antithesis of "irresponsible disposal of public property" because it often increases use and leads to a more attractive collection.

While librarians cited the need to ensure accuracy of information as the single most important reason they weed, circulation data were mentioned as the main criterion used to decide whether an item should be weeded (see Table 4). To be sure, many librarians wrote that "there is no most important factor" insofar as such considerations as timeliness of information, circulation statistics, and condition and attractiveness of the book should all play a role in making a weeding decision. Indeed, the CREW and WIDUS methods—

Table 4
Formal criteria used to make weeding decisions

	Cumulative Mentions*	Criterion mentioned first
Circulation of item	196	74
Physical condition of item	176	45
Accuracy of information contained in item	154	75
Age of item	47	21
Item is sexist, racist, or politically inappropriate	43	22
Existence of duplicates	34	7
Space considerations	25	14
Recommendations from subject bibliographies or other weeding lists	24	4
CREW method (Continuous Review, Evaluation, and Weeding)	23	22
Superseded editions	17	1
Local relevance	13	3
Library mission	7	4
Presence or absence of other books on the same topic	5	1
Constituent part of ongoing series	3	0
WIDUS method (Worn out, Inappropriate, Duplicated, Uncirculated, Superseded)	2	1
Out of print	2	0
Available through inter-library loan	1	0

* Number of times a given criterion was mentioned in a respondent's top three criteria for weeding.

specifically mentioned by 23 and two respondents, respectively—are based on multiple criteria.

Nevertheless, librarians most often circled back to the central importance of circulation counts in weeding decisions. One respondent was enthusiastic about how he/she uses circulation statistics:

> Because we have an automated system we can crank out weed lists on different criteria . . . and we do. Because utilization of the same criteria time after time would not result in a 'refreshed' weed list, each list will be different. Our major criterion is patron usage. Non-use is the kiss of death. Our criteria will usually have one factor [connected with] use—e.g., under 10 checkouts and published before 1990. Another might be less than 10 checkouts in the last 4 years and owned by the mother area library. Each list is different.

According to another librarian, weeding should not be considered an isolated activity, but one that is performed as a natural part of the book selection cycle. As one examines circulation statistics about low-circulating titles, it is necessary to "consider whether it is the only book on that particular subject that we have . . . [whether] it could or should be reordered, and whether or not there is another similar work which we should consider ordering as a replacement. It makes sense to research and record necessary buying information while weeding in order to preclude future gaps in the integrity of the collection." Thus, it is a good idea to keep "online book stores just a click away on your computer screen for quick checks as you check circulation statistics." Clearly, weeding is not seen as a negative that decreases the quantity and quality of a collection, but as a positive element that ensures a dynamic, responsive, and living collection. As the above examples demonstrate,

Table 5
Factors discouraging weeding*

Time	107
Hesitancy in weeding local history materials	53
Hesitancy in weeding "classics"	41
Reluctance due to fear that item might be needed in the future	37
No factors discourage weeding	35
No money to replace weeded books	34
Hesitancy in weeding out-of-print books	25
Hesitancy in weeding one-of-a-kind books (i.e., only book on a particular subject)	19
Vocal public opposition by members of general public and elected officials	18
Hesitancy in weeding "hard to replace" materials	16
Hesitancy in weeding "high-demand" items even if such items are in poor condition	15
Hesitancy in weeding donated/memorial items	10
Lack of staff	6
No storage space available for weeded materials	6
Inclusion in standardized lists such as *Public Library Catalog*	5
State standards require x amount of books per population served or funding formula increases based on number of books per capita	3

* Multiple answers allowed.

many librarians firmly believe that innovative use of circulation data aids in this replenishment process.

4.3. Factors discouraging weeding

If librarians recognize that there are many virtues to weeding, a number of factors nonetheless coalesce to inhibit weeding. Of these, lack of time is the most prevalent factor (see Table 5). The constant press of other duties, coupled with the fact that weeding is a time-intensive activity, caused many librarians to complain that there never seems to be enough time to engage in as thorough a weeding as they would like. Librarian hesitancy to weed individual titles or types of titles also was cited as an important factor discouraging weeding. Such hesitancy centered around local history materials, books by local authors, classics, out-of-print books, donated books, and items that an individual librarian had a hand in purchasing. Few librarians (only 34) mentioned that they were concerned about the lack of money to replace weeded books. Fewer still (only 18) noted that it was unpleasant to receive public complaints about weeded material. Perhaps the most intriguing responses came from three respondents who stated that they are reluctant to weed either because of state standards mandating a certain number of books per capita of population served or because of state funding formulae that tied an increase in collection development budgets to book titles held per capita.

In general, librarians commented that "the smaller the town, the more heat the Library takes about weeding" because people get attached to their books and fear that "they won't get other books to take the place of the old ones." Yet public complaints may quickly turn into public praise once the initial reluctance to weed disappears. In this regard, one librarian stated that he/she weeded 15,000 books during a one-year period, and "the response from the

public (heard frequently) was: Oh, it is so much easier to find things now." In broad terms, lack of weeding was associated with fear, inertia, and a "packrat mentality," causing one librarian to remark that it is "time to weed librarians who don't want to weed." From a philosophical perspective, weeding seems to be an issue that separates librarians who wish to preserve books that might one day be needed from librarians who are committed to a more streamlined and proactively managerial approach to library operations.

4.4. The process of weeding and its aftermath

Do public libraries follow written guidelines of some sort when weeding? Of the 281 respondents to this question (see Question 19 in Table 1), 210 (74.7%) indicated that their library did in fact rely on written guidelines. Of these, 45 (21.4%) respondents specifically mentioned the CREW method. A wide range of other guidelines were also used, including a library's own collection development policy, ALA weeding rules, policies set forth by state agencies or departments, and the *Sourcebook for Small Libraries.*

Most libraries employ a team concept when weeding. Of the 292 replies received to Question 7 in Table 1, 251 respondents (86%) indicated that at least two people participate in the formal weeding process. Of the 41 respondents who said that weeding at their libraries was a solo effort, most were from libraries where they themselves were the only person on staff. The team may consist solely of professional librarians, or it may include professionals, paraprofessionals, and occasionally volunteers. A common approach is to divide the collection into sections, with each person being assigned a section that is then double-checked by another person. Typically, if paraprofessionals have done the initial weeding, then one or two professional staff members review their selections before any items are officially discarded. As a further check, the person in charge of collection development for a particular subject area may also review the weeding choices. Is there room for review of material that has been designated as needing weeding? Of the 290 respondents to this question (see Table 1, question 8), 149 (51.4%) indicated that library staff reviewed items after they had been initially selected for weeding; 123 libraries (42.4%) had no review procedures; 15 libraries (5.2%) allowed members of the public to review weeded materials; and three libraries (1%) had review processes involving the Library Board and trustees.

In many libraries, weeding often resembles a military operation. Assistants "pull" the items or tag them with "weeding action slips." The items are then reviewed by the assistant's immediate supervisor, who then sends them to catalogers so that the items may be deleted from the library catalog or noted as being held in storage. Catalogers may flag an item as being worthy of retention, and then that item is returned to appropriate departmental supervisors. But who has the ultimate say about whether an item should be weeded? Out of 259 clearly interpretable responses, 174 respondents (67.2%) indicated that the final decision was taken at the very highest level of the library hierarchy by a person with the title of Director, Chief Executive Officer, Chief Librarian, or Head Librarian. Conversely, 85 respondents (32.8%) indicated that the final decision remained at the level of a department head: Adult Services Librarian; Collection Development Manager; Assistant Director; Reference Librarian; Branch Manager; Head of Reference; and Head of Technical Services.

Table 6
Public reaction to weeding decisions (n = 282)

No complaints	158 (56%)
Complained that particular items were missing	34 (12.1%)
Complained about books being found in the dumpster	21 (7.4%)
Complained about library not keeping everything	17 (6%)
Complained that weeded books were a waste of taxpayers' money	15 (5.3%)
Complained that they did not understand the concept of weeding	12 (4.3%)
Complained about the library getting rid of "perfectly good books"	10 (3.5%)
Complained that donated material was weeded	5 (1.8%)
Complained about throwing out "classics"	4 (1.4%)
Complained that there was too little weeding	4 (1.4%)
Complained about empty shelves after weeding	2 (0.7%)

Judging by the titles of the individuals involved in final decision-making, weeding is considered to be a vitally important aspect of library work.

In light of the importance that professional librarians place on weeding and the large amount of staff resources and time libraries expend on it, what is the reaction of the public? As shown in Table 6, 56% of librarians stated that members of the public had no complaints about weeding and another 1.4% of respondents indicated that patrons complained that there was too little weeding. Conversely, 42.6% of librarians listed a wide variety of negative complaints from the public about the weeding process, ranging from particular items, especially classics, being missing from the shelves, to anger at finding hundreds of books discarded in local dumpsters, to outrage that taxpayers' money is being wasted when items are weeded. In the face of these public complaints, librarians in turn complained that the public did not understand the library's mission—"we are a circulating library not an archive"—and about "local officials [who] haven't a clue as to what keeps a public library dynamic." One librarian believed that opposition to weeding was a generational issue insofar as most of the complaints emanate from people who lived through the Great Depression in the 1920s and were thus brought up to be frugal and not throw anything away. In order to better educate the public, some libraries have taken out advertisements in local newspapers about the reasons for weeding and have formed committees to define in precise terms what will and will not be kept. For example, one librarian explained that her/his library has a policy, developed by a committee, whereby all books mentioned in the semi-annual *New York Times* "Notable books" list are kept regardless of demand for 10 years. Although methods such as these may help in reducing public complaints about weeding, 42.6% of public library patrons nevertheless expressed some level of dissatisfaction with weeding. Such complaints may reflect weeding policies that are not taking into consideration the needs of public library users for materials that are not exclusively current and new.

4.5. Fate of weeded materials

Weeded material most often ended up being sold, either through formal Friends of the Library (FOL) books sales, informal and ongoing in-house sales, or to book dealers and eBay auctions (see Table 7). Sending weeded books to be trashed or to paper recycling centers

Table 7
Fate of weeded items*

Friends of the Library (FOL) book sales	154
Trashed	124
Ongoing in-house sales (not FOL)	116
Donated	72
Recycled	52
Given to other libraries	32
Storage	31
Offered free to the public	6
Send to exchange book programs	4
Sell to book dealers and eBay auction marketplace	4

* Number of times a given answer was mentioned in a respondent's top three answers.

were two other common options. Trashing books, however, was recognized to be a perilous undertaking, something to be done "quietly," "under the cover of darkness," and "in a locked dumpster" because discarded materials have occasionally been "returned by dumpster rats who cannot bear to see books thrown away." On the other hand, many libraries donated their books to a variety of public and social organizations, thus extending the use value of the weeded item in question. Nursing homes, retirement centers, Veteran's centers, women's shelters, Head Start programs, prisons, and psychiatric hospitals were often the beneficiaries of weeded books, especially large print editions. In addition, new library branches received weeded material to boost their initial stock. Another librarian noted that a "small college nearby takes many [of our books] to build up [its] library and get accreditation." One library stores its weeded material and waits "for delivery of a shipment container to send surplus weeded books to needy nations." Other libraries have formal arrangements with charitable organizations that pick up weeded material and distribute it to third world countries in Africa, Asia, and South America. Another library offers "our older, but still in good condition material, to smaller city, township, or village libraries in our County." Still another library has made arrangements with nearby Native American tribal nations to donate its weeded materials.

As altruistic as these solutions are, they are comparatively rare, especially in relation to the number of libraries who sell weeded books. No doubt many libraries rely on the extra income that such sales bring in—income that typically results in the purchase of new items for the library. Libraries are therefore caught in a conundrum. While the income generated from book sales contributes to a library's financial health, such sales may not have quite the same moral force as donations to social organizations or other solutions. Would librarians therefore personally like to see changes in the way their libraries dispose of weeded materials? As Table 8 shows, if all the responses where the word "sell" appears first are summed, then 115 librarians (40.9% of 281 total responses) believe that selling is the "perfect world" solution to dealing with weeded materials. On the other hand, if all the responses where the word "donate" appears first are summed and then added with the category "find each item a new home," then only 65 librarians (23.1% of 281 total responses) believe that donations are the "perfect world" solution to the disposal of weeded materials. Perhaps not surprisingly, the personal views of librarians parallel what is actually being done with weeded books by their

Table 8
Fate of weeded items "in a perfect world" (n = 281)

Sell the weeded items	82 (29.2%)
Find each item a new home	31 (11%)
Recycle	29 (10.3%)
Donate the items	28 (10%)
Discard	25 (8.9%)
Keep more items	16 (5.7%)
Sell, then donate the rest	14 (5%)
Give to other libraries	11 (3.9%)
Sell, then recycle the rest	11 (3.9%)
Give items away free	6 (2.1%)
Sell, then throw away the rest	6 (2.1%)
Donate, then recycle the rest	6 (2.1%)
Make the books disappear	5 (1.8%)
Book storage facility	5 (1.8%)
Take the books home	3 (1.1%)
Sell by having a year-round Friends of Library store	2 (0.7%)
Digitize weeded items	1 (0.4%)

libraries. Indeed, one reason for the reluctance of librarians to donate weeded materials to less-advantaged groups may be that such donations raise the thorny question of intrinsic worth. One librarian bluntly wondered about the ethics of sending "crummy looking books with information that is incorrect or obsolete to the needy [because] everyone should have access to good material." Another equated donating weeded materials with "sending worn out clothes to goodwill. If it isn't good enough for this library, it probably isn't good enough for another library! . . . I personally hate seeing our outdated material with inaccurate information being bought up by families doing home schooling." Although donations may salve the conscious of some, for others donations imply a two-tier model of information access—another manifestation of the information divide where marginalized and less fortunate groups of people must make do with the discarded materials from privileged societal groups.

Nevertheless, there were a number of noteworthy suggestions that went beyond the "sell, trash, and donate" nexus. Five librarians recommended the establishment of a centralized storage facility to which all libraries could send their discarded materials. This storage center, functioning in the words of one respondent as "a clearinghouse or network to identify libraries or organizations that need books," would serve as a transshipment facility. Various charitable or social organizations could then come to this centralized depot and pick out what they needed. Alternatively, this central depot could be accessible to other libraries in "an amazon.com style way." This recommendation fits nicely with the plea of another librarian for a much-needed "last copy center" that would link all libraries within a geographical region in a powerful inter-library loan consortium. Indeed, the establishment of regional "last copy centers" may be a boon to public libraries insofar as it may free them to weed their local collections, secure in the knowledge that their local weeding decisions are not, in fact, getting rid of hard-to-find or impossible-to-find titles.

Table 9
Personal beliefs about weeding (n = 294)

Question	Yes (%)	No (%)	Don't know or maybe (%)	No response (%)
Have you ever personally saved a book or books that should have been weeded, i.e., met your library's criteria for weeding?	211 (71.8%)	75 (25.5%)	0 (0%)	8 (2.7%)
Do you personally believe that weeding increases book usage?	270 (91.8%)	8 (2.7%)	10 (3.4%)	6 (2%)
Do you personally believe that weeding increases the satisfaction of your patrons?	253 (86.1%)	16 (5.4%)	15 (5.1%)	10 (3.4%)
Question	Yes (%)	No (%)	Yes and no	No response
Do you personally believe that weeding saves staff time?	158 (53.7%)	82 (27.9%)	44 (15%)	10 (3.4%)
Do you personally think that weeding is necessary in order to make room for new technologies?	135 (45.9%)	117 (39.8%)	35 (11.9%)	7 (2.4%)

4.6. Effect of weeding on library staff

As discussed in previous sections, weeding demands a considerable deployment of human resources. Is this investment of human resources a sound one? Does the time devoted to weeding detract from other pressing tasks that staff might be doing, or is it a productive long-term investment that pays off in unintended ways? Opinion was mixed about whether weeding saves time. While 53.7% were of the opinion that weeding did save time, 27.9% held the opposite view and another 15% could see both sides of the question (see Table 9, fourth question). To be sure, the physical act of weeding took up a considerable amount of valuable time, and so many librarians were literally incredulous that weeding could be considered, in any shape or form, as a timesaver. Others begged to differ. Weeding, many felt, increased staff awareness of the collection, which was a boon for collection development practices. For instance, one librarian explained that "regularly working the shelves for the purpose of weeding helps staff get to know their collections. I get better collection priorities feedback from staff who are weeding advocates than I do from staff who are weeding aversive. In fact, weeding aversive staff tend to spend a lot more time complaining about having nothing on the shelves—instead of helping build those collections for customer use." Ten respondents noted that weeding is a great timesaver for reference staff, because "every book is potentially a reference book [and] weeding cuts down on the number of sources that contain out-of-date information." Reference staff therefore do not have to waste precious time looking in sources that might turn out to be erroneous, or in wading through only marginally useful sources that have not been weeded. In addition, weeding helps to provide better reader's advisory services: since shelves are in better order and contain more space, returned books can be shelved more accurately, which facilitates finding just the right title for patrons. Two notions of time are evident in these answers. Weeding may be a time burden

Table 10
Changes needed to improve weeding procedures*

No changes needed	157
More time needs to be set aside for regular weeding	57
More staff needed to help weed	25
More training needed to better understand the concept of weeding	17
More storage space and storage shelves in library needed	11
Book depot needed external to the library	6
More weeding needed	4
Less weeding needed	4
Automation needed	4
Bigger budget for weeding	3
Community experts needed	3
Weeding procedures must constantly evolve	3
Weeding teams needed	2
Handheld scanners for efficiency	2
Written policies needed	2
Weeding teams needed	2
More review [of procedures] needed	2

* Multiple answers allowed.

in the short term, but in the long run, many libraries feel that much time is saved in collection development and reference functions.

4.7. Recommendations for improving the weeding process

In general, survey respondents were quite pleased with weeding procedures at their public libraries. As shown in Table 10, 157 respondents stated that they personally would not implement any changes to their library's weeding procedures. Despite such a high level of satisfaction, a number of librarians felt that more time, money, and staff should be allotted to weeding. To streamline the weeding process, a small number of respondents also expressed a wish for more storage space, book depots, and handheld scanners. In addition, 17 respondents wanted to implement better training practices so as to make staff better understand the concepts behind weeding and the need for continuous evaluation and review of materials. Representative of this group of librarians was the following comment: "The only change I would make is to increase the training and commitment of the library staff evaluating their collections—the human element and personal distaste for weeding makes or breaks weeding." If staff are content to wait until "weeding is a major trauma," everything "falls apart." Another librarian mentioned that workshops about weeding should be offered to the public because, in her/his experience, once weeding concepts and principles have been explained to patrons upset about not finding their favorite books, they "were okay" with it. Perhaps the most original suggestion was offered by the librarian who wanted more community involvement in weeding. This respondent would use "experts in their field," who would be assigned to relevant sections of the collection, as well as "young people to do the bibliographic checking [because] I think it is a great way to learn about the world of letters." Some of these ideas could be combined. If time and staff resources are at a premium and if

weeding is a time-intensive and labor-intensive process, then reaching out to involve community members in weeding may be a useful solution.

5. Discussion

5.1. Socio-cultural implications of weeding

To say the least, public librarians are firmly committed to weeding and its perceived benefits. As shown in Table 9 (first question), a large majority of respondents (71.8%) have never personally saved a book that should have been weeded (i.e., met the library's criteria for weeding). Still, 25.5% of librarians had done so for various reasons, and their comments provide a glimpse into some of the socio-cultural implications of weeding. Local history titles were often saved, as were donated items, award winners, classics, and last copies in a consortium catalog. Occasionally, librarians even ventured to save "good" books that have not circulated within a given time period because such books "add depth to the collection" and "you want to give them one more chance." Another librarian averred that he/she had saved titles from weeding "because I liked them or because I thought a public library should own them even if they didn't circulate." Beyond such sentimental reasons, four librarians admitted that they saved potential weeding candidates in order to give them one last chance to be "discovered." It is a matter of willpower, one librarian wrote, because "with a little push, I [know that I] can find a readership for the item! Maybe a display on the subject?"

Other respondents weighed the historical and socio-cultural value of titles before permanently discarding them. One librarian was especially concerned about books that were examples of the evolution of socio-cultural phenomenon, saving titles where the "format shows how books have changed over the years (beautiful engraved covers, black and white children illustrations, etc.)." Another librarian paid special attention to first editions, citing "an original edition of a book written by William Jennings Bryant about evolution and the Bible from the time of the Scopes trial." Still another respondent rescued the work of a Nobel Prize winner: "a staff member tried to weed Samuelson's *Economics* last week. I brought this to the staff meeting and showed staff that Samuelson won a Nobel Prize for economics and that this is considered a classical work and ought to be kept." Another librarian "reversed a decision on an Encyclopedia of Art that was old and needed rebinding. The original employee felt that the *Grove Dictionary* was a sufficient substitute. When it was pointed out that the first title was a classic set and had color plates (which *Grove* doesn't), the item was sent to the bindery and will be placed back on the shelf when it returns." Personal and detailed knowledge of the collection, this librarian concluded, was indispensable to sound decision making in all weeding decisions. Another librarian eschewed hard statistical data, instead basing his/her decisions on an intimate knowledge about the community served and the tastes of individual readers: "at times one might retain a book or an author because one knows that there are members of the community who still read a particular author or type of book." Finally, another librarian took into account whether a particular title could, in some way, be needed "to answer future central library reference questions [insofar as] the other libraries in the county send us their most difficult reference questions."

Perhaps the most intriguing comments came from three librarians who were not convinced that circulation statistics were reliable indicators about which books to weed. One of these respondents wrote that "sometimes books that end up on the bottom shelf do not circulate and when you shift the shelves and move it up a shelf or two, it will circulate." Two others suggested that poor circulation figures for a particular title were the result of faulty classification or misleading subject headings, and would therefore order the cataloging department to make appropriate changes. According to these librarians, prudent judgment and professional knowledge about the value of a title should never be replaced by a blithe trust in statistical data. There may, in fact, be alternate explanations for low circulation figures, and it is the responsibility of the librarian to consider such possibilities.

For the librarians quoted above, weeding criteria that are based primarily on circulation counts reduce the ambit of their job to one of rote and technocratic procedure. For them, a constellation of human factors and professional insight should, instead, guide every weeding decision. Nonetheless, as Table 9 makes clear, these librarians are in the minority. Much more common is the view that, as one librarian bluntly stated, "I have no love affairs with any particular author or title." In many ways, the seemingly tedious and simple question of weeding brings into focus the emergent divide in the library profession between proponents of dispassionate managerial efficiency and those who approach librarianship from a more intellectual and humanistic-oriented viewpoint. For the former group, weeding is, for the most part, a means to offer a better product line; for the latter group, weeding is a balancing act that necessitates careful attention to a broad spectrum of interconnected issues, including classification, subject headings, reference work, tastes of individual readers, and the generalized knowledge and sensibility that comes from being able to recognize the value of Samuelson's *Economics*, color plates, and illustrated children's books.

As indicated in Table 9 (second and third questions), survey respondents were nearly unanimous in believing that weeding increases book usage (91.8%) and patron satisfaction (86.1%). This is not unexpected. It is interesting to note, however, the language of the arguments they use to make their point. Again and again respondents explained that overcrowded shelves repel patrons and discourage browsing. Patrons are accustomed to gleaming displays of new books at ever-increasingly sophisticated area bookstores, and they therefore have come to expect similar wares and displays at their local library. One survey respondent compared browsing at the library with "shopping in a large department store—there is so much merchandise, it is hard to see what there is and easy to get discouraged." Another librarian wrote that "crowded shelves and worn-out books are distasteful, especially to busy customers." In fact, the idea of busy lives was a recurring theme in these answers. Libraries are now frequented by "busy customers," who are accustomed to fast service in familiar and comfortable surroundings such as shopping malls. If the library does not provide a similar "shopping" experience, the "busy customer" will simply go elsewhere. As one librarian wrote, "I think public libraries are in direct competition with the national bookstore chains like Barnes and Noble. The public has come to expect shelves stocked with fresh, new clean books whether they are in their local library or in a bookstore." Another librarian noted that patrons are not so much interested in "early attic" collections. Or consider the views of the following librarian: "As a customer, I believe I would be more inclined to do business at a store where I don't have to wade through a lot of outdated, unappealing merchandise to

find what I need and want. I would probably visit less often and certainly make fewer impulse purchases. I believe the same theory applies to library customers' use patterns." And, as many librarians pointed out, weeding also increases the level of trust between the library and its patrons. Outdated and obsolete materials may lead to embarrassment or serious mistakes, as in the case of "a teenager who uses an atlas of the USSR" rather than Russia, individuals who rely on a 1970 title about doing their own divorce, or travel guides more than three years old. Here, too, many librarians conceived the library in terms of a store. If a person received faulty goods at a store, would he or she frequent that store again in the future? The implication was: clearly not.

Weeding therefore functions as one way to increase the popularity and prestige of the public library. The result of weeding—a rapid turnover of stock—gives the impression of currency, vitality, and a sound understanding of the principles of the competitive marketplace, where patrons have steadily rising expectations and are constantly comparison shopping among other viable and trustworthy entertainment options. As one librarian explained, "space is tight, books have to earn their space." Competition among books—measured in terms of circulation data—is healthy because the stronger titles drive out the weaker titles, resulting in an overall better consumer experience. Just as a bookstore "remainders" titles that do not sell to make room for the constant arrival of new titles and to increase its sales and hence its profits—thus justifying its continued existence—so the public library must also do something to remove titles that do not circulate in order to retain and increase its budget allocations, which are often set in relation to the value and esteem in which the community holds the library, which in turn depends, to a large degree, on circulation figures. Also, just as a grocery store pulls discontinued and perishable items from its shelves to ensure that its customers do not suffer harm, the comments of some librarians suggested that libraries must treat information as a commodity that has an expiry date. In many respects, then, weeding not only allows the public library to make a claim to be a competitive force in the new entertainment marketplace, but it also allows the library, as four respondents put it, to provide "clean" and "fresh" material that will give patrons a "safe" feeling. As one librarian summarized, "[p]eople are not into the stuffed looking, dingy, dust smelling type of libraries anymore. They expect atmospheres more like coffeehouses or nice bookstores. People also like fresh smells and organization. I do try. . . to not let any shelf be less than half full and no more than half full. We burn scented candles and everyone loves the fresh smell and atmosphere."

The movement toward homogenization recalls George Ritzer's theory of McDonaldization, where services and procedures once subject to the fluctuations of human interaction undergo a rationalization process that emphasizes efficiency, predictability, calculability, and control [18]. Although named after the fast-food industry, Ritzer argues that the McDonaldization process has expanded to a variety of situations and venues, including credit cards, theme parks, and universities. Brian Quinn suggests that academic libraries too have succumbed, especially in the predictability and standardization of their collection development practices, "resulting in collection content varying less from one library or type of library to another" [19]. To judge by some of the comments presented here, weeding may function as a homogenizing agent in many public libraries, creating a situation where the product lines (books) offered show little variation from library to library. To be sure,

librarians would likely be indignant at the suggestion that their local library has no differentiating features from the public library in the next town or city, but such differences are increasingly measured in the same way that McDonald's offers regional variations of its standardized menu in diverse countries.

5.2. Weeding and new technologies

There was a sharp division of opinion as to whether weeding is necessary "in order to make room for new technologies in the public library." As shown in Table 9 (fifth question), slightly more respondents replied in the affirmative (45.9%) than in the negative (39.8%) to this question, with a fairly large minority group hedging their answers with a "yes and no" reply (11.9%). What do these figures mean? Some who replied in the affirmative suggested that, "although technology takes up a large chunk of space," there may actually be space savings once obsolete material is weeded, "especially in the case of reference materials where by the time that a book volume is published the information may be obsolete, while . . . reference materials. . .available in non-print formats are extremely current." Another librarian wrote that "weeding creates floor space for emerging technology—that is a good thing [because] patrons want information in all formats, not just print versions." Still another librarian indicated that "weeding is necessary to have space for just about anything new. . . . The space necessary for audio books, CDs, and videos as well as more public access computers has to come from the space that is used or could be used by books." In this regard, there were a number of librarians who offered stories about how they had had to eliminate "hard-copy back periodicals" or "3,000 hardback fiction books" to find sufficient place for computer workstations.

Those who responded in the negative to this question argued that weeding and the increase of information technologies in public libraries were independent phenomena. One librarian observed that "each medium has its place and weeding is done to make room for new books"; another was equally adamant that "we do not weed to make room for new technologies. We weed to make room for newer book titles." Others noted that "it really depends upon how much space and money you have." One respondent, calculating that a properly sized public computer workstation takes about as much space as 500 books, admitted that there are "real tradeoffs," but believed, overall, that books and new technologies supplement one another. The real issue, according to this individual, was "expanded space" in the form of larger library buildings. Indeed, the theme of larger buildings reappeared again and again. Libraries are not so much increasing weeding to make room for new technologies as they are increasing total square footage: "we are planning for building expansion"; "we are building bigger libraries"; "we have enlarged 4 libraries and are planning a 5th to enlarge." Yet, as one librarian lamented, "what I am seeing here, and we are not unique, is a large percentage of our Internet stations being used for e-mail and chat—not what we envisioned when we started the service." Although increasing library size may resolve the vexed issue of "weeding for the sake of new technologies," what happens when those new technologies become mere e-mail and chat stations? In such cases, the mission of the public library has evolved—for better or worse. But it is an evolution that may come at the expense of weeded

books that have been replaced by new technologies that may not be being used for their intended purposes.

6. Conclusion

As one of the final questions in this study (See Table 1, Question 16), librarians were asked to state their personal philosophy of weeding "not taking into account the procedures that your library actually follows in weeding." Of the 292 answers received to this question, 245 respondents (83.9%) indicated that weeding is essential or vitally necessary for the ongoing good of the library, while only 22 respondents (7.5%) wanted less weeding to occur. Their beliefs could be summed up as follows. Weeding is a fundamental activity that must be encouraged and embraced. Collections must be current, and must reflect what the community needs and will use. Certainly, weeding is personally difficult for many librarians because of their innate love of books, but if the public library is to be perceived as an appealing place, weeding is absolutely required. Weeding increases circulation, and increased circulation means that the library is "serving its community well." In addition, an up-to-date collection reflects a sense of responsibility, care, diligence, work, and a high level of knowledge among staff members. Accordingly, such a collection is more valuable to the community than one that gets used infrequently. Weeding also has a host of welcome byproducts. For example, staff members familiarize themselves with what does and does not circulate, thus greatly improving overall collection development choices. Weeding forces staff members to come face-to-face with obsolete information, which stimulates an awareness that reference sources must constantly be reviewed so as to provide patrons with correct information. The following response encapsulated the feelings of many:

> My personal philosophy of weeding is that when a patron comes to the library for information, by virtue of an item residing on the library shelf, the patron will believe it is the best information available. Children are especially vulnerable, as they do not have the ability to discern what is good information. These younger patrons deserve their materials to be held to the same high standards as the adult materials. Having nothing on a subject is better than having materials that are misleading, inaccurate, and out-of-date.

Indeed, another librarian pointed out that weeding speaks to the very professionalism of librarians and the esteem in which libraries are held by the general public. "If librarians were held to the same professional standards as doctors and lawyers, we would need malpractice insurance to cover our liability in continuing to make available some of the *misinformation* on library shelves" (original emphasis). Weeding thus goes to the very core of the professional responsibilities of the librarian. Whether it is viewed as a "necessary evil" or as a pleasant task that demarcates the public library from the local archives or academic library, weeding, according to one respondent, should be something that is viewed as a professional task of the highest intellectual order. "If [weeding] is not done, there is just another reason not to have librarians . . . in this modern age of 'dumbing down' professions and replacing them with mindless clerks and voicemail. . . . "

Many of the views of the public librarians surveyed here find echoes in prescriptive

studies about the advantages of weeding. Segal, for instance, suggested that weeding has six advantages: saving space; saving time of patrons and staff; making the library more appealing; enhancing the reputation of the collection for reputability and currency; providing information about which items need to repaired or replaced; and providing feedback on the strengths and weaknesses of the collection [20]. There was an overwhelming belief that weeding increased book use (91.8%) and the satisfaction of patrons (86.1%)—so much so that 71.8% of public librarians had never saved a book that was designated for weeding (see Table 9). Moreover, 53.7% of surveyed librarians felt that weeding was a long-term timesaver, making both collection development and reference easier and faster (see Table 9). Many of the librarians subscribed to Sharon Baker's view that weeding decisions are, essentially, "product decisions" that must take into account varying life cycles [21].

At the same time, weeding is far from being simple, nor can it be reduced to an activity without broad implications. In fact, weeding raises a swirl of crucial issues that go to the very heart of library work. It gives rise to questions about the nature of what it means to be a library professional, as well as questions about the role and nature of the public library within the community and in the global competitive marketplace. It touches upon issues connected with new information technologies, and the juggling act that public libraries must perform to maintain both print collections and electronic resources. Weeding now has become an integral part of library and collection management procedures and protocols, contributing to the discursive formation of the public library as a venue that offers safe and clean "product lines" with various natural life cycles and expiry dates. Of course, the concept of weeding cannot be held responsible for commodification and homogeneity, but, in its current manifestation, weeding procedures that do not take into account factors other than circulation may have the effect of exacerbating commodification and homogeneity in the public library. When only the most popular books are found on library shelves, the intellectual choices available to patrons shrink and become standardized.

To be sure, the standardization process begins with selection. For example, in a study of how many "best general-interest books" of 1999 and "best academic books" (including books about the "democratic process") are held by 20 public libraries across the United States, John Budd and Cynthia Watt have shown that, while 29 of the 30 "best general-interest books" are held at rates of more than 70% by the surveyed libraries, only 8 out of 19 "best academic books" are held at rates of more than 70% by the surveyed libraries [22]. These figures suggest that many public libraries initially have a uniform range of titles for patrons to choose from. But that range could shrink even further when the books in both "best" categories are weeded to reflect circulation data and to make way for new "best books." Public librarians will have to determine whether these standardization processes are positive and negative, and act accordingly.

Weeding may also contribute to making public library collections ephemeral. There is no denying that many public library patrons seek current materials, yet there are also users who desire older material, whether for pleasure or historical research. Although many respondents emphasized that it is the role of academic libraries and archives to preserve older materials, it is also true that such research venues are not always accessible to the public, whether because of distance or lack of institutional affiliation. As Matthew Simon observes, even though the public library is now perceived as a community and social center, a play space,

a study hall, a museum, and a cultural center, it also remains a "window on the world" and a "warehouse of explosives . . . whose shelves are ranked with the most furious combustibles in the world—the brains of men" [23]. Based on their views about weeding, many public librarians operate under the assumption that the only worthy "furious combustibles" are those of recent vintage. This may not necessarily be the case. If the library is to remain "a place of energy . . . where one discovers a different but more valuable text while looking for a particular title" [24], it is important to understand fully how weeding does, or does not, contribute to making the library intellectually dynamic for all members of the public.

Acknowledgments

We would like to acknowledge Moya K. Mason, who provided research assistance for this project. We also acknowledge the students enrolled in the class FIS 2127 Collection Development and Evaluation at the University of Toronto during the 2000 Fall Term. Their names are listed in Appendix A.

Appendix A

Names of students who sent out surveys for this study

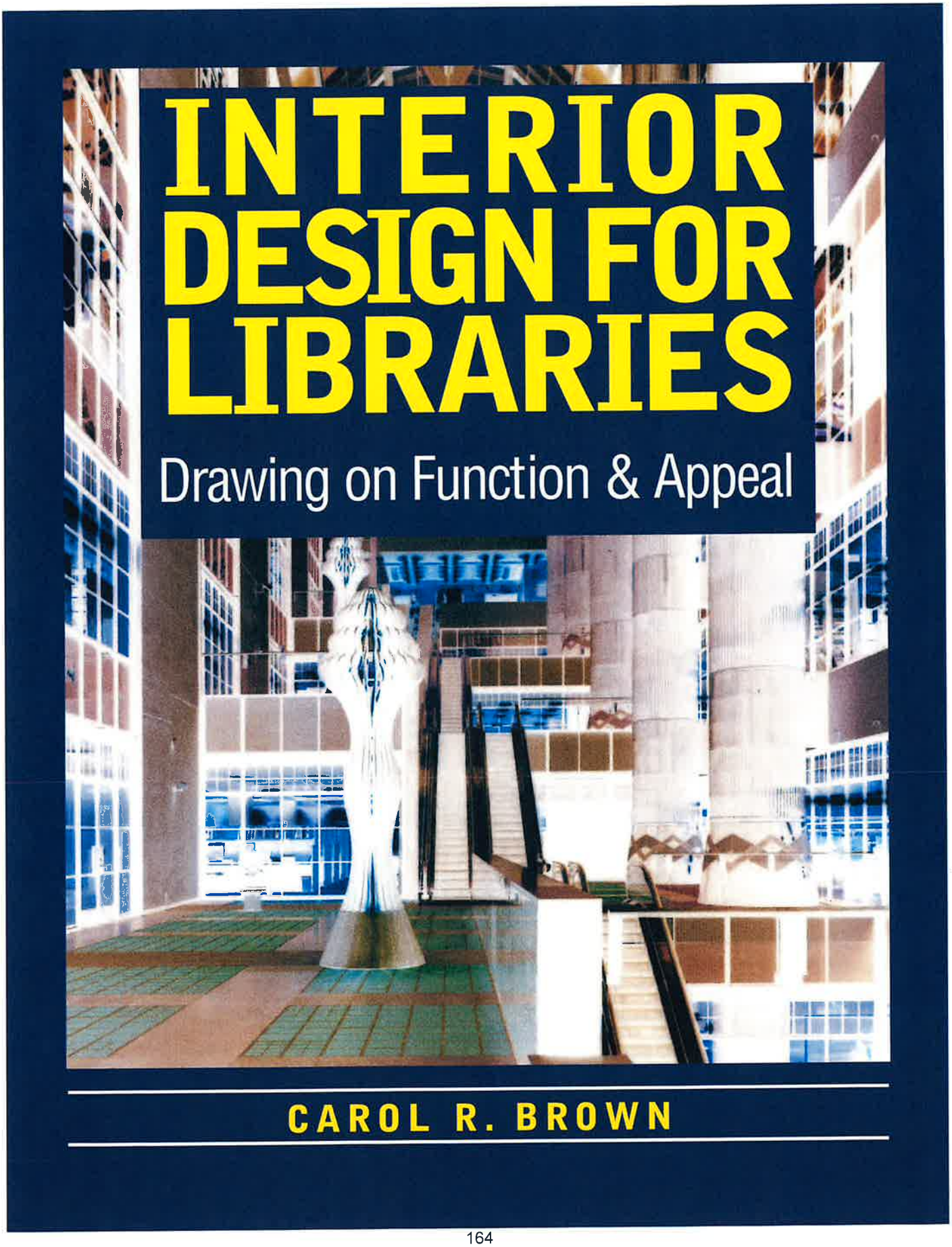
Esther Atkinson
Joanne Bainbridge
Robin Bergart
Maryann Breukelman
Keren Dali
Helen Flint
Denis Frias
Glenda Garbutt
Heather Glerum
Viveca Gretton
Susan Kun
Alexander Magno
Jo-Ann McQuillan
Loyd Mbabu
Patricia Richl
Mark Rose
Jessica Ross
Brian Vetruba
Carolyn Ziegler

References

[1] Roy, L. (1994). Weeding. In: A. Kent, & H. Lancour (Eds), *Encyclopedia of library and information science* (p. 352–98). New York: Dekker (Volume 54, Supplement 17).
[2] Ibid., p. 355.
[3] Breisch, K. A. (1997). *Henry Hobson Richardson and the small public library in America: a study in typology* (p. 222–7). Cambridge, MA: The MIT Press.

[4] Miller, J. W. (1984). Throwing out belles lettres with the bathwater. *American Libraries*, *15* (6), 384–5.
[5] Slote, S. J. (1997). *Weeding library collections: library weeding methods* (4th ed), (p. 49–50). Englewood, CO: Libraries Unlimited.
[6] Segal, J. P. (1980). *Evaluating and weeding collections in small and medium-sized public libraries: the CREW method* (p. 3, 20). Chicago: American Library Association.
[7] Ibid., p. 10.
[8] Slote, S. J. Weeding library collections, p. 63.
[9] Carey, C. (1992). Survival weeding. In: B-C. Sellen, & A. Curley (Eds), *The collection building reader* (p. 139–40). New York: Neal-Schuman Publishers.
[10] Jacob, M. (2001). Weeding the fiction collection: or should I dump Peyton Place? *Reference & User Services Quarterly*, *40* (3), 234–9.
[11] McKee, P. (1981). Weeding the Forest Hill Branch of the Toronto Public Library by the Slote method: a test case. *Library Research, 3*, 283–301 (p. 298).
[12] Moore, C. (1982). Core collection development in a medium-sized public library. *Library Resources & Technical Services*, *26* (1), 37–46 (p. 41).
[13] Roy, L. (1990). Weeding without tears: objective and subjective criteria used in identifying books to be weeded in public library collections. *Collection Management*, *12* (1/2), 83–93 (p. 90).
[14] Rouse, R. (1971). Within-library solutions to book space problems. *Library Trends*, *19* (3), 299–310.
[15] Futas, E., & Tyron, J. S. (1990). Scheduled reference collection maintenance: the Rhode Island experience. *Reference Librarian, 29*, 69–76.
[16] Truett, C. (1990). Weeding and evaluating the reference collection: a study of policies and practices in academic and public libraries. *Reference Librarian, 29*, 53–68.
[17] Engeldinger, E. A. (1986). Weeding of academic library reference collections: a survey of current practice. *RQ*, *25* (3), 366–71.
[18] Ritzer, G. (1993). *The McDonalidization of society: an investigation into the changing character of contemporary social life*. Thousand Oaks, CA: Pine Forge.
[19] Quinn, B. (2001). The McDonaldization of academic libraries? *College & Research Libraries*, *61* (3), 248–61 (p. 252).
[20] Segal, Evaluating and weeding collections, p. 3.
[21] Baker, S. L. (1993). *The responsive public library collection: how to develop and market it* (p. 66–7). Englewood, CO: Libraries Unlimited.
[22] Budd, J. M., & Watt, C. (2002). "Do you have any books on . . . ": an examination of public library holdings. *Public Libraries*, *41* (2), 107–12.
[23] Simon, M. (2002). Will the public library survive the Internet? What patrons value in public libraries. *Public Libraries*, *41* (2), 104–6. Simon quotes Christopher Morley's *The Haunted Bookshop* (1919).
[24] Ibid., p. 106.

Appendix
CORNETTE09


INTERIOR DESIGN FOR LIBRARIES
Drawing on Function & Appeal
CAROL R. BROWN

INTERIOR DESIGN FOR LIBRARIES

Drawing on Function & Appeal

CAROL R. BROWN

AMERICAN LIBRARY ASSOCIATION
Chicago and London
2002

While extensive effort has gone into ensuring the reliability of information appearing in this book, the publisher makes no warranty, express or implied, on the accuracy or reliability of the information, and does not assume and hereby disclaims any liability to any person for any loss or damage caused by errors or omissions in this publication.

Trademarked names appear in the text of this book. Rather than identify or insert a trademark symbol at the appearance of each name, the authors and the American Library Association state that the names are used for editorial purposes exclusively, to the ultimate benefit of the owners of the trademarks. There is absolutely no intention of infringement on the rights of the trademark owners.

Composition by ALA Editions in Franklin Gothic and Bookman using QuarkXPress 4.1 for the PC

Printed on 50-pound white offset, a pH-neutral stock, and bound in 10-point coated stock by McNaughton & Gunn

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1992. ♾

Library of Congress Cataloging-in-Publication Data

Brown, Carol R.
Interior design for libraries : drawing on function and appeal / by Carol R. Brown.
p. cm.
Includes bibliographical references and index.
ISBN 0-8389-0829-2 (alk. paper)
1. Library buildings—United States—Design and construction. 2. Library decoration. 3. Library fittings and supplies. I. Title.
Z679.5 B76 2002
727.8'0973–dc21 2002001325

Copyright © 2002 by Carol R. Brown. All rights reserved except those which may be granted by Sections 107 and 108 of the Copyright Revision Act of 1976.

Printed in the United States of America

06 05 04 03 02 5 4 3 2 1

CONTENTS

ACKNOWLEDGMENTS v
INTRODUCTION vii

1 Basic Considerations in Library Interior Design 1
2 The Planning Phases of a Library Building Project 9
3 Basic Interior Design Issues 24
4 Library Furnishings 43
5 Signs and Wayfinding 87
6 Selecting Materials, Finishes, and Colors 96
7 The Interior Design of Spaces for Children and Teens 109
8 Lighting and Acoustics 118
9 Conclusion 124

APPENDIXES
A Interview Questions for Obtaining Information from Library Staff 127
B Directory of Contributors 135

BIBLIOGRAPHY 137
INDEX 139

ACKNOWLEDGMENTS

I would like to thank all the individuals who contributed either directly or indirectly to the preparation of *Interior Design for Libraries*. Most of my work on this book occurred after I left full-time consulting and took a position at the Fort Bend County Libraries (FBCL), headquartered in Richmond, Texas. Special thanks, therefore, go to Jane Powell and Roman Bohachevsky (current and former county librarians, respectively), who supported both my consulting work and the writing of this book. Several other Fort Bend County Libraries staff members assisted in my research. Molly Krukewitt, coordinator of youth services, was my advisor in matters concerning library service for children and teens. Jill Sumpter and Danea Hall of the library's technology staff helped with topics involving computers. Linda Lupro, formerly a staff member of the FBCL, provided me with research assistance for several years. I especially want to express my appreciation to Joyce Claypool Kennerly, who served as my general advisor, local editor, and technical consultant throughout the preparation of this book. I wish to thank all my other friends at the Fort Bend County Libraries who patiently listened to me talk about "the book" for two years.

I would like to thank Dana Rooks, director of the University of Houston Libraries, who took the time to discuss academic libraries with me. Thanks also to Joanne Downing and Eric Brown, who assisted with proofreading the manuscript.

I am extremely grateful to David Malman, of Architectural Lighting Design, who generously allowed me to use his information on lighting. Many architects and interior designers (and their staff) assisted me by providing information and photographs. The members of two architectural firms in particular spent hours with me discussing projects and their approach to the interior design of libraries. In this regard I would like to thank Denelle Wrightson and Maureen Arndt of Phillips Swager Associates for sharing information and numerous photographs and drawings for this book. Special thanks also go to Lynn Barnhouse, Jack Poling, and Jeff Scherer of Meyer, Scherer, and Rockcastle for supporting my work by providing information and photographs. Thanks especially to Jack for reading the manuscript and making excellent suggestions for changes.

Other architects and interior designers who assisted with this book include Daria Pizzetta and Deborah Kirschner of Hardy

Holzman Pfeiffer Associates; John Focke and Beth Walker of Ray Bailey Architects; Chuck Witt and Tammy Durrum of Johnson Romanowitz Architects; Ken English of Hermes Architects; Kirksey; Lynn Metz and Nicky Vidaurre of F & S Partners; and Bev Moris of Simon, Martin-Vegue, Winkelstein, Moris.

I would like to thank all the photographers who graciously allowed me to include their copyrighted work without paying usage fees. Their names are included with the photographs that they contributed to this book.

Several furniture manufacturers and sales representatives also provided photographs of their products for this book. I would like to thank Jerry Blanchet and MJ Industries; John Lumley and APW-Wright Line; Jill Randolph and ASI Sign Systems; Anne Kik and the Worden Company; Aaron Moser and Thos. Moser Cabinetmakers; Penny Schmitz and Libra-Tech; and Ty Peterson and Fetzers' Inc.

The names and contact information for all of the aforementioned appear in appendix B.

INTRODUCTION

The subject of interior design is relevant to both planning new and expanded library buildings and to renovating existing library spaces. The responsibility for interior design on a project may lie with an architectural firm, an interior design firm, or with architects and designers working together. In many smaller building projects, responsibility for the design of a library interior falls to the library director or to members of a library board.

The information in this book is intended for library planners, for architects and designers who have not built libraries in the past or who need to update their knowledge of library interior design, and for architects who are interested in hearing about interior design from a librarian's perspective. The information on library design presented here will provide first-time library planners with some basic resources needed to complete their project successfully. Most librarians will find themselves responsible for a renovation or a new building project at some time in the course of their careers. The information here should be helpful in making interior design decisions for library spaces of all sizes.

Hopefully, the topics discussed in this book will prompt a dialogue between the design professionals and the library staff working together on a building project. Architects and interior designers should listen carefully to staff requirements regarding adjacencies, visual control, and library policies and procedures. In turn, library staff, board members, and organization officials should allow design professionals to carry out their work without constant interference. Design professionals who have planned libraries successfully in the past should not assume that a library built several years ago can be a model for a library built in the 21st century.

The information presented here is relevant to any kind of library—academic, public, school, and special. The commonalities of interior design for libraries are greater than the differences. The missions of different types of libraries result in different spatial relationships within each type of building, but interior design issues are the same. All types of libraries have service desks, computer workstations, seating for users, shelving or storage units for materials, and staff work areas. All successful libraries are designed to provide comfort, convenience, attractive surroundings, and safety in functional spaces.

I am a librarian, rather than an interior designer, but over the course of more than 20 years of library consulting work, I have gathered

information on the interior planning of libraries through working with dozens of architects and designers on numerous library projects. My additional research for writing this book involved interviewing interior designers and architects who specialize in library projects and studying the relevant literature. The information provided here is based on my own experience and knowledge. I freely acknowledge that other individuals may have views entirely different from the ones given here that may also result in successful library interior design.

By way of background for anyone unfamiliar with the role of the various design professionals in a building project, architects usually have an academic degree in architecture and are licensed by examination in the states in which they work. The architect is hired and is under contract by the owner of the project to develop all of the drawings and written specifications that are needed to construct or renovate a building. The architect hires any consultants needed for the project, including structural, mechanical, and electrical engineers and, sometimes, acoustical and lighting consultants. The architect usually puts the construction contract out to bid. Often the architect's scope of work also includes overseeing the construction of the library.

The work of an interior designer often overlaps the work of the architect. An interior designer may have an academic degree in interior design, and some U.S. states require interior designers to be licensed. Interior designers usually work on the details of the layout of the library, select and price furnishings, and are involved in choosing finishes for all aspects of the building. In many successful projects, the interior designer is involved in all aspects of planning the building, from programming to the library's opening day.

In many projects, the roles of architect and interior designer are not so clear-cut. In some architectural firms, architects provide interior design services, as well as planning the building. Many architectural companies have their own interior designers on staff; these designers may have architectural degrees as well as a background in interior design. In other cases, the architect or the library owner will hire an outside interior design firm to provide these services.

On some projects, a library consultant may be part of the planning team. A library consultant is often a person with library management experience who serves as a liaison between the local planning team and the design professionals. Some consultants are architects or interior designers. Sometimes the consultant is hired by the architectural firm and sometimes by the library. The consultant may be involved with programming and layout and may provide review services throughout the project.

Throughout this book, the word "staff" refers to library staff. The term "local planning team" refers to the individuals representing the library owner during the planning process. The team may include library staff; city, county, or organizational officials; members of library or other boards; faculty members; and other individuals designated to work with design professionals (architects and interior designers) during the planning of new or renovated library spaces.

Basic Considerations in Library Interior Design

CHAPTER 1

Interior designers work with many of the same fundamental elements of design used by painters, sculptors, and other visual artists. Academic training in interior design usually includes a course on the basic elements and principles of design. For the interior design of libraries, the principles of design are used to create library spaces that are both functional and aesthetically pleasing.

An experienced interior designer uses the fundamentals of design in a manner that seems intuitive. When selecting furnishings, the basic design elements of form, size, and scale enter into the decision-making process. "Form" refers to the basic shape of an object (or a space) generated by lines, planes, volumes, and points. Individual furniture items are chosen with appropriate size and scale so that they are correctly proportioned to the overall size of the space and to other objects within it. Scale is an important consideration in regard to who will use the selected furnishings. For example, in order to provide furniture of the appropriate scale for children, the tables and chairs in a youth area are smaller than similar furniture in an adult area. Other design elements and principles considered in interior design are balance, harmony, rhythm, and emphasis.

While successful library interior design results from the application of the same elements and principles used in the interior design of any type of building, library design is distinctive because of the unique mission of all libraries. Libraries are usually nonprofit institutions that exist for the benefit of a company, an educational organization, or the residents of a governmental jurisdiction. While a larger organization or government pays for library services, users of a library rarely pay directly for services. A library has a particular mission to support the organization of which it is a part: a public library provides services to local residents; a school or academic library supports the curriculum of an educational organization; and a special library supports the work of a company or institution. A library is, therefore, a service organization.

Libraries are similar to modern bookstores in many ways. Both libraries and bookstores have ranges of bookstacks, comfortable seating areas, and service desks. Libraries also have work areas that are similar in design to those of commercial offices. Increasing use of computers and distance education in libraries has resulted in the

demic libraries, are frequently located adjacent to windows so that users have a view of the outside while they are reading and studying.

Some common adjacencies in a public library relate to children's areas. Young children should not have to walk through adult spaces to enter the children's area, to walk to the circulation desk, or to use a rest room. If the library's community meeting room is used for children's story times and activities, the meeting room should be located adjacent to the children's room. Within a children's space, school-age young people should not have to walk through the preschool area to get to their own materials and services.

In a public library, the relationship of the children's and adult areas is an interesting consideration. In one library system, the children's area in a branch library was directly adjacent to the adult area. Users and staff complained frequently about the noise from the children; however, adults and children moved easily from one space to the other. In another branch, the library was L-shaped, with the children's area in one leg of the "L" and the adult area in the other leg. Users could access the circulation desk from the children's area without passing any adult materials. The staff believed that this arrangement had an adverse effect on the use of adult materials: adults brought children to the library, checked out children's materials, and didn't bother to go a few extra steps to the adult collections.

Adjacencies within a library are also determined by the need for visual control, which involves security, and the need to observe users who may need help. In small and medium-sized public libraries with no security staff, the layout of stack and seating areas may be determined by the need for visual control. Stacks can be lined up in a direction that allows staff an easy view down the aisles. Low stacks and seating can be placed in front of tall stacks in relation to service desks in order to prevent higher bookstacks from obscuring a clear view of seating areas or computer workstations from the desk. In order to maximize a small staff, a computer-training room or study rooms may have some glass walls and open off the reference area to give the staff visual control of the area.

Noise control is another defining factor in regard to locating spaces in the library. At one time, libraries were considered to be quiet spaces, with noise confined, for example, to the meeting room. Now, many library users have new attitudes about what is an acceptable noise level in a library. Extensive use of computers in libraries has resulted in more conversation between staff and users and between several users collaborating at a single computer. In determining adjacencies, consideration should be given to locating noisy library functions next to each other: circulation desks, browsing areas where users select audiovisual materials, and, possibly, the entrance to the children's area.[1] Quiet areas, such as reading and study space and periodical areas, are located away from the noisy functions. Computer-free rooms, quiet reading rooms, and individual study rooms placed in adult areas offer spaces where users can read in a quiet environment.

inclusion of academic classrooms and computer labs in libraries. Only libraries, however, are designed with a unique combination of bookstacks, banks of computer workstations, classrooms and training areas, and meeting spaces that are "free" to users.

Because libraries are service organizations, the successful design of a library of any type (school, public, academic, or special) is based on careful consideration of several factors that enhance the use of the library by its clientele and support the work of the staff. Two of the most important factors are those of relationships, or adjacencies, and the movement of people and materials through the library. Architects, interior designers, consultants, and other members of planning teams should consider these and other factors during the design process.

Relationships, or Adjacencies

The terms "relationships," or "adjacencies," refer to the space-planning process in interior design. Space planning involves determining how large spaces within a building (like rooms and designated areas) will be arranged and relate to each other within each larger area. Likewise, it involves determining how furnishings and equipment will be arranged and relate to each other within each room and area. In other words, determining the relationships in a building involves deciding what spaces and functions will be adjacent to other spaces and functions.

Carefully planned relationships within a library serve to ensure that a facility will function successfully for both the public and the staff. A logically arranged library will be convenient and comfortable for users, will enhance self-help and wayfinding, and will provide a productive environment for the staff.

The relationships within a particular library are determined by studying that library's philosophy of service, its use of materials and services, and its policies and procedures. For example, the procedures for signing up for use of a computer in a public library or for obtaining reserved materials in an academic library are relevant to determining the relationships between service points and other library functions. As public-use computers have increased in number in all types of libraries, library philosophies have generally dictated that staff assist users at computer workstations from a nearby service desk. Online catalogs, by contrast, are frequently located throughout the library in stack areas to allow easy access to the catalog.

In most libraries, a circulation desk is located close to the main entrance, so that users can return books and make inquiries upon entering the building and can check out materials on the way out of the building. An information or reference desk may also be located within view of the main entrance, so that users can ask for directions when they come into the library. Collections of current magazines and newspapers in public libraries, and tables and carrels in aca-

Because it has fewer materials and services, the smaller a library building is, the easier it is to determine relationships within the space. In a large academic or public library, however, determining relationships may involve studying the locations of departments and collections on several floors. The design of such a building must include, for example, consideration of how users access the materials (open or closed stacks), what subject areas are generally used together, and what is most convenient for users.

In a multilevel library, the adjacencies within a single floor must be planned. These adjacencies may include the relationship of the information desk to reference book collections and closed stacks, the relationship of faculty and staff offices and carrels to designated subject specialties, the relationship of online catalogs to ranges of open stacks, and consideration of where to place information desks for visual control.

The relationships between public and staff areas are based on consideration of library procedures and policies. The adjacencies should support the work of the staff as they provide service to the library's users. Generally, staff work spaces are close to the public-service areas relevant to the work of a particular staff. For example, in most libraries, the circulation desk is usually adjacent to the circulation work space, so that staff may move easily from staff to public areas as additional assistance is needed at the desk. Likewise, reference work space is usually located close to the reference desk. For the convenience of the staff, technical-services work spaces in small libraries are located next to the receiving area. Often, the director of a small library prefers to have his or her office close to the circulation desk. In an academic library with subject specialists, faculty members or specialists responsible for particular collections may have an office near their designated subject areas.

Another important consideration in planning staff areas is sometimes ignored by architects. In small libraries (or any library, for that matter), staff rest rooms should not open directly off the staff break or lounge room. Pleasant eating experiences are not enhanced by the sounds and odors from a nearby rest room.

In a large multistory building, it is imperative that the freight elevator be easily accessible from the loading dock and receiving area. If the technical-services department is located on an upper floor, the freight elevator must open onto this floor. Ideally, the freight elevator will open directly into the technical-services area.

The relationships within particular staff areas should be planned carefully. In a technical-services area, for example, the furniture and shelving layout should reflect the workflow and the movement of new materials through receipt and check-in, to cataloging, and finally to processing. In a small library, it may be necessary to lay out the space carefully to distinguish between the location where new, unprocessed materials come into the technical-services area and the location where processed materials are housed when they are ready to go to the shelves.

Movement of People and Materials through the Library

In an effort to design an aesthetically pleasing building, consideration of the functional importance of how people and materials move through the library should not be forgotten. ("Circulation through the building" is the term frequently used for this aspect of a facility; however, in library lingo, "circulation" more often refers to the check-out of materials.)

When designing the interior of a library, members of the planning team should take an imaginary walk through all parts of the building. The tour may be as simple as "walking" through the final layout of the building on paper, or the tour may be a virtual walk through the building using a computer-generated model.

In a small public library, the movement of materials and people is accomplished by planning the adjacencies as discussed in the preceding section. Library users can usually move easily from the building entrance to the adult or to the children's area or from the entrance to the community meeting room.

In a large building, however, careful planning of the movement of people and materials involves considering vertical movement from floor to floor, as well as horizontal movement across a single story. In one disconcerting situation in a large public library, users standing on one side of the building could look across a large atrium to the other side of the same floor; however, no obvious path from their side to the other side of the floor was visible. Neither users nor staff should experience the inconvenience of having to walk down stairs, or take an elevator down, and then walk back up stairs, or take an elevator back up, to get to the other side of the same floor. Library users in any building should be able to follow directions to any function in the building by way of a straightforward, logical path.

A library's staff move collections of books, periodicals, and audiovisual items around a building on a daily basis; the layout of a library should facilitate such movement. Logical arrangement of the building should support moving materials from the loading dock or receiving area to the technical-services area or, in the case of donated books, to a storage area. Both the vertical and horizontal movement of processed materials from technical-services areas to stack areas should be made convenient by providing adequately sized doors, aisles, and elevators, and by providing direct routes from processing areas to stack areas. Likewise, the route for moving returned materials from staff check-in and sorting areas back to the stacks in public areas should be logical and convenient. Doors or passages from staff areas to public areas should always be designed to allow for the convenient passage of a loaded book truck manned by a single person. In all but the smallest libraries, loaded book trucks should be moved from the sorting area to the public area through a door that lies directly between work and public areas; trucks carrying materials ready to be returned to the shelves should not have to travel through the busy area behind the circulation desk.

Other Interior Design Considerations

In addition to achieving functionally effective adjacencies and circulation, successful library design should result in attractive and comfortable spaces. In the second edition of *Interior Design*, John Pile states, "In an ideal world, every space that we enter and use would be designed not only to serve its purpose well but also to offer a visual experience that would be appropriate, satisfying, and even memorable."[2] An effectively designed library should offer just such a visual experience. (See figures 1 and 2.)

Furnishings, materials, colors, and lighting are just a few of the design elements in a building that make it an inviting place in which to be. In public libraries, one of the catchphrases often used in recent years is "the library as destination." In other words, library staff want people to come to the library because it is a comfortable, attractive, and pleasant place to spend some time, like a modern shopping mall, a park, or a movie theater.

A comfortable library is one in which materials and services are arranged in a logical manner, signage and other wayfinding elements assist with self-help, and furnishings are appropriate for their intended use. For example, satisfactory wayfinding devices to help the user include a clear and consistent sign system, a logical room layout that enhances self-help, visual clues such as color-coding of signs and furnishings, and changes in the color of carpet that indicate varying library areas. Shelving should be arranged in a logical manner that will assist library users in finding desired materials.

In a comfortable library, computer workstations may be at standing height for quick checks of the catalog or at seated height for



FIGURE 1

Main Library renovation, Texas Tech University, Lubbock, Texas. Architects, F & S Partners and Parkhill, Smith & Cooper, Inc. Used by permission of the photographer. Photo credit: Robert Suddarth Photographer.

involved Internet or database searching. Ergonomic task chairs may be provided at computer workstations, while standard reading chairs may be provided in quiet study areas. Reading and study areas may include both seating at tables and seating at individual study carrels. In children's areas or school libraries, chairs with several seat heights are provided for young people of all ages.

Successful libraries are also safe places designed to accommodate people of various physical and mental abilities. In public libraries, a facility must accommodate people of all ages in a safe environment. Design of a safe library includes consideration of such obvious factors as accessibility, lighting, and signage for emergency situations. Consideration should also be given to matters of flammability and toxicity when selecting carpets and upholstery; to the stability of chairs and shelving; and, in a children's area, to sharp corners.

Maintenance is an important design issue in nonprofit organizations, where funding is not often available for replacing worn and dirty carpets and for reupholstering, refinishing, or replacing furnishings. Maintenance factors are especially important in public or academic libraries with heavy use. Many materials and furnishings that can be used successfully in libraries with limited use or in residential design are inappropriate for heavily used library buildings. As a rule, libraries should not be built with interior elements that cannot be cleaned easily, such as broad, exposed beams visible from upper floors. Many libraries cannot afford the special equipment or contract services that would be needed to clean and maintain hard-to-reach building elements.

One of the major lessons librarians have learned over the last few years is the need to design libraries with internal flexibility. Modular



FIGURE 2

Chatham-Effingham-Liberty Regional Library, Savannah, Georgia. Architects, Hardy Holzman Pfeiffer Associates. Used by permission of the photographer. Photo credit: Robert Batey Photography.

library design with few load-bearing walls is an essential element of a flexible library. Walled spaces in the library must be planned to allow for changes in the future. Acoustical concerns make it necessary, for example, for libraries to design some walls that isolate spaces and that can be easily removed as library functions change. A public library may be designed with a glass "box" near the reference area that is used primarily for computer training; however, in the future, when computer use becomes as commonplace as turning on the television, special training areas may no longer be needed and can be removed.

Libraries planned now must be able to accommodate the unknown technology of the future. Libraries must be designed with an infrastructure that will allow for adding and moving computers easily and for relocating or replacing bookstacks and seating areas. Because we don't know the interior layout of the library in the future, lighting patterns should not be tied to the initial furniture and shelving layout. Good lighting should be available to library users regardless of how the spaces are arranged in the future.

Libraries are usually designed to be used for many years. During the life span of a library building, the staff, philosophies, policies, collections, and services will inevitably change. The library must be flexible enough to accommodate these changes easily and inexpensively. Often, library staff, board members, and officials have to be reminded to set aside their personal likes and dislikes and to concentrate on planning a library that is designed for an unknown future.

Selecting a carpet that was used successfully in the local doctor's office or choosing a furniture design because it looks great in someone's new house is not an effective way to make decisions during the interior design process. The recommendations of professionals who can take a more objective view of the design—architects, interior designers, and consultants—should be carefully considered in making final interior design decisions.

NOTES

1. Another philosophy suggests that high-interest browsing materials should be located beyond bookstacks, so that users may find books in which they are interested while walking to the browsing area.

2. John F. Pile, *Interior Design*, 2nd ed. (New York: Harry N. Abrams, 1995), 35.

The Planning Phases of a Library Building Project

CHAPTER 2

Library building projects grow out of the realization by staff and users that a library is inadequate and out-of-date. The library can no longer carry out its mission and fulfill its long-range goals in the existing building. The bookstacks are all full; more computers, reader seating, and perhaps more meeting and training spaces are needed; and the library looks old and shabby. The library may no longer be large enough because its parent educational institution or governmental jurisdiction has grown substantially since the library was built. In recent years, many building projects are the result of more general changes in libraries. The computerization of library operations and resources has rendered building space insufficient and power and data distribution difficult to accomplish in older buildings.

Assessment and Recommendations for Improvements

Effective building projects—new buildings, expansions, and renovations—begin with an assessment of the existing building and a determination of what is required in the new or renovated space. Assessments and recommendations for building projects may be undertaken by an outside consultant or by a local planning team that may include library staff, faculty members and officials, and board members. Public libraries may use processes discussed in several books about library assessment, such as *Determining Your Public Library's Future Size,* by Lee Brawner and Donald Beck.[1]

The task of assessing a current library leads to the identification of what is generally needed in a new building. In order to determine the overall size of the new space, it is necessary to make decisions early in the planning process about the size and requirements of each individual functional space in the new building. The planning team will have to answer dozens of questions like the following:

How many items should be housed in the new space? In other words, what should be the capacity of the building for books, audiovisual items, magazines, and other types of materials? What is the expected rate of acquisition and deacquisition (weeding) of materials?

How many seats for library users should be provided at tables and carrels and in lounge chairs? What is the maximum number of computer workstations required at locations throughout the building?

What special spaces, such as local history and genealogy collections, are needed?

How many and what types of meeting and training spaces are needed?

How many service desks will be needed?

What types and how many faculty and graduate student carrels and offices will be needed?

A local planning team, a consultant, or an architect uses the answers to these and many similar questions to determine the overall amount of space needed. Architects and consultants who have worked on libraries previously can apply square-foot values to a library's specific functions based on their past experience with library space planning or by applying standard formulas for library space to those functions. Square-foot formulas for many spaces and furnishings can be obtained from *Building Blocks for Library Space: Functional Guidelines.*[2]

Programming and Funding

Based on the assessment and recommended requirements, preliminary programming of a new building is completed in order to establish the amount of funding needed for the project. A library building consultant sometimes develops a preliminary program. After a budget is developed, funding is acquired. (Obtaining funding is often the most difficult and time-consuming part of a project.)

The overall project budget will include the cost of construction and all interior elements, such as carpet and other floor coverings, lighting, and millwork. The budget will also include an amount for furniture and shelving. Furniture and shelving budgets are often based on a per-square-foot allotment. In developing a budget for furniture and shelving, the following items should be considered:

The expected level of quality of the furniture.

The aesthetic requirements of the project.

The amount of standard furniture that will be used, as compared to custom-designed and -built furnishings that will require additional engineering or testing.

The expected quality and cost of materials and finishes to be used.

The amount of built-in electrical systems and accessories that will be specified with the furnishings.

The items that are to be included in the furnishings budget. (For example, service desks may be included in the construction

budget as millwork items or may be included in the furnishings budget.)

Any existing furniture items that will be reused in the new or renovated building and any costs associated with refinishing these items.

Any expected increase in the cost of furnishings from the time the budget is established to the time the items are purchased.

After funding is obtained, a site has been acquired, and an architectural team selected, preliminary programming is refined and expanded by the architect working with an interior designer. The architect and designer review the initial assumptions of preliminary programming and provide the client with options for planning a functional library.

The final building program states the building requirements and serves as a guide during the design process for local planning team members, architects, interior designers, and other design professionals. As a project progresses through schematic design and design development, the planning team can check the plans, as drawn, against the information outlined in the building program, to ensure that the architect has carried out the requirements of the program.

Successful programming of both the architectural and interior design elements of a library begins with extensive dialogue between the design professionals and the library staff. The architect, interior designer, or library consultant programming a new or renovated building must spend time on-site in the existing building, meeting with staff and local planners in groups or individually. For small projects, an architect or a consultant preparing a building program may collect information during one site visit that lasts a day or two. For very large projects, a design team or library consultant may make several trips to the site and spend days, or even weeks, conducting community focus groups and meeting with local staff and planners before preparing a building program.

On small projects where a design team may have little experience building libraries, the architect and interior planners must meet with library staff and the local planning team to find out how the library operates and how the building can best serve the needs of expected library users. The architect or consultant programming a new or renovated building must obtain answers to the following types of questions. (Many of these questions are similar to those asked earlier when the overall amount of space for a new library was determined; however, more detailed information is needed at this phase of the project.)

Who uses the library; e.g., students and faculty of an academic institution, community residents of all ages, elementary and high school students and teachers, engineers working in the parent company, art students at nearby universities, etc.?

How is the library used; e.g., for quiet study as well as computer searching, to research case law, for children's activities, to

complete homework and study for exams, to prepare for teaching classes, etc.?

How many staff members will work in the completed library? Where in the building will they work? How will they complete their work? Will they work "on the floor" but also have a workstation somewhere else in the building? What size of work area does each staff member need? How should work areas relate to public areas? What support-service areas are needed (technical services, public information, automation services, etc.)?

How does the library operate on a day-to-day basis?

What public services will be offered by the library; e.g., reference, circulation, programming for adults and children, computer and bibliographic instruction, interlibrary loan, mobile outreach services, assigned study space, distance education, etc.?

What size are the collections to be housed in the library initially? What types of materials will be included in the collections?

How many computers will the building hold initially? Where will the computers be located in relation to collections and service desks?

What special areas will be required in the library; e.g., local history and genealogy room, media production areas, auditorium, green rooms for theatrical productions, Friends areas, etc.?

It is important for staff to provide very specific answers to these questions. Library staff may need to ask for guidance from the interior designer regarding the format of some answers. For example, if the staff supply information about collection size, the counting method—or formula for determining quantities—should be agreed upon by the library staff and the interior designer. The interior designer or consultant should be able to verify the quantities using the same counting method.

In building projects for large libraries, architects or consultants must also carry out information gathering in order to program a facility that meets the needs of a particular group of users and staff. A design team with extensive library-planning experience should not assume that information collected for similar library projects can be applied directly to other libraries that they design in the future. Experienced library architects can, however, facilitate the programming process by knowing what questions to ask and by offering library staff and the local planning team options in regard to building requirements that have worked successfully in other libraries.

Based on information collected by the design team, the details of the expected interior design of a new library are delineated in the *building program*. The building program notes the relationships or adjacencies required between various functional areas of the building, as well as relationships needed within a single department. The program lists the allocations of space and general requirements within

the building and describes in detail the use, occupancy, and furnishings of each individual space. General requirements may include, for example, accessibility; heating, ventilation, and air-conditioning; lighting; and acoustics. Specific kinds of furnishings and other interior features are described in a separate building program section for each space.

The following is an example of a segment of a building program that describes an adult reference center in a public library.

Subarea	*Square Feet*
Adult reference desk	400
Reference book collection, 8,000 volumes, @ 108 vols. per double-faced section[3]	1,780
Computer workstations, 24 computers with printers, @ 60 square feet	1,440
Computer lab for training, 12 computer workstations, @ 60 s.f.	720
Small group/quiet/tutoring rooms, each with seating for four, 8 rooms, @ 150 s.f.	1,200
Study/tutoring rooms, each with seating for two, 4 rooms, @ 75 s.f.	300
Conference room	300
File cabinets, 8, @ 20 s.f.	160
Atlas case	40
Dictionary stand	25
Reader seats at tables for four, 32 seats @ 30 s.f.	960
Public copy room/alcove with counter, paper storage, and work area	200
Total size	7,525

Occupancy

Seating for 36 at computers; 32 at reader seats at tables and carrels; 40 at tables in small rooms; maximum of 3 staff members at one time

Adjacencies

The reference desk should be adjacent to the reference book collection, the computer workstations, and the computer lab. If possible, the small study rooms and the young adult area should be visible from the reference desk. The reference work area should be adjacent to, or close to, the reference desk.

Requirements

The reference center will include most of the adult services that require assistance for use. A reference desk

located in the center of the area will be large enough to accommodate three people working there at one time. The reference desk should be visible from the entrance to the reference area. At least one 36"-wide section of the desk will be between 30" and 32" high, for wheelchair access required by the 1990 Americans with Disabilities Act (ADA). Privacy issues should be considered when designing the desk. One end of the desk, for example, may be designed as a special workstation for private discussions between a staff member and a library user. Ready-reference shelves and a work counter may be located behind the reference desk.

The reference book collection should be located on double-faced sections of shelving, preferably no more than 48" high, next to the reference desk. Equipment tables to hold 24 computers with printers for the catalog and reference sources in online and CD-ROM formats should be located close to the reference desk. The tables will be seated height; some will accommodate wheelchair access. Reader tables and carrels in the reference center should be equipped with tabletop access to power and to the library network.

A computer lab will be located in a separate walled room adjacent to the reference area. The lab will have glass walls above 42". When the room is in use for a training session, the door will be closed. When private training or classes are not being presented, the door to the lab will be open and the computers will be available as additional workstations for public use. The lab will also contain a covered white markerboard; an electrically operated, ceiling-mounted projection screen; and a mobile equipment cart or desk.

Small group or quiet study rooms will be located within view of the reference area. The rooms should have glass walls to allow for visual control from the reference desk and should be soundproofed. Each room will hold a table and two to four chairs. The rooms should be wired to allow for the use of laptop computers. The conference room should be supplied with a covered white markerboard and should have a counter and small sink behind closed doors to allow for coffee-making in the room.

A circulation desk and work area might be described in a building program as follows.

Adjacencies

A book-theft detection system will be located at the entrance/exit to the main part of the library. Requirements for the theft-detection system should be discussed with the appropriate vendor.

The circulation area should be close to the browsing area where high-interest items are stocked. The self-check station should be close to the circulation desk and visible from it, but should not be a part of the desk.

The circulation desk must be located adjacent to the foyer and visible from the library entrance. The desk must be directly adjacent to and open into the circulation workroom. The office for the circulation manager will be located inside the workroom. The desks for circulation staff and shared space for part-time staff should be in the area nearest to the door to the circulation desk.

Preferably, the check-in station (a computer workstation), sorting area, book truck storage, and the two book-drop areas will be adjacent to each other. The book return from the foyer should drop directly into the work area close to the check-in station. The drive-up book-return room should be in the same general area. Also, when planning the location of a drive-up pick-up window, consider that the pick-up window should not block access to the drive-up book return (and vice versa).

Requirements

Twenty to 25 feet of clear space should be left in front of the circulation desk to allow room for queuing. The location and shape of the desk should be planned to expedite the movement of library users waiting to conduct business at the circulation desk. The staff may prefer a desk with a zigzag design that indicates where patrons line up. Regardless of the design of the desk, the important matter of how people will line up in front of the desk should be considered and discussed with the Library Director.

Because staff will spend several hours at a time standing and working at the desk, the floor behind the desk should be cushioned in some manner. Eight to 10 feet of space should remain empty behind the circulation desk to allow for the movement of staff and book trucks. Consider designing the desk with special "docking areas" for book trucks and delivery bins. A door directly behind the circulation desk should lead to the circulation workroom. The door should not, however, provide a view into the workroom; people waiting at the circulation desk should not be able to look into the workroom. Offset doors or a short hall should lead from the circulation desk to the workroom.

The circulation desk may be constructed by a library-furniture manufacturer and may not, therefore, be part of the construction contract. The desk will, however, be planned in consultation with the architect at the same

time the building is designed. The circulation desk will include a multicircuit electrical system that must be hardwired to the building power at one point.

The circulation desk must be large enough to accommodate a maximum of six people working there at one time. Staff will be checking out materials, registering users, and handling returned materials and fines. A workstation that matches the desk may be located on the wall behind the desk.

Several sections of shelving will be needed in the circulation desk area, or in the workroom in a space close to the desk, to hold reserved books waiting to be picked up by users. The section of the desk closest to the library entrance will include a book-return slot. The desk will have a level top (no transaction counter) at standard 39" standing desk height. A minimum of one 36"-wide section of the desk must be wheelchair height (30" to 32" high recommended) to comply with the ADA. This lowered area may be used as a card registration or children's check-out area, as well as providing a wheelchair-accessible station. A stool or chair that can be easily moved will be located next to the lowered area for patrons wishing to sit down while registering. (Alternatively, the staff may prefer a separate registration counter away from the circulation desk.)

The office for the circulation manager will be located in the work area. The office will contain a desk to accommodate a personal computer, a credenza with overhead storage, several bookcases, and a guest chair. The architect should discuss with the planning team the possibility of having some glass in the wall between the workroom and the circulation desk area, and glass in one wall of the office.

The circulation work area will include desks or workstations for full- and part-time staff. If space is available, the workroom will also include a built-in counter, approximately 15' long. The counter should be 29" high and should contain three knee spaces and have three pedestals with drawers below the worksurface. The counter should be 30" deep to accommodate computers. Built-in adjustable shelves should be built above the work counter. (This millwork will be part of the construction contract.) Access to power and data for the counter should be above the worksurface.

One section of the workroom will be the book-sorting area. The area will include sections of steel shelving, 90" high, for sorting returned materials prior to placing them on book trucks to be reshelved. A large open area for parking book trucks should be located next to the sorting shelves. The sorting area should include an area for

storing bins containing books to be delivered to branch libraries.

A small room opening off the circulation workroom will provide access to the exterior drive-up drop for the 24-hour return of materials. The book-return chute should be located in such a manner that it can be accessed from the driver's side of an automobile; ADA standards apply, also. The location and placement of the book-return room (room that items drop into from the drive-up book return) should be discussed with the staff. Book-drop rooms are frequently a target for vandalism. The room must be an enclosed space equipped with a floor drain; two-hour, fire-rated walls; a smoke/heat alarm system; and an automatic fire extinguishing system. A second book/audiovisual-return slot in the foyer of the building will be used to drop returned materials into a depressible book truck in the workroom. Both of these book-return slots should be adjacent to the check-in computer workstation.

A future drive-up pick-up window will be staffed at specific times each week to allow users to drive by to pick up requested items without coming into the library. The pick-up area should have a secure, lockable window that can be unlocked when service is available. At least two sections of double-faced shelving should be located directly behind the window to house items to be picked up by users.

The following is an example of how a technical-services room might be described in a building program.

Requirements

The technical-services area is a nonpublic space where library materials are acquired and prepared for use. Technical-services functions include acquisitions, receiving, cataloging, and processing of all types of library materials.

A receiving area should be located next to the door through which deliveries and shipments of materials will be received. A small open space should be left in the receiving area for the temporary storage of materials and equipment coming into the building. The receiving area should include a table or counter for sorting mail, unpacking boxes, and preparing items for shipping. The receiving area will also need a computer for checking order records and storage space for postage meter, scales, and shipping supplies. Approximately 60 staff mailboxes should be located in the receiving area.

Computers will be used at work spaces throughout the area. A walled office for the head of technical services should be located adjacent to the work area for this staff. The office should have some glass walls to allow for a view into the adjacent work area. The office will contain a desk to accommodate a personal computer, a credenza with overhead storage, several bookcases, lateral files, and a guest chair. The work area will be furnished with approximately seven desks or workstations. The use of office panel-system dividers in the work area should be discussed with the planning team. A copier and a fax machine will be located in the work area.

Because book trucks will be moved frequently around the room, aisles between workstations should be a minimum of 48". The room will also contain the equivalent of 10–12 double-faced sections of 90"-high shelving and one or two worktables.

The power and data distribution system in this area should be as flexible as possible to allow for reconfiguring the space as the library changes. The interior of the space should be planned to reflect the flow of materials: purchase of materials, receipt and check-in of new items, cataloging, processing, and movement of materials out to the public area of the library. The interior layout and workflow should be planned in consultation with the library staff. The room should be planned so that there is a clear spatial distinction between those materials *coming in* for processing and those materials *going out* of the department to the public shelves and other work areas.

Each area of the technical-services department should be planned to serve the particular needs of the tasks performed there. The processing area, for example, will require extensive storage space for supplies. Millwork to hold boxes of book covers, laminating film, and other processing supplies should be planned in consultation with the staff.

A large walk-in storage closet will be located adjacent to the technical-services area. The closet should be furnished with 24"-deep industrial steel shelving to hold office and processing supplies.

Discuss the possibility of adding a staff conference room that will be available for staff meetings of the circulation and technical-services staff.

After a draft of the building program is prepared, the document will be reviewed by the local planning team and the architect. Changes and additions will be made to the program based on the review.

Schematic Design

With the building program complete, the architect begins the process of schematic design of the building. Deviations from the building program may occur during schematic design (and, occasionally, during design development) as the planning team and the architect agree that changes from the detailed requirements of the program may enhance the design of the building. It is essential that the interior designer work with the architect from the very beginning of the project. An architect cannot plan a successful building without considering the interior design of the spaces.

Sometimes, library staff who have planned for years for a new building try to draw the library on paper or in their thoughts prior to meeting the architect. The planning process will work more smoothly if the local planning team members do not have specific preconceived ideas about how the library should look or how it should be arranged. The architect is a professional who is being paid to do the design work.

Throughout the design process, it is the responsibility of the local planning team (library staff, board members, officials, facilities management staff) to carefully review all drawings to ensure that the plans are carrying out the intent of the building program. Members of the planning team should ask as many questions as necessary in order to understand the design of the library and how it works. Many architects prepare dimensional sketches or study models in order to help the local planning team understand the library design. (The planning team may request sketches or models if they have not been prepared by the architect and are needed to completely understand the design.)

When members of the local planning team believe that areas within the library (as drawn) will not function effectively, it is their job to point out their concerns to the architects. Members of the planning team may make suggestions for improvements; however, it is always the responsibility of the architect to find a solution to problems. It is sometimes necessary to make compromises during the design process, but functional considerations should prevail over aesthetic considerations.

The interior design of a library begins with a study of the relationships of the various functional spaces within the building. At the beginning of the schematic-design phase of a project, the architect or the interior designer will present the owner with diagrams that illustrate the relationships identified in a building program. The easiest drawings for a library planning team to understand are simple bubble diagrams that show the relationships within the building and, perhaps, the relative sizes of individual areas. Through a series of discussions between the architect, the interior designer, and the local planning team, the bubble diagrams will be refined and take shape as the earliest schematic drawings of the building interior. Members of the planning team should feel free to ask questions and make comments about both the diagrams and the early schematic drawings.

The schematic design may change several times before all parties agree that the relationships, as drawn, will work. Sometimes changes may be made later in the process as furniture and shelving are added to the plan. Schematic-design drawings will show the walls of rooms and door locations within the building. Early interior elevations drawn during the schematic-design phase will illustrate the preliminary locations and heights of windows and building entrances. Using the initial plans, the architects, interior designer, or building consultant will begin to draw preliminary furniture and shelving layouts in order to compare the capacity of the building, as drawn, with the building program requirements.

Design Development

The next phase of the building process is the design-development stage. During this phase, the architect begins refining the schematic plans. Mechanical, structural, and electrical engineers hired by the architect begin developing the details of the building. During design development, the interior designer, architect, or consultant refines the furniture and shelving layouts and begins making initial furniture selections.

During the design-development or construction-drawing phase, the interior designer will obtain budget prices for the initial furniture and shelving selections to ensure that the cost of furnishings will not exceed the allotted funds in the overall project budget. If the cost of initial furnishings chosen exceeds the funding available, changes must be made during later stages of the project; less expensive furnishings or fewer items must be substituted for initial selections and quantities in order to stay within the furnishings budget.

A budget for furnishings is usually based on information supplied by vendors. The interior designer, consultant, or a staff member prepares lists of furnishings desired and writes preliminary requirements or specifications for the items. The list is sent to a furniture vendor, or to several vendors, who will provide budget prices. If they know they have a good chance of being awarded the job, most vendors will supply budget pricing. In situations where state or local regulations and a local purchasing department do not want the library to work solely with one vendor, the list of possible furnishings can be sent to several vendors and those vendors who are interested will each supply budget prices. In projects that involve bidding, budget prices received from vendors will be higher than the vendor's final bid price; vendors do not want to show their hand completely in the early stages of a project.

Development of Construction Drawings

The last planning phase of a building project is the one during which the architects prepare the construction (or working) drawings and

detailed specifications that will be used in constructing the building. A construction contractor is awarded the job based on bidding from the construction drawings and specifications. (Most projects involve two bidding processes, one for building construction and one for furnishings.)

During this phase, interior planning involves working with the architect and interior designer to plan the specific details (dimensions and materials) of any built-in furnishings such as counters, cabinets, and bookcases. All of the interior finishes will be selected, such as plastic laminates for built-in counters and cabinets, carpets and other flooring materials, paint or vinyl wall coverings, rest-room tile, etc.

For a small project in which the construction will be completed in a year or less, final furniture and shelving selections should be made during the period of time that the construction drawings are being prepared. For a large project that will take more than a year for building construction, final furniture selections may be made during the time that construction of the building occurs. Additional budget pricing may be obtained after final furniture selections are made, to determine that the furniture choices remain within the allotted budget.

After final furniture and shelving selections are made, the interior designer works with the project team to choose colors, finishes, and materials for furnishings. Furniture and shelving selections are documented in specifications prepared by an interior designer, consultant, or architect. In public projects that require a bid process for furniture, the specifications become the major part of the furniture bid document. In a small project, the selection of finishes and the preparation of specifications and bid document can be completed while construction drawings are prepared or in the first six months of building construction.

In large projects, such as the construction of a main library for a city, the entire furniture, shelving, and finish selection process and the preparation of bid documents may take a year or more. Prototypes or mock-ups of custom-designed furnishings may be built. The design team may visit furniture factories to determine which companies have the human resources and facilities to complete the project within the desired time period.

After a bid document is prepared for furnishings, the project is put out for bid by the institution or organization that is the "owner" of the project. (Alternatively, when bidding is not required, prices are negotiated with vendors.) The period of time needed for bidders to complete their bid varies according to the complexity of the project. In a small project with mostly standard or customized versions of standard furnishings, bidders can be expected to return their bids in four weeks. In a large, complex project that requires the making and submission of samples, the bid period may stretch into months.

After bids are received, the period of time required to award bids also varies with the size of the project. A small project with bids that

can be easily evaluated and awarded quickly by a local council or board may have bids awarded within three weeks or a month. A complex project, however, may take a month or more to evaluate. In situations where the governing body does not agree with the recommendations made by the planning team or the design professionals, the process of awarding bids may be prolonged while additional bids are sought or time is spent justifying the recommended awards to officials.

After bids are awarded, vendors are required to prepare shop drawings for some of the furnishings specified. Shop drawings illustrate in detail how custom items, and sometimes standard items, will be constructed. Vendors are required to submit shop drawings to the owner for approval. The drawings will be reviewed by the interior designer, the architect, or a consultant. Many shop drawings require some redrawing to correct misinterpretation of the written specifications. On a project of any size, when the shop drawings must be reviewed and redrawn several times, the shop drawing approval stage of the project may take two or three months. On a large project, of course, the time may be longer.

Library furnishings are placed in a production queue by a factory, once shop drawings have been approved. Furnishings for small projects (buildings less than 100,000 square feet) can be produced by a number of factories. Furnishings for large projects, like the 375,000-square-foot San Francisco Main Library, can only be produced by factories with the capability for extensive projects.

When an order for furnishings is placed in a factory's production schedule, the vendor will notify the interior designer or consultant of the projected shipping date for the completed furnishings. This date, as well as the expected completion date of the building construction, may change several times during the course of the project. The interior designer and vendor will communicate several times to adjust either the building completion date or the expected delivery date of the furnishings.

The production time needed for furnishings or shelving depends on the quantities of furniture required, the complexity of the design of custom pieces, the availability of materials, and the total workload of the factory. The lead time for receiving furniture can also vary according to the time of year the order is placed.

In summary, the time required for furniture production depends on the size of the project, the circumstances of the manufacturer, and other unknown factors. In order to determine a tentative schedule to cover the time frame from bidding through delivery, interior designers or consultants must discuss the expected schedule with possible bidders. To set an initial schedule, it may be easier to begin with the expected delivery date following building completion and work backward.

Often, library staff or other local officials will set the date of the grand opening of a new library without consulting the interior designer about reasonable delivery dates of furniture. The disap-

pointing result can be that the library is opened with some furniture not yet on-site. The interior designer or consultant understands furniture production and works closely with a vendor or manufacturer to estimate the delivery and installation date of furnishings. In order to ensure that the building interior will be complete before the grand opening, the date of the event should not be determined too far ahead of building completion, and the opening date should be set in consultation with the interior designer and the architect.

The following is an example of an ample time schedule for the purchasing of furnishings for a 30,000-square-foot building. The schedule would obviously take much longer for a larger building.

Bid documents prepared	April–June 2003
Items go out for bid	July 1, 2003
Bids due	July 31, 2003
Bids evaluated	August 1–31, 2003
Bids awarded	September 30, 2003
Shop drawing phase	October 1–December 31, 2003
Production of furnishings	January 1–June 30, 2004
Expected completion date of building	June 30, 2004
Delivery of all furnishings	July 1–31, 2004

NOTES

1. Lee B. Brawner and Donald K. Beck Jr., *Determining Your Public Library's Future Size: A Needs Assessment and Planning Model* (Chicago: American Library Association, 1996).
2. *Building Blocks for Library Space: Functional Guidelines* (Chicago: American Library Association, 1995).
3. Twenty-four square feet per double-faced section.

CHAPTER 3

Basic Interior Design Issues

During the schematic and design-development phases of a project, building planning requires the integration of decisions regarding library architecture, engineering, and interior design. The process of planning the interior of a library begins with the architectural design of the building, but because architectural structure determines the basic sizes and shapes of interior spaces, consideration of the library's interior design must occur simultaneously with designing the exterior of the building. (See plates 1A and 1B.)

A functional library cannot be designed by planning how the building will look on the outside until the relationships, relative sizes, and necessary shapes of areas needed in the interior have been studied. A library design that begins, for example, with planning an attractive exterior intended to please the city council but with little or no regard for interior function may not be a successful library building.

Library Shape

In determining the basic shape of a new library, library architects and consultants agree that the most functional shape for a library is a square, or a series of squares. Architects sometimes see this shape as too simple and uninteresting; however, long, narrow spaces and round rooms do not allow for the efficient layout of ranges of shelving or for good visual control by staff. Nor do narrow or round spaces provide the flexibility of squares. Aaron and Elaine Cohen express the desirability of the square in library buildings as follows:

> With a square, there is more floor area in relation to the confining envelope than other easy-to-build configurations. A square is also simple to divide and rearrange. Cut in two and the result is two small rectangles. Cut in four and the result is four small squares. No matter if the library is large or small, to be built from the ground up or simply rearranged, the square always works.[1]

Modular Design

Successful libraries are designed with few load-bearing walls and with large, flexible spaces that can be easily rearranged as library needs change. The engineering of the library structure should be

done early in the planning process, either prior to or at the same time that initial shelving layouts are being planned. The basic bays or modules of the building structure (recurring dimensions between columns) should be planned to accommodate the efficient layout of ranges of shelving from column to column. It is disconcerting as a consultant or interior designer to lay out the shelving with the columns in one configuration, only to be told that the distance from column to column was only an approximation and that the locations of columns will be changing.[2]

The size of bays should allow for easy integration of bookstacks and furnishings into the library design. Bays should be designed to accommodate standard double-faced shelving units, 36" wide × 24" deep, with aisles a minimum of 36" wide (42" wide is preferred by the Americans with Disabilities Act). Some public or school libraries may prefer aisles 48" wide. If 36"-wide aisles are planned, it should be noted that the depth of a double-faced section of shelving is a *nominal* 24". Most bookstacks have an actual depth of more than 24" at the base, and when end panels are added, the actual depth of the bookstacks at the point of the end panel can be 2" to 3" more than the nominal depth of 24".

Ceiling Heights and Location of Windows

In addition to the size of bays in a building, it is often necessary to know ceiling heights in the major areas of the building and the locations and sizes of windows prior to laying out the building interior. The architect and interior designer must, therefore, work together on these issues from the very beginning of a project. For example, an architect may design a building with a low ceiling over stack areas and a higher ceiling over a center axis of the building. The architect and the interior designer should agree that the various ceiling heights will enhance the functionality of the space as a library and not adversely affect required relationships. In public and school libraries where wall shelving is used, the location and height of windows and soffits may be crucial factors in determining the location of stacks and, ultimately, the shelving capacity of the space. (See figure 3.)

Power and Data Locations

The use of computers throughout a library has confirmed the need to plan the structure and systems of the building simultaneously with the interior design. Because libraries and technology change continuously, buildings must be designed with built-in flexibility for providing and changing power and data locations wherever they are needed in the future. Even if data transmission becomes wireless in most buildings, the need for power at computer locations will continue.

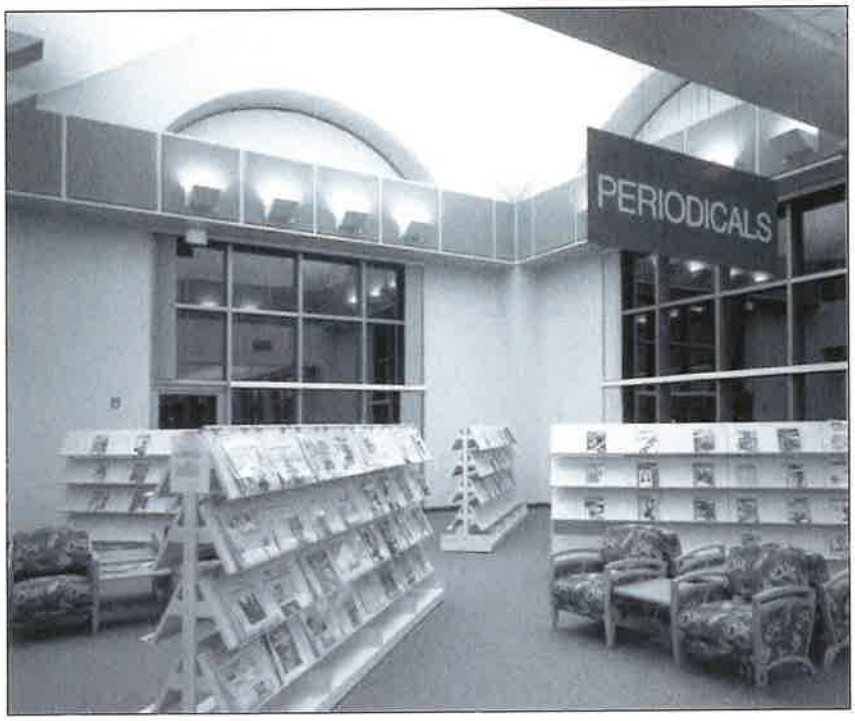


FIGURE 3

Davis Library, Plano, Texas. Architects, Phillips Swager Associates. Used by permission of the photographer. Photo credit: Copyright King Graf 2001.

Modular construction with columns helps to provide a means of ensuring that power and data are available to all parts of the library. Power and data lines can run inside a column from the ceiling to a few inches above the floor. When designing columns, architects might consider the need for columns to carry power and data lines. Solid wood or solid steel columns that are not furred out decrease the flexibility of the building for accommodating power and data.

Columns cannot be used, of course, for supplying power and data to open floor spaces. Plans for running power and data lines through a building are usually based on the size of the building and the project budget. Most small libraries with limited budgets run power and data through the building slab, using standard conduit terminated at specific locations in the floor. Architects and electrical engineers with limited knowledge of libraries may not understand the need for an extensive grid of conduit in reading table, carrel, computer, and reference areas. It is sometimes the responsibility of the library planning team to insist on building in power and data conduit in areas where computers will not be used initially. Also, it is necessary to provide power and data in areas that are initially built for bookstacks. In some libraries built 10 years ago or less, stack areas have already had to be reduced or reconfigured in order to accommodate more computers. It cannot be assumed that any area of the library initially used for bookstacks will always be used for them.

Library projects with larger budgets and spaces may be built with extensive under-floor duct systems (like Robertson duct)

installed in a regular grid that provides flexibility in moving power and data locations. Standard ductwork may be used in some areas of the library, while an under-floor grid system is installed in areas that are expected to house the most computers—reference areas, reading areas, and technical-services workrooms. When furniture placement and electrical plans are developed at the same time, power and data can be provided from walls to carrels and tables.

In summary, regardless of how power and data are handled in the building, decisions about the interface of the building system and the use of furniture must be made together. The architect must provide a blueprint that overlays the building's power and data system over the furniture layout. The ultimate goal is to avoid having to use a power pole for power and data in the library at some time in the future.

Other Building Elements

Some interior building elements are controversial additions to public and academic libraries. The inclusion of an atrium in a library, for example, should be considered carefully. Where effective use of resources is a particular concern to an organization or community, an atrium that is aesthetically pleasing but occupies a large amount of interior space may be a public relations disaster. The library's public may see the atrium as wasted space that could have been used for bookstacks, computers, and seating. Moreover, an atrium entails nonfunctional space that must be heated, ventilated, and air-conditioned.

Other interior elements that should be considered carefully are interior fountains (often a maintenance headache), gardens (water for the plants can have an adverse impact on the environment for books), and any body of water that has the potential for causing accidents or attracting children. In children's areas, structures that encourage climbing, jumping, or running should be avoided. As plans for a library proceed, it is important to consider the locations of small building items in relation to larger furnishings. It is disconcerting, for example, to find late in the planning process that a fire extinguisher is on a wall where shelving is to be installed.

Planning the Furniture Arrangement

Planning the furniture placement in a library involves trying out various arrangements. The design professional working on the interior layout draws various schemes for main public areas before deciding on the best options to show to the planning team. The local planning team reviews the presented drawings, suggests changes, or asks for additional drawings. The use of computer-assisted design (CAD) programs in interior design allows the architect or designer to make changes easily and quickly.

Furniture and shelving layouts should reflect the adjacencies outlined in the library building program. If the drawings do not reflect the programmed relationships, the planning team should express its dissatisfaction and ask the design professionals to offer additional options. Members of a successful planning team should voice their concerns and may offer suggestions for changes.

Planning library furniture and shelving layouts involves considering universal design factors that ensure the library will be convenient and comfortable for people of all ages and abilities. The philosophy of universal design incorporates existing laws, such as the Americans with Disabilities Act, as well as the spirit of the law to ensure accessibility and comfort for everyone.

Furniture arrangement and the selection of individual pieces of furniture are tasks that involve consideration of human factors that affect how people react within an environment. One of the relevant human factors in library interior design is the concept of acceptable personal space; that is, how closely can people sit or stand next to each other and continue to feel comfortable? In the United States, in a social context like a library, most people are comfortable at a distance of four to five feet. In intimate conversations, however, individuals may be comfortable at a distance of less than four feet. Different cultures have different attitudes toward what is an acceptable space between people in various social situations. In many countries, a comfortable distance in a social setting can be less than four feet.

In addition to a desire for personal space, individuals have a need to define their "territory." For example, seating at a single carrel in a library clearly defines one person's territory. The desire for personal space and territory are demonstrated by the manner in which library users select seats at a reading table. Strangers prefer sitting across from each other, rather than side-by-side. People sitting side-by-side prefer to have some space between themselves and the person seated next to them. The first person to take a seat at a table for six, for example, usually takes a seat at one end of the table, and the second person takes a seat at the far end of the table on the other side. In a crowded library, two more people may take seats at the other two corners of the table; however, only in a very crowded library will anyone take the middle seat between the people on the ends. Sometimes when people are forced to sit close together, they will set up a psychological barrier between themselves and others (a pile of books) or will change their body language (turn their back toward the other person).

A similar concern for personal space occurs when users select lounge seating in a library. When lounge chairs are placed side-by-side, individuals often leave an empty seat between themselves and another person. Sofas can be used in children's areas where a young person and a caregiver sit together to read, but two- and three-seat lounges are not generally used in most library areas, because two strangers will not sit next to each other on a couch.[3]

In order to design a furniture layout, preliminary decisions must be made about the types of furniture to be used. Libraries should be planned with a variety of spaces and furnishings that will accommodate many different personal preferences. Rectangular tables, for example, are often used by people who are working alone. Round tables, however, suggest working together. Some people prefer to be at a table where they can look around and see what is going on in the area, while others like a semiprivate space—like a carrel with side panels—where they can look up and see others, but still have a sense of privacy. More small tables for four rather than larger tables for six are preferred because of people's attitudes toward personal space and territory—the middle seats at a table for six are often wasted space.

Academic libraries have individually assigned carrels or offices. In public libraries, small study rooms with seating for one to six are provided for quiet study, tutoring, and small group projects. Groups of teenagers like small study rooms or round tables where they can talk and study together. Young children like small, cubbyhole spaces, where they can crawl in to look at books alone. Children also need spaces where they can sit down with a caregiver to share a book.

In public and school libraries, the relationship between seating, stacks, and service desks is especially important. Ranges of tall bookstacks should not be placed directly in front of service desks; computers and seating should be between service desks and tall stacks in order to give the staff a clear view of users seated at tables and computers. In large libraries, stacks are often arranged around the perimeter of the room, while reference desks, seating, and computers are arranged in the center of the room.

When planning for a line of reading tables or carrels where the chairs of one table/carrel will be back-to-back to the chairs of the next table/carrel, the tables/carrels should be arranged with a minimum of five feet of space from one worksurface edge to the next worksurface edge. If space is available, an even larger aisle should be planned between tables or carrels. In public libraries, tables may be arranged in lines of six or seven or in small groups of four to six, while in academic libraries, dozens of tables may be arranged in study-hall style in a large room.

The arrangement of lounge seating depends on the expected use of the chairs. Single lounge seats for quiet reading are often separated by an open space of three feet or more, or by an occasional table. An area for quiet reading may have some lounge chairs placed back-to-back. Lounge chairs that are placed closer together and face-to-face suggest that the area is appropriate for conversation. Face-to-face lounge seating, for example, might be used in a children's area where caregivers converse while their children are in a nearby story time.

Computer tables are usually arranged within view of a service desk, so that assistance is nearby. The arrangement of computer areas depends on the type of tables that will be used for holding the equipment. Preliminary decisions about computer furniture have to

be made during the later stages of the schematic-design phase of the project in order to coordinate the furniture layout with electrical plans. In reference areas, both academic and public libraries need banks of computers that are efficiently arranged on some kind of double-faced, starter/adder type of furniture supplied with an integrated electrical system. Users spend long periods of time at computers and want space around the computer to hold books and personal items. Each computer worksurface should be 48" to 60" wide and 36" deep, overall. When banks of computers are arranged with chairs backing from both sides into an aisle, the tables should be seven to eight feet apart to allow for the passage of a user or staff member between the chairs.

Academic libraries often have large computer areas (information arcades, for example) that are designed for both group and individual use of computers. Six-sided modules with two or three seats at each computer workstation have worked successfully in this situation.

Academic and public libraries may include computer-training labs. Libraries can make efficient use of computers and space by designing a computer lab close to a reference area. The lab is a separate room with glass walls that can be closed during a training session for staff or the public. When a class is not in session, the room can be left open, providing users access to additional computer workstations for individual work. (See plate 2A.)

Computer labs may be arranged in classroom style, with all participants facing the instructor, or they may be arranged with the workstations located around the perimeter of the room, with users



FIGURE 4

Main Library renovation, Texas Tech University, Lubbock, Texas. Architects, F & S Partners and Parkhill, Smith & Cooper, Inc. Used by permission of the photographer. Photo credit: Robert Suddarth Photographer.

facing the wall. In either arrangement, the instructor must be able to walk behind computer users to view their screens during a training session. Computer labs may also be designed to serve as teleconferencing and distance-education labs; therefore, seating arrangements must allow for a view to individual computers, to the instructor, and to videoconferencing equipment. (See figure 4.)

The usefulness of a computer lab can be increased by locating one or more small conference rooms adjacent to it. The rooms can be used for classroom training that does not involve hands-on access to computers and for breakout sessions that are part of a presentation.

Stack Areas

In public libraries, stack areas are often interspersed with reading areas to make the atmosphere more casual and less "academic." In college and university libraries, however, large stack areas are planned for the most efficient use of space for collections. In public and school libraries, ranges of bookstacks may be used to delineate particular areas in the library: adult and juvenile, preschool and school-age, middle school and high school. In any kind of library, stacks should be arranged to allow for shelving books in a logical sequence with either the Dewey Decimal or Library of Congress classifications. Users should be able to find a call number easily without the help of a staff member.

Standard sections of wood or steel shelving are 36" wide, though 24"- and 30"-wide sections are also available. Double-faced, freestanding shelving should be drawn 24" deep on initial furniture layouts. Single-faced wall shelving should be drawn 12" deep, although in final furniture selections later in the process, shelving may actually be 20" or 10" deep in some areas. Sections of shelving are installed together to form a range. In public libraries, a rule of thumb suggests that ranges of shelving should not be more than six sections, or 18 feet, long. In academic libraries, however, ranges are often longer than six sections.

At the corners of a room where two ranges of steel wall shelving meet, the two ranges should not overlap. Special square filler sections (10" × 10" or 12" × 12" × the height of the shelving) can be used to finish off the empty corner.

As previously noted in the discussion about the size of building modules, the aisles between bookstacks must be a minimum of 36" wide, with 42" aisles preferred by the ADA. Sometimes public and school libraries have aisles 44" or 48" wide.

It is a generally accepted practice that cross aisles between groups of ranges are a minimum of five feet wide. The minimum width of cross aisles or aisles at the end of a bookstack range is defined by the ADA as follows. Section 4.3.3, "Accessible Route, Width," in *ADA Accessibility Guidelines for Buildings and Facilities*, states: "The minimum clear width of an accessible route shall be 36

in. (915 mm) except at doors. . . . If a person in a wheelchair must make a turn around an obstruction [such as the end of a range of shelving], the minimum clear width of the accessible route shall be as shown in Fig. 7 (a) and (b)."[4] Figures 7A and 7B show that two 90-degree turns in a wheelchair around an object a minimum of 48" wide requires a 36" aisle; however, two 90-degree turns in a wheelchair around an object *less than 48" wide* requires a 48" aisle." In other words, a 24"-deep bookstack range requires an end aisle a minimum of 48" wide. Application of the ADA is, of course, a matter of interpretation, so some architects believe that a 36" aisle at the end of a range is acceptable. In some cases, the width of the aisle will be determined by a local or state ordinance and may be somewhere between 36" and 48". In order to ensure accessibility for everyone, 48" aisles are preferred at the end of ranges.

In small public libraries with limited staff, ranges of bookstacks are often arranged perpendicular to the service desk in order to allow staff to look down the aisles more easily, for security reasons, and to see users who may need assistance. In school libraries, bookstacks may be used to delineate separate seating areas for several classes.

Building Examples

Maribelle M. Davis Library, Plano, Texas; Architects, Phillips Swager Associates

The Davis Library is a 30,000-square-foot building that is part of a library system whose technical-services operations are located in another library. (See figure 5.) The public entrance to the library leads into an area that can be used when the main part of the library is closed. For before- or after-hours meetings, the public can access the meeting room, rest rooms, kitchen, and related storage without entering the library proper. Although the meeting room can be secured from the rest of the building, the meeting room is adjacent to the children's area of the library. Young people can pass directly from the children's area into the meeting room for puppet shows and other activities presented for large groups. Small groups of children can participate in programs in the story-time room in the children's department. Or the staff of the library can hold two presentations simultaneously by using both the story-time area in the children's department and the meeting room. (See plate 2B.)

In this library, the children's space is a separate room with a glass wall at the entrance that allows a view into the room from the adult area. The walled room allows children to be themselves without disturbing adults who prefer a quieter library environment. The children's reference desk is located adjacent to the main entrance, so that users can ask for assistance upon entering. Computers are located close to the librarian's desk, so that staff can provide help easily and maintain visual control of the use of the equipment. Preschool book collections and book collections for

DAVIS PUBLIC LIBRARY PLANO, TEXAS

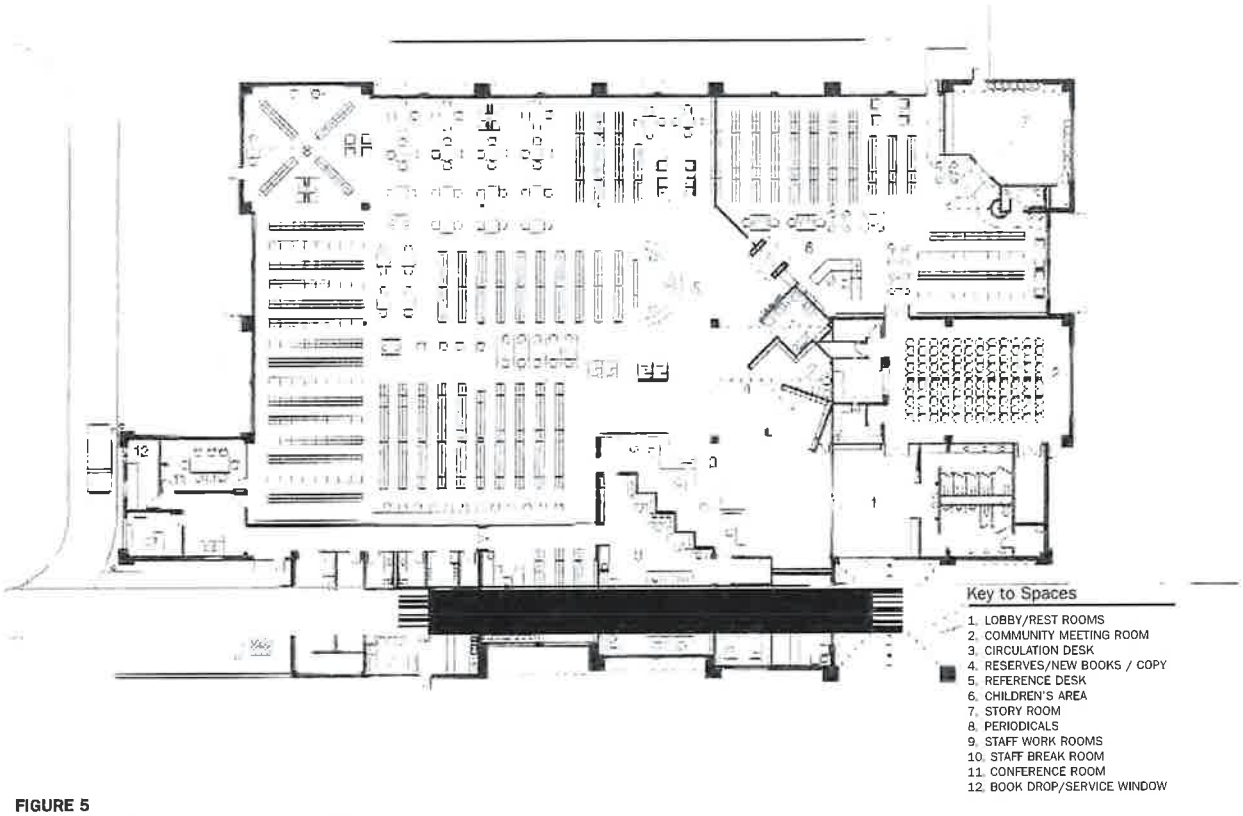


FIGURE 5

Davis Library, Plano, Texas. Architects, Phillips Swager Associates. Used by permission of the architects.

33

school-age children are separate, so that older children do not have to pass through the "baby" area to get to their books. A family rest room is provided.

For the convenience of users, the library circulation desk is located right inside the main entrance. A book drop close to the library entrance allows users to drop off returned books as soon as they enter. The stairstep design of the circulation desk provides an indication to library users of how to line up for checking out books. Two self-check stations are located close to the circulation desk, so that staff can assist users the first time they use the self-check equipment. The workroom is located directly adjacent to the circulation desk so that additional staff may be summoned when more help is needed at the desk.

In this library, materials that have been reserved by users are not stored behind the circulation desk and retrieved by staff. Rather, the books are shelved in an alcove in the public area of the library and retrieved by the users themselves.

The young adult section of the library is located close to the children's area, but in the adult area. The young adult area is located within easy view of the reference desk, so that staff may easily maintain visual control. The audiovisual collections—popular materials in public libraries—are located next to the young adult area.

The adult reference desk is located in the center of the adult area and within view of the main entrance to the library. The reference book collection is located behind the desk for easy access by the staff. The reference stacks are 42" high, so that the staff have a better view across the room. Computer workstations are placed near the desk, so that staff can easily assist users. The periodicals are in a separate space that provides a view to the outside and is away from the noisy area around the reference desk. A conference room that can be used for staff and public meetings is located at the back of the adult area.

Other back-of-the-house areas include a drive-up, outside book drop, the branch manager's office and reception area, delivery entrance, and the staff lounge and rest rooms.

Sugar Land Branch, Fort Bend County Libraries, Sugar Land, Texas; Hermes Architects

This branch library is 20,000 square feet in size; technical-services operations are located in the system's main library. (See figure 6.) The main entrance to the library provides access to the meeting room, rest rooms, kitchenette in the meeting room, and related storage. A drop-down gate can be lowered to lock off the meeting room module from the rest of the library. Upon entering the library, the children's area is located in the right wing of the building and the adult area is located in the left wing. Drops for returned materials are provided outside the entrance to the building and in the foyer. Returned materials drop directly into the workroom.

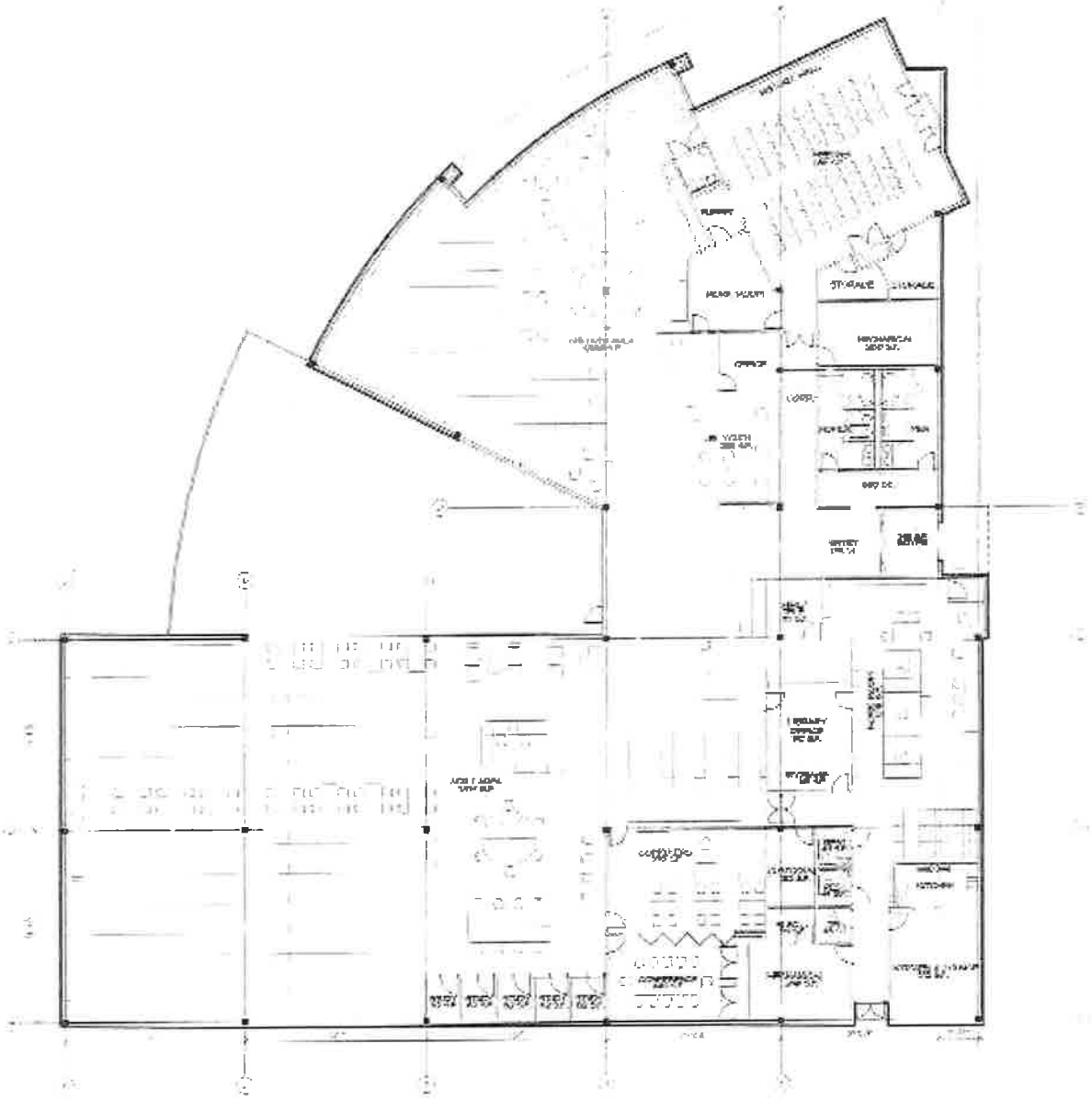


FIGURE 6

Sugar Land Branch, Fort Bend County Libraries, Sugar Land, Texas. Hermes Architects.
Used by permission of the architects.

The circulation desk is located directly to the left of someone entering the building. The corridor to the workroom, located behind the desk, includes bookstacks for shelving reserved books to be picked up by users. The workroom for all staff is located adjacent to the circulation desk.

The young adult area in this library (referred to as "jr. youth" in the plan) is a separate section of the children's area. It is located directly inside the entrance to the area so that young adults do not have to pass through the preschool and school-age areas to get to their space.

In this building, all children's group activities occur in the meeting room, which is directly accessible from a door in the children's area. A children's rest room is provided. The children's reference desk is located within easy view of the entrance to the area. Computers are located close to the reference desk. The children's librarian's office, the workroom, puppet theater, and meeting room are adjacent to the reference desk.

The library's audiovisual collection is located next to the circulation desk, in a highly visible space. The branch has the capacity for 30 adult computers. Twelve computers are located in the computer lab, which is located within easy view of the reference desk. When the computer lab is needed for classes for the public or staff, the door to the room is closed. When classes or demonstrations are not in progress, the room remains open and the computers are used by the public as additional workstations.

An electrically operated, movable partition separates the computer lab from the adjacent conference room. When additional seating is needed in the computer room, the partition can be folded back. The conference room can also be used for breakout sessions as part of computer training or as a general conference room for meetings by public and staff.

The adult area of the library includes five study rooms that can be used for quiet or group study. The reference desk is located at the entrance to the adult area. Periodicals are on the shelves next to the window seating. Reference books are located on the shelves closest to the reference desk. Adult fiction is housed on one side of the main aisle and adult nonfiction is housed on the other side of the aisle.

Hedberg Library, Carthage College, Kenosha, Wisconsin; Architects, Meyer, Scherer & Rockcastle, Ltd.

The Carthage College library is a 65,000-square-foot facility constructed in 2001. The library serves the faculty and the 2,250 part- and full-time students of the college. (See figures 7A and 7B.)

The layout of the Hedberg Library illustrates some of the differences between public and academic libraries. The building has two floors: a ground floor that is partly below grade and a first floor that

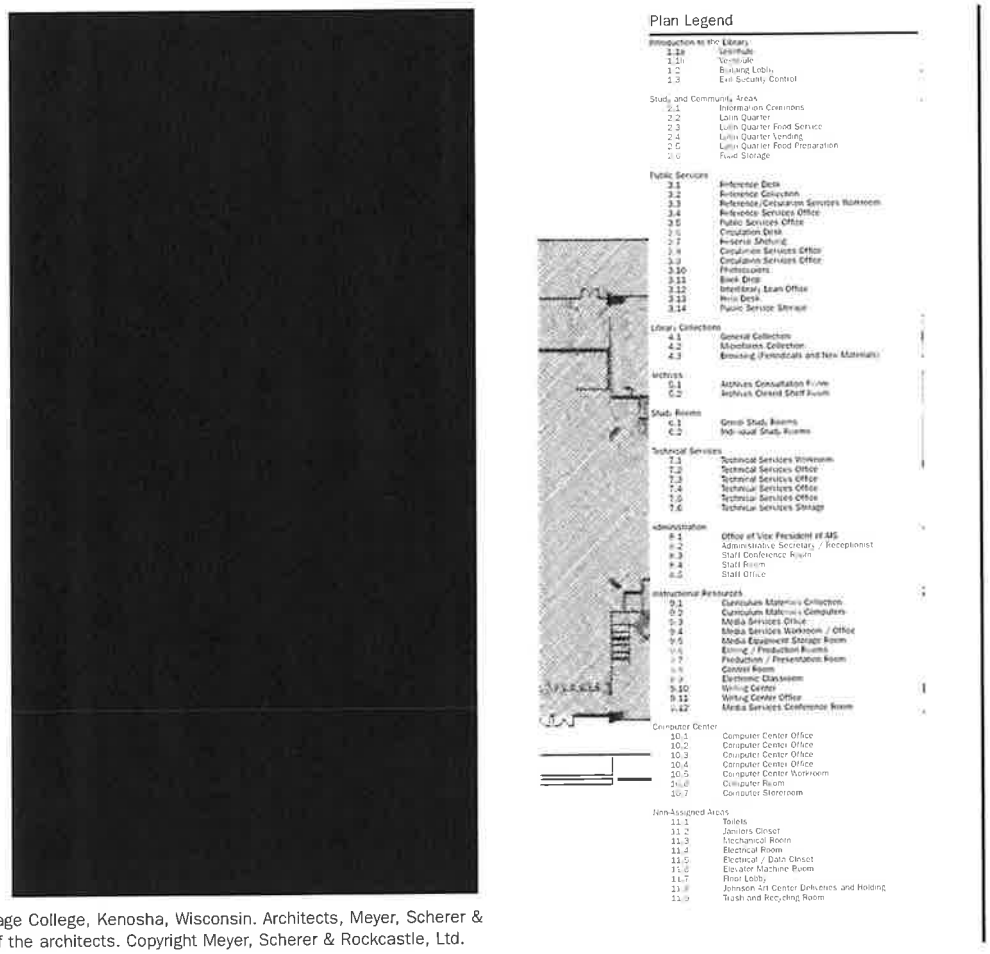
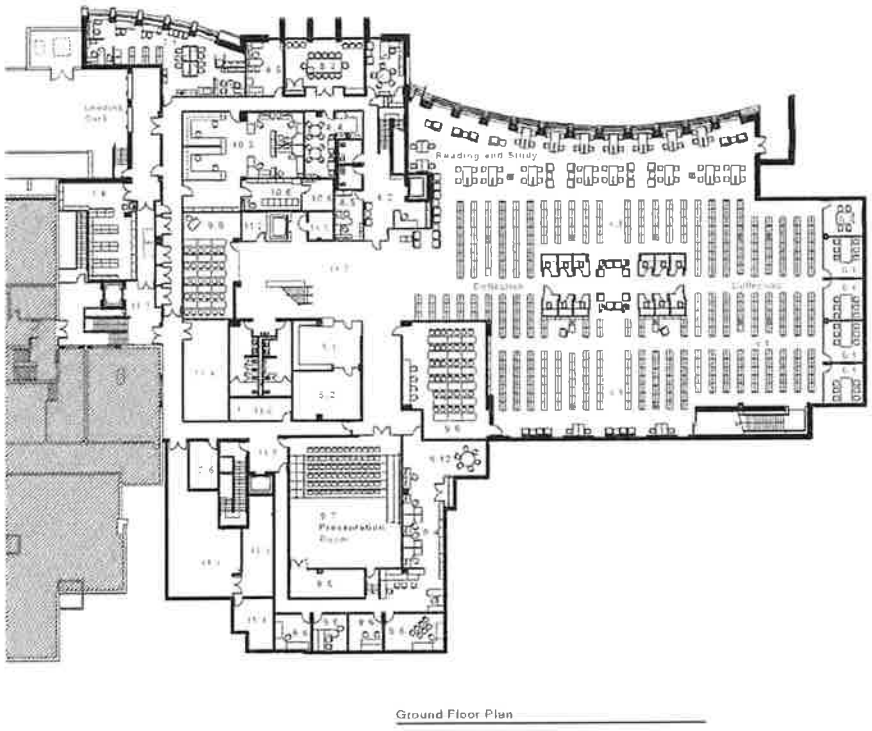


FIGURE 7A

First-floor plan, Hedberg Library, Carthage College, Kenosha, Wisconsin. Architects, Meyer, Scherer & Rockcastle, Ltd. Used by permission of the architects. Copyright Meyer, Scherer & Rockcastle, Ltd.

37



Plan Legend

Introduction to the Library
1.1a Vestibule
1.1b Vestibule
1.2 Building Lobby
1.3 Exit Security Control

Study and Community Areas
2.1 Information Commons
2.2 Latin Quarter
2.3 Latin Quarter Food Service
2.4 Latin Quarter Vending
2.5 Latin Quarter Food Preparation
2.6 Food Storage

Public Services
3.1 Reference Desk
3.2 Reference Collection
3.3 Reference/Circulation Services Workroom
3.4 Reference Services Office
3.5 Public Services Office
3.6 Circulation Desk
3.7 Reserve Shelving
3.8 Circulation Services Office
3.9 Circulation Services Office
3.10 Photocopiers
3.11 Book Drop
3.12 Hearthbrary, Loan Office
3.13 Help Desk
3.14 Public Service Storage

Library Collections
4.1 General Collection
4.2 Microforms Collection
4.3 Bindery, Periodicals and New Materials

Archives
5.1 Archives Consultation Room
5.2 Archives Closed Shelf Room

Study Rooms
6.1 Group Study Rooms
6.2 Individual Study Rooms

Technical Services
7.1 Technical Services Workroom
7.2 Technical Services Office
7.3 Technical Services Office
7.4 Technical Services Office
7.5 Technical Services Office
7.6 Technical Services Storage

Administration
8.1 Office of Vice President of AIS
8.2 Administrative Secretary / Receptionist
8.3 Staff Conference Room
8.4 Staff Room
8.5 Staff Office

Instructional Resources
9.1 Curriculum Materials Collection
9.2 Curriculum Materials Computers
9.3 Media Services Office
9.4 Media Services Workroom / Office
9.5 Media Equipment Storage Room
9.6 Editing / Production Rooms
9.7 Production / Presentation Room
9.8 Control Room
9.9 Electronic Classroom
9.10 Writing Center
9.11 Writing Center Office
9.12 Media Services Conference Room

Computer Center
10.1 Computer Center Office
10.2 Computer Center Office
10.3 Computer Center Office
10.4 Computer Center Office
10.5 Computer Center Workroom
10.6 Computer Room
10.7 Computer Storeroom

Non-Assigned Areas
11.1 Toilets
11.2 Janitors Closet
11.3 Mechanical Room
11.4 Electrical Room
11.5 Electrical / Data Closet
11.6 Elevator Machine Room
11.7 Floor Lobby
11.8 Johnson Art Center Deliveries and Holding
11.9 Trash and Recycling Room

FIGURE 7B

Ground-floor plan, Hedberg Library, Carthage College, Kenosha, Wisconsin. Architects, Meyer, Scherer & Rockcastle, Ltd. Used by permission of the architects. Copyright Meyer, Scherer & Rockcastle, Ltd.

is at grade. The building is entered through two sets of entrance doors into a lobby on the first floor. A café (referred to as "Latin Quarter" in figure 7A) is entered off the lobby, outside the library space. Rest rooms on this floor are adjacent to the lobby and outside the entrance to the library. Security gates are located at the entrance to the library.

The circulation desk is directly inside the library entrance. The staff expect to implement self-check in the future. An L-shaped reference desk faces both the entrance doors and the corridor to the reference area. A second smaller "help" desk sits next to the reference book collection and the information commons, or main computer area. The work area and offices for circulation, reference, and some automation staff are situated close to the public circulation and reference areas. The remaining areas of the first floor house a browsing area for periodicals and new materials, a special curriculum-materials collection for education students, a reading area, computers to be used in conjunction with the special curriculum collection, and a writing center.

The ground floor of the Hedberg Library houses the general collections of the library, a reading and study area, and individual and group study rooms. Most of the tables in the reading area are equipped with power and data connections. In public libraries, staff members usually offer assistance and maintain visual control on every floor that is open to the public. The Hedberg Library, like many academic libraries, however, does not have staff at service desks on both floors. All of the Hedberg Library's service locations are on the first floor.

Two electronic classrooms and a production/presentation room are on the ground floor of the library. Media-services offices, workroom, storage areas, and editing/production rooms are adjacent to the presentation room. An archives workroom and closed stacks are situated off the lobby. The rest rooms on this floor are inside the library space.

The technical-services and computer-center offices, work areas, and storage are on the ground floor adjacent to the loading dock. The offices of the administrative secretary, the library director, and other staff members are also located on the ground floor. Staff areas on the ground and first floors are internally linked by stairs and an elevator.

Library, River Oaks Baptist School, Houston, Texas; Architects, Kirksey

This library is a 9,000-square-foot facility constructed in 1997. It serves the faculty and 740 students in preschool through the eighth grade. (See figure 8.)

The library has a large open area along one wall, which is enhanced by tall windows. The open area was designed to be used as a storytelling space (with children seated on the carpet) that could serve double-duty by providing an attractive area for school receptions

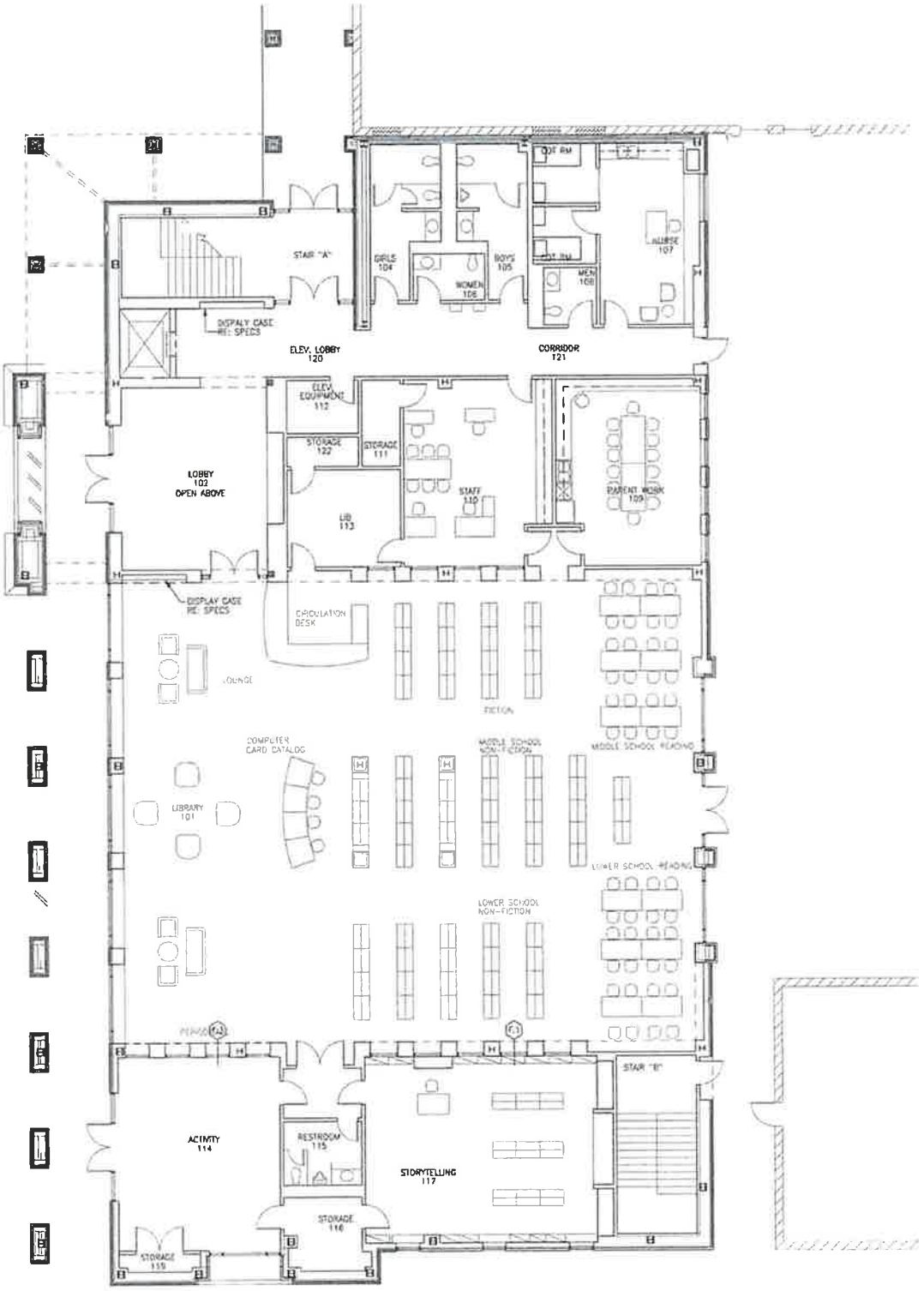


FIGURE 8

Library, River Oaks Baptist School, Houston, Texas. Architects, Kirksey. Used by permission of the architects and River Oaks Baptist School.

when the library is closed for business. (These spaces are indicated as "Lounge" and "Library 101" in figure 8.) The granite-topped circulation desk is the showpiece of the library. The library staff visited other libraries to look at recessed computer monitors in desks and tables. After their visits, they decided to have recessed monitors in the circulation desk and in the computer tables. Because of the availability of electronic resources on networked computers in the classrooms, the library was planned with very few computers for opening day. Later, more computers were added to the library. The large central reading room houses books and magazines on 48"-high shelving for school-age students. The large reading room also includes chairs and tables to accommodate two classes at one time in the library. A smaller room (labeled as "Storytelling" in figure 8) houses the picture and easy book collections.

A small room with a door to the outside (labeled "Activity" in figure 8) was designed as an after-school study area for students. The room is furnished with folding tables and stacking chairs that can be removed or pushed aside to allow for other uses of the room. Since the building opened, the after-hours room has also become home for a special collection of books donated to the library.

The library includes an office for the head librarian and a small work area for the rest of the library staff. The library and the school rely on volunteers who carry out special projects. One small room in the library (labeled "Parent Work" in figure 8) was designed to provide a work area for volunteers and space for housing materials and supplies used for special projects.

Do-It-Yourself Space Planning

Sometimes the staff of public, school, and special libraries do not have the funding needed to hire a design professional to rearrange the library. In that case a do-it-yourself furniture layout is required. You will need a "to-scale" plan of your building (a blueprint), some tracing paper, a ruler, and some tape. If you have a plan scaled to 1/8" = 1'.0" or 1/4" = 1'.0", it is easier to draw the plan using ruled tracing paper with blue lines that will not show when the plan is copied.

Lay your tracing paper over the original blueprint, tape it down, and trace the building footprint with all of the existing walls. Then remove your "new" plan and begin drawing. (If you don't have a scaled plan of the building, you will have to measure and draw one, using a scale of one-quarter or one-eighth inch per one foot of building.)

If you are rearranging existing furnishings, measure each piece, so you will know what dimensions to draw on the plan. Rather than drawing furnishings on a plan, you might cut out scaled furniture shapes and place them in various arrangements on your plan. Begin with an open mind. Start by eliminating the idea that something has to remain where it has always been—including whole areas like the

children's space or adult bookstacks. You are just planning on paper—anything goes. You can throw it away and start over.

The following are basic space planning guidelines:

Stack range lengths—usually a maximum of six sections in public libraries.

Double-faced stacks 24" deep; single-faced shelves 12" deep.

Aisles between stacks—minimum 36", 42" preferred; 48" even better.

Guideline for turning space at end of range—48".

Rule of thumb—keep a minimum 36" clear aisle everywhere.

Tables with chairs backing into chairs—5' minimum table edge to table edge.

Consider clear space around a circulation desk for lining up, at reference desks for people waiting, around display racks for people browsing, as well as space for people's feet in lounge areas.

Use your imagination to think about elevations in the interior space. What will you be able to see as you look across a room from a service desk? Consider the location of tall shelves and display racks in relation to service desks.

NOTES

1. Aaron Cohen and Elaine Cohen, *Designing and Space Planning for Libraries: A Behavioral Guide* (New York: R. R. Bowker, 1979), 67.

2. For an extensive discussion of modular construction, see Philip D. Leighton and David C. Weber, *Planning Academic and Research Library Buildings*, 3rd ed. (Chicago: American Library Association, 1999), 424–51.

3. For an extensive discussion of personal space, see Cohen and Cohen, *Designing and Space Planning for Libraries*, 13–20.

4. *ADA Accessibility Guidelines for Buildings and Facilities, Federal Register* 56, no. 144 (July 26, 1991).

Library Furnishings

CHAPTER 4

Because of aesthetic as well as functional concerns, furniture selection is one of the most important aspects of the interior design of a library. The furnishings selected for a library should reflect the overall interior design concept of the building, while serving the functional needs of staff and users.

In small projects with no interior designer, the library staff or board sometimes selects the furnishings. In these projects, the standard offerings of library or commercial furniture manufacturers are usually selected. In large, well-funded projects, some of the furnishings are standard commercial items, while others are designed by architects or interior designers specifically for that library. Custom furnishings are produced by a library or commercial furniture manufacturer or by an architectural woodworking shop. In some projects, an architect, interior designer, or consultant selects standard furnishings and adds special customized features to them. For example, a basic library reading table may be purchased with a custom design on the end panels.

A number of factors affect the cost of purchasing particular furnishings. The price of an item is determined by the volume of items to be purchased; the cost of materials, labor, and finishes; and competition in the marketplace. The larger the quantity of any one kind of item purchased, the lower the price of each item. For example, it is more expensive per unit to buy 10 sections of steel shelving than it is to buy 100 sections. A planning team that decides to buy 25 custom tables this year and 25 of the same tables next year will probably pay more per table than the library that buys all 50 tables at the same time. When all the tables are purchased at one time, the manufacturer has only one factory setup for all 50 tables, prepares a custom finish only one time, buys all of the materials in one order, and ships all of the tables in one truck.

Furniture items used in libraries and other commercial settings are designed to withstand heavy use. The joinery, materials, and hardware are engineered to work together to provide a durable product that will last. The cost of engineering a product must be recovered by a manufacturer when the product is sold. Furnishings offered as standard items by a library company have been previously engineered; the shop drawings required for their manufacture are

already available. Standard items are, therefore, less expensive than custom items that have to be designed and engineered prior to production. Because most of the design work has already been done on the item, customized features on a standard product, such as a special end panel on a standard table, do not cost as much as a new custom item.

The amount and kind of materials used in a furniture piece also affect the price. The more solid wood and wood veneers, for example, that are used in an end panel for bookstacks, the higher the price of the end panel will be. An end panel with a 1/8" solid-wood edge band and veneer only on the front of the panel will be less expensive than an end panel with a 2" solid-wood edge band and premium veneer on both faces.

Many library furnishings are made of northern-grown oak because of the availability of that wood. The kind of wood used obviously affects the price of a piece of furniture. Oak furnishings are usually the least expensive, while maple and cherry are slightly more expensive. Special woods, like the highly figured sycamore used in the main library in San Francisco, add to the cost of furnishings. Other special materials, such as stone on the tops and fronts of service desks, also increase the cost of items. The cost of materials is sometimes affected by outside conditions; for example, steel-shelving prices are often based on the cost of steel at a particular time.

Most library furniture manufacturers offer a line of standard color finishes on oak, maple, or other woods. These finishes come at a standard price; however, all of the manufacturers will provide furnishings in a special color finish for an extra cost, called an upcharge. The same is true for steel shelving. All companies have standard colors, but will match other colors for an additional cost.

The cost of furniture is also affected by the market at any given time. A manufacturer who is seeking new projects to increase production at a factory will negotiate or bid lower than a manufacturer with a factory that is working to capacity.

In summary, projects with limited budgets usually purchase standard furniture items with standard finishes; all of the items for the project should be purchased at one time. Projects with large budgets usually have some standard furniture items but also include custom-designed and -engineered furniture items manufactured from special materials with custom finishes.

Members of a library planning team who have not been involved in purchasing furnishings for a new or expanded library need to understand how orders are handled by furniture factories. Some companies, such as manufacturers of office furnishings, have quick-ship programs for specific items; however, most furniture made by large commercial or library furniture manufacturers is produced after the order is received. Factories do not fit a job into the production schedule according to the date the purchaser wants to have the furniture. Orders that require the preparation of shop drawings by the factory and approval of the drawing by the library are usually not

placed on the production schedule until the library owner has approved all of the drawings. Orders are placed on the production schedule, therefore, in the order in which they are received and any required shop drawings are completed. The delivery date of furnishings depends on a number of variables, some controlled by the manufacturer and some controlled by the library owner. Some of these factors include the following:

- The length of time the factory takes to produce the shop drawings
- The length of time the owner takes to approve and return approved shop drawings to the factory
- The availability of the materials required for producing the furnishings
- The length of time the factory requires to prepare finish or product samples
- The length of time the owner takes to approve and return approved finish or product samples to the factory
- The number of jobs already in the production schedule queue at the factory
- The changes required by the owner after the job is in production (for example, the building construction may fall behind schedule)

The interior designer, consultant, or (on small projects) the librarian continues to coordinate the schedule of building construction and the delivery dates of the furniture throughout the furnishings production period. Because so many variables are involved, it is difficult to determine the exact date that furnishings will all be delivered and installed. Standard steel shelving and office furnishings may be delivered two to three months after the factory receives a purchase order. On small projects, wood furniture items that are mostly standard pieces may be produced in three to four months. Larger projects with many custom-designed furnishings may require four to six months (or longer) to produce.

The cost of a piece of durable commercial furniture is often higher than the cost of a piece of residential furniture. The difference in price should be justified to reluctant funding bodies by using the concept of life-cycle costing. The life-cycle price is the cost of a piece of furniture with the number of years the item will last factored in.

Service Desks

All types of libraries have service desks. In small school and public libraries, and in some special libraries, one desk serves both circulation and reference functions. (See figures 9 and 10.) In larger academic and public libraries, users may receive service at several different

desks designed for circulation functions and several other desks designed for reference and information functions. In large libraries, some staff may answer traditional reference questions from behind a service desk, while other staff or docents roam among computer workstations assisting people with questions. In a multistory library, users can more easily locate a service desk when each desk is placed in the same relative location on each floor. Service points can be more easily identified by users if all of the desks are designed with the same materials, finishes, or colors.



FIGURE 9

Springhill Elementary School, Longview, Texas. Jeff Potter Architects. Concertina desk manufactured by BCI. Photo used by permission of Libra-Tech Corporation. Photo credit: Penny Schmitz.



FIGURE 10

Beeville Public Library, Beeville, Texas. Ray Bailey Architects. Photo used by permission of the photographers. Photo credit: Copyright Hester & Hardaway-Photographers.

In most small to medium-sized public libraries, check-in and check-out of materials is handled at one desk located near the entrance to the library. These desks are often custom-designed, monumental pieces of architectural woodwork meant to serve as the centerpiece of the library's interior. In recent years, some libraries have preferred to install modular desks with components that, theoretically, can be rearranged or added to as library needs change. In larger libraries, circulation functions may be handled at multiple desks, with one for check-out, another for check-in, and a third for reserved items.

Another alternative to the single circulation desk is based on the concept of check-out counters in a retail store. Instead of one large circulation desk where several staff members serve the public, smaller, separate circulation stations serve individual lines of users, like the check-out stands at a grocery store. Individual circulation stations help to define where people wait in line for service and to indicate who is the next person to be served.

Service desks are built in many shapes and sizes. (See figure 11.) Some desks are designed with a stairstep design across the face to delineate separate check-in and check-out stations. Desks are square, rectangular, or round in shape. A curved desk works if the desk is large and designed to accommodate four or more staff at one time. Small round desks do not function well, however, because staff members tend to get in each other's way as they are working.

Service desks may be considered pieces of millwork that are included in the construction contract, or they may be considered furniture items and included in the furniture package. Desks may be built by millwork houses, by library furniture manufacturers, or by architectural woodworking companies. Sometimes the outer shell of



FIGURE 11

Harold B. Lee Library, Brigham Young University, Provo, Utah. Reference desk, tables, chairs, paneling, and trim manufactured by Fetzers' Inc. Photo used by permission of Fetzers' Inc. Photo credit: Douglas Kahn.

a desk is constructed by a millwork house and the interior components are made by a furniture manufacturer. This sounds possible in theory, but it is difficult to coordinate two sets of shop drawings and the installation for both pieces and have the two portions of the desk work together perfectly when both are installed.

Architects should be asked to set aside any preconceived ideas that they have about the manufacture of service desks and to work with the local planning team to determine the best options for the library. Architects should review, with the planning team, the pros and cons of using a millwork desk as opposed to a manufactured desk.

Regardless of how desks are purchased and manufactured, thorough planning is essential for each individual library and situation. When a new library is planned, the local planning team should work closely with the architect and other design professionals to make sure that many options in regard to the design and manufacture of the desk are considered. The basic requirements for a desk should be included in the building program: number of separate desks required for circulation and reference, type of desks (traditional desks or individual check-out stations), maximum number of staff to be accommodated, maximum number of computers and other equipment to be used, types of storage needed (shelves; box, pencil, and file drawers; slots; specialty shelves), operations to occur (check-in, check-out, reference assistance, materials' return, borrower registrations, reserved items pick-up), special requirements, and the ages or capabilities of the users who will approach the desk. (See figure 12.) The building program should also note any items to be located directly behind the desk, such as ready-reference books on shelves or book trucks, and how much space will be needed to accommodate these items.

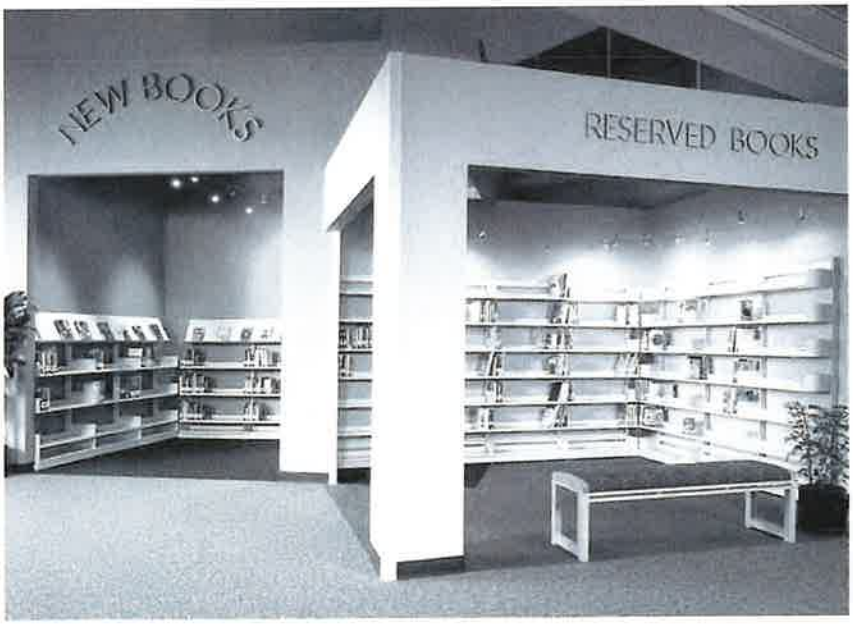


FIGURE 12

Davis Library, Plano, Texas. Architects, Phillips Swager Associates. Photo used by permission of the photographer. Photo credit: Copyright King Graf 2001.

The building program should state any requirements for access to and egress from the desk by the staff. In libraries with theft-detection systems, it is sometimes necessary for staff to be able to exit easily and quickly from behind the desk when the system alarm sounds.

Some of the issues to be addressed in the building program will be based on the policies and procedures of the library. For example, the staff at the desk may be expected to stand or to sit on high stools at all times, in order to be at eye level for all users approaching the desk. Or the staff may be allowed to be at seated height until someone approaches. The design of a desk may be determined by the clientele of the library and the types of questions that will be asked. In an academic or medical library, for example, questions may require a long consultation between the library staff and the user. In this case, both staff and user may wish to be seated on the same side of the desk so each can view the same computer with ease. A need for privacy in conducting reference interviews may also be a consideration in designing the configuration of a service desk.

Library staff should be closely involved in designing the interior components of a desk. The architect or interior designer should interview staff who will be using the desk and ask them to state their needs and expectations for the desk. Following the interview, a design professional should prepare a simple drawing of the interior of the desk that provides his or her interpretation of staff requirements. The staff should then be asked to review the drawing. The staff and the designer should work together until they agree on a satisfactory configuration of interior desk components. In large projects, a mock-up of the proposed desk may be built to ensure that the finished desk will fulfill the requirements of the staff and the library users.

The exterior of the desk is designed by the architect or interior designer, but with review and approval by the local planning team. The standard height of the worksurface of a circulation desk is 39". This is a time-tested standard—36" is too low for a tall person and 42" is too high for a short person. Design professionals are urged not to deviate from this height.

ADA guidelines require that one unit of each service counter must be accessible from a wheelchair. The unit must be located on an accessible route and must be at least 36" wide. The unit can have a maximum height of 36" from the finished floor, if the accessible area is designed for a library user in a wheelchair to pull alongside the desk. Other ADA guidelines suggest that a unit designed to allow a user in a wheelchair to pull under the desktop should have a worksurface between 28" and 34" above the finished floor. In situations where the wheelchair is pulled under the desktop, kneespace that is a minimum of 19" deep must be provided.

One 36"-wide accessible unit, 30" deep, is not sufficient in a library where the staff wish to sit facing a person in a wheelchair who has pulled under the desk. A 30"-deep worksurface will not allow for the 19" of knee space required of a person in a wheelchair

in addition to adequate knee space for a library employee seated directly opposite on the staff side of the desk. If two 36"-wide units are used for the ADA-required unit, the wheelchair user can pull up under one 36" portion of the desk and the staff member can sit comfortably pulled up under the other 36" portion of the desk. Equipment can be arranged in such a manner that a computer does not obscure the line of sight between the user and the staff member.

For many years, the standard depth for circulation desks manufactured by library furniture companies was 30". As computer equipment grew larger, however, the 30" depth became too narrow to accommodate the equipment, unless a pullout keyboard tray was also used. Service desktops had to be increased to 36" or 38" deep in order to accommodate a monitor, a keyboard, and grommet holes for dropping cords beneath the top (except in situations where flat-screen or recessed monitors are used).

In determining the depth of a service desk, the following should be considered:

A need for relative privacy in conducting circulation and reference transactions. The two people involved in the transaction should be close enough to use low voices while speaking to each other across the desk.

Attitudes about personal space. The two people in the transaction should be about three feet apart in order to feel comfortable with each other.

At a circulation desk, the desk should be narrow enough for users and staff to push stacks of books across the desktop for check-out—the desk should be no deeper than an arm's length.

The desk should be deep enough to accommodate all of the equipment that will be placed there, while still maintaining adequate personal space for staff and users.

Usually the design of a custom desk has an impact on the depth of the desk. For example, when a reference desk is designed with a transaction counter around the staff side, the transaction counter cannot intrude so far over the staff worksurface of the desk that the staff's usable portion of the desk is not deep enough to accommodate computer equipment.

In a library expecting a high volume of circulation, a transaction top on a circulation desk (a counter higher than the rest of the worksurface) is not recommended. It is easier for staff to push a stack of checked-out materials across a desktop to the user than to pick up the stack of materials and lift them to the higher level of the transaction top. At a reference desk, however, the staff worksurface may be at 29" high, while the desk has a transaction counter at 36" high. The transaction counter is convenient because a reference book can be placed on the counter to be viewed by a user and a staff member.

The basic units of custom service desks are constructed of wood that is faced with a variety of materials, including wood veneer, high-

pressure plastic laminate, steel, and stone. The tops of desks are faced with laminate, granite, marble, or synthetic materials such as Corian and Granirex. When laminate tops are used on a desk, all edges of the desk should be banded with solid wood to prevent damage to the laminate. Laminate tops that are self-edged are not recommended for any desk; the edges can be easily chipped when staff or users bump into them with a book or other object. Granite or marble tops are often used for aesthetic purposes; however, stone tops should be considered for functional reasons also. The color in plastic laminate tops eventually wears away as a result of pushing books across the top of a circulation desk, so the top must be replaced. Stone tops last for the life of the library and are recommended for academic and public libraries where extensive use is expected. The use of synthetic materials, such as Corian, for desktops should be considered carefully. Some materials may contract over time and leave gaps in the desktop between sections of the material.

One of the most important aspects of planning service desks involves determining how power, data, and wire management will be handled in a desk. Power, data, and telephones may be accessed at the desktop from floor outlets installed under the desk or from outlets installed inside the desk on the staff side. Outlets must be carefully placed so that they are as far away as possible from the feet of staff working at the desk. Enough outlets and circuits must be provided to handle the maximum number of computers and other equipment expected to be used for the lifetime of the desk. Electrical outlets that are a fixed part of the building are inflexible and cannot be moved easily.

Desks made by library-furniture manufacturers are often purchased with three- or four-circuit, eight-wire, integrated electrical systems that are installed along the length of the desk. Outlets for data and power are located below the top of the desk. The electrical system is hardwired to the building power at one point, where the electrical contractor for the building has supplied a junction box with appropriate wires. Flexibility is an advantage to a built-in system; power is supplied along the length of the desk and outlets can be moved or added as the placement of equipment on the desktop changes. The integrated electrical systems in library furniture are similar to the systems that are used to power office-panel systems. Architects and designers who are not familiar with library furnishings are encouraged to consider all of the ways of handling power and data in service desks prior to making specific plans.

Cords and cables from equipment housed on top of the desk are passed through the top to the area below the surface by means of grommet holes. Grommets are often a problem. In many cases, holes for dropping cords are drilled into the desktop on-site when the desk is installed. Grommet sleeves are placed in the holes; covers are placed over the holes that are not being used presently. Unfortunately, the covers are sometimes pulled out by people waiting at the desk and are subsequently lost. The open holes are

unsightly, and inappropriate items are dropped through them. So-called tamper-proof grommets have covers that are controlled by a spring, but eventually the spring will fail to work. Most libraries need grommets that are a minimum of 3" in diameter or rectangular grommets that are even larger. Consult with the library's technology staff to determine the size and location of grommets needed.

Wire management is an issue related to the increased use of electronic equipment. Ideally, all of the cords and cables below the desktop would be stashed neatly in wire-management trays, so that a staff member working behind the desk would not see a mess of cords beneath the desktop. Library-furniture manufacturers supply wire-management channels that are installed along the length of the desk; however, the channels are often too small to accommodate the massive amount of cords, cables, and transformers that are housed below the desktop. Also, the furniture supplier may manage to place all of the cords in the wire-management channels when the desk is first installed, but as equipment changes, library staff do not take the time to get down on their hands and knees and attempt to maneuver the cords into the undersized wire-management channel.

The author worked with the Worden Company to devise a mesh bag for wire management that has worked successfully at the Sugar Land Branch of the Fort Bend County Libraries, in Sugar Land, Texas. The bag is attached to the underside of a desk or a tabletop. The top of the bag is held shut with Velcro. When the top is opened, all of the cords can be easily placed in the flexible bag. The bag has holes in the sides for stringing cords from bag to bag, if necessary. The bag is large enough to hold more cords than any rigid wire-management channel now available.

The mess of cords under a service desk can also be hidden by constructing a second, inside wall, or panel, in the desk. The panels serve to hide the cords and power and data entries. The panels are equipped with doors to allow the staff to access power and data equipment when needed.

The view of the backs of computers and multiple cords is an unattractive part of circulation desks. The exposed cords are also a problem where young children are able to reach and pull the cords. While a transaction top helps to hide the backs of computers, the ergonomic risk to staff, caused by lifting books from one desk level to another, outweighs the aesthetic benefits. Permanent screens or wells to partially hide computers can be built into a circulation desk, but they limit the use of computers along the worksurface—computers can only be used where screens or wells have been constructed. Movable screens can be designed to match the desk and can be attached with Velcro tape to the desk. Flat-screen monitors used at a circulation desk are a much more attractive option than bulky CRTs.

Another solution for eliminating an unsightly view of the back of computers is the use of recessed monitors. Recessed monitors are placed in a "cradle" mounted under the worksurface of the desk. The

monitor is viewed through a piece of glass that is flush with the desktop. The mechanism for recessed monitors is available from several manufacturers, such as Nova and Parallax, and can be mounted into any custom desk. (Desks for recessed monitors are available as standard furniture items supplied by several manufacturers.) Staff are usually not accustomed to using recessed monitors. Before specifying recessed monitors for a library, therefore, it is a good idea to give staff an opportunity to visit a library where such monitors are used at a service desk. Make sure everyone can see the screen. Some people with bifocals may find it difficult to adjust to viewing a recessed screen. Another disadvantage of recessed monitors is that staff cannot show a screen to a user requesting to see a record.

In plans for the arrangement of modules within a circulation desk, functions should move from left to right (from the public point of view), with the return of items and check-in on the left side of the desk and check-out on the right side. A book-return unit should be located in the area closest to the main entrance to the library, so that people can return materials as soon as they enter the building.

On some projects, architects provide detailed drawings of service desks that are used for the purpose of bidding. The drawings are part of the construction drawings, if the desk is a millwork item, or are part of the furniture bid document, if the desks are purchased as part of the furniture bid.

In some small projects, the service desks are described in the furniture bid specifications and illustrated only with diagrams. The following is a sample specification for a two-part reference desk. The specification illustrates the kinds of detailed decisions that must be made when designing a desk (even apart from the actual construction of the desk). The details on the front of the desk described here match details on the library's circulation desk. Three drawings accompanied the specification in the bid document. (See plates 3A and 3B.)

> The desk shall be faced on all exposed surfaces with cherry veneers. The patron side of both sections of the desk shall be faced with cherry veneer, with hickory veneer inlays to match the circulation desk design.
>
> A transaction top on the front section of the reference desk shall be supplied with a 3/4" Granirex slab top with an ogee bullnose edge on all edges. The top of the back section of the desk shall be supplied with a 3/4"-thick Granirex slab top with an ogee bullnose edge on the patron side of the desk and a bullnose edge on the staff side. The 29"-high worksurface on the front unit shall be laminate with 5/16"-thick solid cherry edge band.
>
> Both sections of the desk shall be supplied on both the patron and staff sides with a 6"-high toe kick, recessed 3". The toe kick shall be constructed of 3/4" unfinished plywood. Porcelain tile supplied by the Construction Contractor will be applied on-site by the tile

setter, under the direction of the Architect. The vendor awarded the bid for the desk shall be responsible for supplying and installing all parts of the desk, including the Granirex top.

The overall depth of the desk on the front section, including the transaction top, shall be 38". The back section of the desk shall be 36" deep. The desk shall have a transaction top approximately 9" deep that shall extend around all modules of the front section of the desk (but not around the end panels). The transaction top shall extend approximately 2" beyond the front edge of the desk and approximately 7" over the 29"-high worksurface. Support for the transaction top shall be on the working side of the desk and shall be hidden from public view. The transaction top shall be designed to allow for clear space on the work surface of 28". A cord-drop slot shall be located in the space under the transaction top. The slot shall begin at least 28" from the working-side edge of the top.

Two power-entry devices shall be supplied to the integrated electrical system—one power entry for each part of the desk. The reference desk shall have the same electrical specifications as the General Electrical Specifications.

The desk shall have the same construction specifications as the circulation desk.

The front section of the desk shall be supplied with the following modules:

Module A: 36" wide × nominal 38" deep × 29" high at worksurface. Shelf unit supplied with one adjustable shelf and one fixed base shelf.

Module B: Curved, closed corner unit. Supply closed-access panel through one side of the corner unit to allow for maneuvering data cables through the corner unit.

Module C: 36" wide × nominal 38" deep × 29" high at worksurface. Knee-space unit with no fixed base.

Module D: 36" wide × nominal 38" deep × 29" high at worksurface. Storage unit with two drawers, 6" high × 18" wide at the top of the unit and one fixed base shelf.

Module E: 36" wide × nominal 38" deep × 29" high at worksurface. Knee-space unit with no fixed base.

Module F: Curved, closed corner unit. Supply closed-access panel through one side of the corner unit to allow for maneuvering data cables through the corner unit.

Module G: 36" wide × nominal 38" deep × 29" high at worksurface. Shelf unit supplied with one adjustable shelf and one fixed base shelf.

The back section of the desk shall be supplied with the following modules:

Module H: 36" wide × 36" deep × 36" high. Closed cabinet unit. Fixed base with two doors that open out from the center of the unit. Supply interior of cabinet with two adjustable shelves.

Module I: Curved, closed corner unit. Supply closed-access panel through one side of the corner unit to allow for maneuvering data cables through the corner unit.

Module J: Nominal 36" wide × 36" deep × 36" high. Atlas case with access from the patron side of the desk. Atlas case shall have five pullout shelves operating on full-extension ball-bearing slides, with stops to prevent removal. Each shelf shall have a clear area of 26" wide × 24-1/2" deep × 3-3/8" high. Shelves shall be constructed of 3/4"-thick plywood with cherry face and 1-1/2"–wide front retainer. The staff side of the atlas unit shall be faced with cherry veneer.

Module K: Nominal 72" wide × 36" deep × 36" high. Shelving unit built with access to nominal 18"-deep shelves on the patron side and nominal 18"-deep shelves on the staff side. Full back panel between the two shelving sides of the unit. Each shelving unit on both sides shall be supplied with a fixed base shelf and two adjustable shelves. Units shall have standard wood library shelving construction with intermediate panel.

Module L: Curved, closed corner unit. Supply closed-access panel through one side of the corner unit to allow for maneuvering data cables through the corner unit.

Module M: 36" wide × 36" deep × 36" high. Storage unit with four legal-sized file cabinets and a fixed base.

Supply two end panels 29" high for the front section of the desk and two end panels 36" high for the back section of the desk.

Some libraries are installing self-check machines in the library or are including access to power and data for the future use of self-

check equipment. In selecting a location for self-check, keep in mind that patrons may need some instructions the first time they use the equipment, so the machine should be placed within a short distance from a service desk. On the other hand, the self-check equipment should not be so close to the check-out desk that people waiting to use self-check get in the way of others in line to check out books by the traditional method. Self-check machines may be used successfully in a children's area, where young people learn how to use the equipment quickly.

Shelving

Over the last few years, new libraries have included a larger amount of interior public space devoted to computers in proportion to space used for bookstacks. Except in a few academic libraries, however, shelving units for housing books and audiovisual materials have remained an essential part of the furnishings for any library. Standard library shelving consists of three-foot sections of shelving placed together to form ranges of shelving. In some situations, sections of shelving that are 24" or 30" wide are used.

Architects and interior designers who are considering providing lights on bookstacks rather than general lighting in a stack area should study the possibility carefully and discuss the idea with the local planning team. The flexibility of a library interior is essential because of the kinds of changes occurring in libraries in general. The use of only stack lighting severely restricts the rearrangement of the stacks. If stacks are removed from an area, general lighting must be added later, when funds may not be available. If stack lighting is used for aesthetic reasons or to improve the visibility of the stacks, general lighting that is adequate for future use of the space without the stack lighting should also be installed in the area.

Wood shelving or architectural woodwork is often used in small special libraries where the aesthetic look of wood is an important aspect of the interior design of the space. Designers who are considering the use of wood shelving should read an article by Ann Massman entitled "The Wood Shelving Dilemma."[1] The article outlines the ways in which wood shelving puts library materials at risk of damage because of its acidic nature and other chemical components in wood. Massman states that "it is strongly recommended not to use wood shelving and other wood storage equipment to store library materials with long-term value."

Most libraries are furnished with steel cantilevered shelving, which is less expensive and provides more flexibility for changing out the components than wood shelving. Architects and interior designers who have not planned libraries for several years are urged to tour the exhibits at a library conference or talk to local vendors about shelving products currently on the market.

The safety of steel bookstacks was an issue in the past, when

most shelving units were starter/adder systems that depended on sway braces with turnbuckles for stability. Architects and others specifying steel shelving now benefit from the independent performance-testing of steel bookstacks carried out under the auspices of the staff of *Library Technology Reports* during the 1990s. In order to ensure that shelving purchased meets the highest performance standards, specifications for steel bookstacks should require that shelving shall have been tested and shall have passed the standards set by ANSI/NISO Z39.73 1994, "Single-Tier Steel Bracket Library Shelving." The standards ensure that the shelving bears prescribed loads without sagging or bending, that the shelving finish endures normal use for at least 30 years, and that changing the position of adjustable shelves can be accomplished without tools.

Decisions regarding the details of shelving to be purchased should be discussed by the design professionals with the library staff. What is desired in one library may not be what is needed in another. The first decision to be made is whether to use wood or steel shelving. Some libraries use steel shelving in most of the library, but use wood shelving or architectural woodwork in rooms for special collections or local history.[2]

Before making final decisions about shelving, the following issues and questions regarding steel shelving should be addressed. The items listed are relevant to all types of libraries.

Types of Steel Shelving

Most libraries today purchase one of two types of shelving, either welded-frame systems or European-style starter/adder systems. Products of both types have passed the required performance testing. Welded-frame systems consist of uprights and spreaders that are welded together; each section of shelving includes a four-sided frame. With welded-frame shelving, all frames are alike; a starter section is not needed at the end of each range.

European starter/adder shelving, introduced into the United States by the Danish company BCI, consists of a T-base welded to an upright. Top and bottom spreaders are attached to the uprights with a hook-in type of assembly. Some systems add a center crossbar to every three to five sections for stability. Because of the attractive rectangular shelf brackets on starter/adder shelving, this type of shelving is sometimes used without end panels.

Either type of shelving is acceptable. Sometimes the welded-frame systems are slightly less expensive than starter/adder systems. In an open-bid situation, where the library wants the best price regardless of which type of shelving is used, manufacturers of both types of systems could be listed as acceptable and the specifications written to allow vendors of both products to bid.

Several shelving manufacturers also offer special systems designed for highlighting special collections. Some public libraries use these specialty systems, like BCI's System Arc, for displaying

new books and audiovisual materials near the library entrance. These and other shelving systems can be equipped with lights. The use of lighted shelving must be planned, of course, at the same time as the electrical plans for the building are determined.

Heights of Shelving

Decisions regarding the height of shelving to be specified depend on how the bookstacks will be used. In children's areas of public libraries, for example, picture-book shelving for preschoolers should be no more than 42" high, while shelving for school-age children may be 48" or 66" high. In elementary school libraries, where space is available, the staff may prefer to have no shelving higher than 48". In academic libraries, where the most efficient use of space is the prime consideration, 90" stacks will be used. Because of the size of the volumes, shelving in law libraries may be as high as 93".

In many libraries, the height of the shelving may be determined by a need for visual control from a service desk to the other side of a reading room. Where line of sight is a priority, shelving should be no more than 42" high. In the adult areas of public libraries, shelving heights may vary because of the height of the ceiling, the types of materials to be housed, and the amount of overall space available for shelving the collection. Where space is limited, collections are usually placed on shelving 90" high. Because of the difficulty of retrieving books from the top shelf of a 90"-high stack, most public libraries would prefer to have shelving for adults that is 78" or 84" high. Some libraries place nonfiction on 90" shelves, but place fiction, large-print books, and audiovisual collections on lower shelves, such as 78" or 66" high.

Wall and Freestanding Shelving

Steel shelving is available as single-faced or double-faced sections. Single-faced shelving must be attached to a wall for stability. Double-faced shelving is often freestanding. In many libraries, double-faced stacks do not need to be attached to the floor, and no special bracing is required. Libraries in earthquake-prone areas should be familiar with their governmental requirements for the installation of library shelving where double-faced shelving must be permanently attached to the floor or braced overhead.

Shelves

Standard adjustable shelves are available in many different depths; for example, 8", 9", 10", 12", and 16". Some specialty shelves are only 6" deep. The shelf depth needed depends on the type of material to be housed on the shelf. Specialty shelves for audiovisual materials are usually 6" or 8" deep. Books for school-age children and adult fiction will fit on a 10" shelf. Most picture books, adult nonfiction,

and reference book shelving should be 12" deep. Law books may require shelves 14" or 16" deep.

In specifying shelves, it is important to discuss with vendors, and to indicate in your specifications, whether the depth of the shelves you are ordering is actual or nominal. Some vendors discuss shelves in terms of nominal depth, that is, the depth of the *actual* steel shelf may be one inch less than the *nominal* depth. On a regular flat shelf with no back, the nominal depth is the depth from the front edge of the shelf to the imaginary centerline of the shelving frame. In other words, the vendor may be including the space at the back of the shelf created by the upright as part of the depth of the shelf.

Adjustable shelves may be regular flat shelves that allow for pushing a book back beyond the actual depth of the shelf, or the adjustable shelves may have an integral back (an upturned flange about 1" to 1-1/2" high) that prevents books from moving beyond the actual back of the shelf. If the library intends to use a sliding book support, integral shelves are required.

In some shelving systems, each side of a double-faced section of shelving has a separate base shelf. In other systems, the base shelf is double-faced, and only one shelf is specified. Base shelves that slope up are available and are popular in public libraries. The slope helps to make titles on the bottom shelf more visible. Base shelves are available in the same sizes as adjustable shelves. Many libraries specify the base shelf deeper than the adjustable shelves in order to increase stability. For example, if 10"-deep shelves are specified on sections of wall shelving, a 12"-deep base may be specified. A vendor would refer to this shelving as "10 over 12."

Special Shelving Components

Picture-book shelving for children's areas has 12"-deep shelves that are supplied with a full back. The shelves are slotted to accommodate movable dividers to hold the books upright. Five dividers per shelf, including the base shelf, should be specified. Similar slotted shelves can also be used for housing back issues of magazines or small books, such as plays or *Cliff's Notes.*

All shelving systems offer periodical display units with fixed or hinged shelves. Hinged periodical shelves can be fitted with a slotted shelf beneath the display unit for the storage of recent back issues of magazines. Current issues of newspapers can be displayed on periodical display units fitted with one- or two-piece hinged Plexiglas covers.

All shelving systems offer a wide variety of special shelves for audiovisual and other materials. Shelves to hold CDs, paperbacks, videos, and DVDs are 6" to 8" deep and are sloped up to hold the materials in place. These shelves may be ordered with or without slots and dividers. Other accessories include a rod that fits into the shelving frame to hold hanging bags (for children's books and cassettes, for example), browser boxes that fit into shelving frames for audiovi-

sual materials or paperbacks, and pullout reference shelves located where users may need to set down a book and open it in the stacks.

It would be helpful if one type of book support could be recommended, but the perfect book support that will satisfy everyone has yet to be invented. Some librarians are proponents of sliding book supports on integral back shelves, while others say the sliding book supports don't really slide and the plastic brackets break easily. The type of wire book support that is squeezed to fit under the shelf above may work if the books are tall enough to fit behind the book support, the tension on the support is strong enough, and the gauge of wire is sufficient. For many years, the Houston Public Library bought Gaylord's large, cork-based book supports and had them finished to match the shelving purchased. The staff there felt this was the best book support. For length of years of satisfactory service, a 9"-tall, findable book support with a cork base may be the easiest way to go.

If sliding or wire book supports are to be purchased, ask for several to try out before purchase. Try them out on full shelves of books of various heights. In a bid situation, require bidders to supply sample book supports to be tested on-site.

Canopy Tops and End Panels

Steel shelving can be purchased with matching steel canopy tops that should match the depth of the base of the shelving. In situations where money is an issue and aesthetics is of less importance than function, 90"-high shelving can be used without canopy tops. Without the tops, some librarians say the titles on the volumes on the top shelves can be viewed more easily because the tops don't block light from above.

Most public libraries prefer canopy tops because they give the shelving a more finished appearance. Steel tops are not very functional for low shelving where items will be placed for display. The paint gets marred and the tops can bend with the weight of some objects. In many cases, shelving that is 42" and 48" high is specified with custom tops that are made of particleboard faced and self-edged with laminate, faced with laminate and edged with solid wood bands, or faced with wood veneer and edged with solid wood bands. Low shelving may also have granite or marble tops. In a bidding situation, the shelving supplier and the manufacturer of the custom tops should be required to work together to ensure that the tops fit the specific shelving supplied. The bid document should also indicate whether the shelving vendor or the custom-top vendor will supply the hardware for attaching the tops. In some projects, the architect or the interior designer may design special stone tops, cornice tops, or wood bases, in order to give steel shelving a less utilitarian look.

In large academic libraries where ranges of stacks are purely functional, steel shelving may be purchased without end panels. Likewise, some public libraries using the European-style starter/adder shelving

may choose not to use end panels. Most libraries, however, choose to use some type of end panel. The least expensive ones are matching steel end panels purchased along with the shelving system. The cost of end panels varies greatly, depending on the type of materials used, the size of the end panels, and the custom detail specified. End panels are made with particleboard or lumber cores that are faced in some manner. (See figures 13, 14, and 15.) The following are some end-panel options:

End panels with laminate on both faces and all edges.

End panels with laminate face on both sides and with a solid wood edge around all four sides of the panel. The solid wood edge may have one of many different shapes.

End panels with slat wall on the outer face, laminate on the backside, and all sides self-edged with laminate.



FIGURE 13

Mira Mesa Branch Library, Mira Mesa, California. Architects, BSHA. Used by permission of MJ Industries. Photo credit: Don Snipes Photography.

End panels with slat wall on the outer face, laminate on the backside, and with a solid wood edge around all four sides. (Slat walls can be supplied with no inserts, or with plastic or aluminum inserts between the slats.)

End panels with wood-veneer face on both sides and solid wood edge band on four sides. The price of wooden end panels depends on the thickness of the panel (the thicker it is, the more expensive), the size and shape of the solid wood edge (the wider it is, the more expensive), and detailing at the corners.

End panels with wood-veneer face on both sides and solid wood edge band on four sides and with special custom details added; for example, laser-cut drawers, special inlays, details added to match other furnishings, and details designed to accommodate end panel signs.



FIGURE 14

Loudoun County Public Library, Leesburg, Virginia. Used by permission of MJ Industries. Photo credit: Paul Colburn.

In order to meet a budget on a small project, it may be necessary to work with a vendor to determine how the library can afford wooden end panels. For example, a vendor may begin by quoting you a price for a wooden end panel that is 1-3/8" thick with a 5/8" solid wood edge around all four sides. Instead, ask for a quote on a panel that is 3/4" thick and that has a 1/8" strip of solid wood around the outside edges.

The same end panel need not be used in all parts of the library. Detailed custom panels may be used near the entrance to the library to make a good first impression, while less fancy end panels may be used in other parts of the library. It is not uncommon for the children's area of a public library to have end panels entirely different from the adult part of the library. The end panels in a children's area



FIGURE 15

Berlin Peck Memorial Library, Berlin, Connecticut. Used by permission of MJ Industries. Photo credit: Hutchins Photography, Inc.



FIGURE 16

Parr Library, Plano, Texas. Lorca series table and chairs and Galaxy series end panels manufactured by the Midlands Company. Photo used by permission of Libra-Tech Corporation. Photo credit: Penny Schmitz.

offer architects and interior designers an opportunity to display their creativity. The end panels in the children's area may be faced with several different colors of laminate. Wood end panels may be decorated with laser-cut images of interest to children. (See figure 16.)

Computer Furniture

Almost any worksurface in a library carries the potential for becoming furniture to hold a computer at some point in the life cycle of the library. During the design process for new and renovated libraries, however, specific pieces of furniture are purchased to hold computers for library users and staff.

All library-furniture manufacturers offer some type of standard computer furniture that can be easily customized to fit the requirements of a particular library. The following are some of the questions to be asked in designing or selecting computer furniture.

What kind of work will library users be doing at the computer? Will people use it to make quick catalog searches, or will they spend a longer time researching topics on the Internet and other electronic resources? Will furniture be needed for self-check machines now or in the future?

Who will be using the computer? Will it be used by preschoolers and school-age children playing educational games? By medical school students researching a topic? By high school students doing a homework assignment?

How many people will be using the computer at one time? Will single individuals use each computer all of the time, or will two or three people use the computer collaboratively?

How much equipment is each computer workstation expected to hold? Monitor, keyboard, and CPU only? A printer? Speakers? A scanner?

How will the interface between the computers and building power and data be accomplished?

Quick catalog searches can be done at a computer placed on a stand-up table with a 39"-high worksurface. Most libraries need fewer stand-up computers and more computers at lower heights. Longer computer searches require a sit-down table with a worksurface that is 29" high. (See figures 17 and 18.)

Computers used for a quick catalog search can be accommodated on a worksurface that is 36" wide. Computers used for longer transactions require surfaces 48" to 60" wide, so that the person using the computer has space for books and papers beside the equipment. Also, greater privacy for each person is afforded by a wider worksurface for each computer.

Most libraries need workstations designed to accommodate more than one person using a single computer. Students at all levels, children, and even adults sometimes work collaboratively at a computer for particular projects. Homework assignments sometimes require working together at one computer. Preschoolers often use a computer with a parent or caregiver. Use of a single computer by several young teenagers is frequently an after-school social activity in public libraries. Sometimes an entire family may become involved in using a computer.

Collaborative use of computers has implications for the size, configuration, and location of computers in the library. The amount of space allocated for each computer on a table should be large enough



FIGURE 17

Hudsonville High School, Hudsonville, Michigan. De Gilde computer table manufactured by the Worden Company. Used by permission of the Worden Company.

(48" to 60" wide) to allow more than one person to view the computer screen at the same time. Stools or chairs for two or three children and adults should be provided for every computer in the children's department of a public library. In academic libraries where collaborative learning is expected, large six-sided computer workstations that allow for several people to sit close to the computer are sometimes used. The furniture usually has tall dividers between each piece of the "pie" to give each group some privacy.

The collaborative use of computers can be a noisy activity. Some individuals in public libraries like to use a computer in a relatively quiet area with little conversation going on around them. Some accommodation may be made for these users by placing some of the workstations away from the area where most of the collaborative activity is going on.

Decisions regarding computer furniture involve determining how the various pieces of equipment will be housed on the furniture. The CPU (central processing unit), for example, may sit on the top of the table surface or it may be housed in a special holder under the worksurface. If a CPU holder is purchased, make sure it is large enough to accommodate the size of the CPU to be used by the library, now and in the future. Also, consider how easily staff can access the entire CPU when it is in the holder, whether the library will require some kind of locking mechanism for the CPU holder, and how much air circulation will be provided to the equipment placed in the holder. A computer keyboard and mouse used on library furniture may sit directly on the worksurface, or may be housed on a pullout shelf. Space on the worksurface may also be needed for speakers or scanners.

Consider how printing will be handled. Will each computer have its own printer (so space will be needed on the worksurface), or will



FIGURE 18

Main Library renovation, Texas Tech University, Lubbock, Texas. Architects, F & S Partners and Parkhill, Smith & Cooper, Inc. Photo used by permission of the photographer. Photo credit: Robert Suddarth Photographer.

all of the printing be networked to a central printer located away from the computers? Have other furnishings been designed to hold the central printer? Where debit cards will be used, has space been planned to accommodate card dispensers and printing equipment? In situations where limited space is available, the ability of a worksurface to hold the required computer equipment can be checked by developing a scale drawing of the tabletop (from plan view—looking down on the table from above), with each piece of equipment drawn to scale or with scaled cutouts of the equipment that can be arranged on the drawing of the tabletop.

When a new building is planned, decisions regarding how computer tables will be powered should be made before the electrical plans are completed. Power can be provided from electrical outlets at each computer location. More than one duplex outlet will be needed at each location, however. Alternatively, on tables with one or two computers, power may be accessed from a power strip mounted on the underside of the worksurface. The power strip then plugs into an outlet in the floor or wall.

Another solution involves purchasing computer workstations supplied with integrated electrical systems (for example, eight-wire, three-circuit systems) that are wired to building power from a single junction box. The outlets in the system are then attached to the piece of furniture at regular intervals. The use of furniture with an integrated electrical system is recommended where computers are placed on long rows of workstations. Integrated electrical systems are useful in building renovations in order to avoid trenching concrete floors. A range of workstations can be powered easily from one point—from electricity brought through a wall or down a building column—and wired to the furniture electrical system.

In discussions with architects and electrical engineers who are not familiar with libraries, the local planning team should discuss the number of circuits that will be provided in areas with numerous computers. Explain that, because of the popularity of computers in libraries, it is possible that every computer will be in use at one time.

Most libraries still provide data for networked computers and printers by cabling through conduit to termination points for data jacks in the floor or the wall. Patch cords are then used to carry data to computers. The use of wireless data transmission has, however, made it possible to add networked computers to areas of the library where conduit has not been provided for data.

Access to power and data below the worksurface of a computer table can be accomplished by supplying grommets through the worksurface. A more flexible method is the use of a cord-drop slot, a minimum of 2" deep, located at the back of a worksurface. The slot allows cords and cables to drop at any point along the worksurface. On a computer table that is one large, flat surface with panel ends, the tabletop is constructed in two pieces in order to allow for the slot in the middle. The slot should be supplied with a retaining strip to prevent pencils or other small objects from falling through to the

floor. On computer workstations that are built with back and side panels, the worksurface is recessed away from the back panel to allow for the cord drop.

The problem of wire management is the same on computer tables as it is on service desks. The mesh bag mentioned in regard to service desks works well on large computer tables. Custom-built, panel-end computer tables may be built with a "box" running along the length of the middle of the table, under the top. The box holds and hides all of the cords and cables from the computers. Lockable doors in the box provide access to hidden cords and cables.

Public-access computers are used in libraries on large, flat tables with no dividers and on rows of starter/adder carrels with low intermediate panels or with low or high dividers. Library-furniture manufacturers make all shapes and sizes of furniture for computer workstations, including six-sided or round tables that can be designed to fit around building columns. (See figure 19.) Computer tables can also be individual units designed especially for wheelchair use. Many computer tables have laminate tops with wood edge bands. Tabletops that are self-edged with laminate are not recommended, because the laminate can easily break. Where the extensive use of computers is expected, a polyvinyl chloride (PVC) edge on computer tables or carrels may be used.

Some interior designers prefer to use commercial products made by office-furniture manufacturers to hold public-access computers. Components of office-panel systems and furniture designed especially for computer classrooms or information areas (like KI's Workzone tables or Worden's Pavilion series) work well in the library because of their built-in electrical systems and wire-management capabilities.



FIGURE 19

Carroll High School, Southlake Independent School District, Southlake, Texas. Architects, SHW Group, Inc. Mezitta computer tables, Serpentine Unit,manufactured by BCI. Photo used by permission of Libra-Tech Corporation. Photo credit: Penny Schmitz.

Some libraries have opted to provide computers with recessed monitors (discussed previously for use with circulation desks). Recessed monitors provide more privacy for individual users; however, they are a hindrance when a staff member is assisting a library user and both of them must see the screen at the same time. Recessed monitors would not be workable in a situation where any type of collaborative computer use is expected or where visual control is a priority (for example, in a school library). (See figure 20.)

Computers can also be placed on built-in millwork or on architectural woodwork counters built against a wall. All of the requirements regarding kind of use by library patrons, size and amount of equipment to be housed, electrical and data access, and wire-management capabilities must be considered in designing custom-built furniture for computers. In one library where educational software for children is loaded on the hard drives of individual computers, the computer monitors and keyboards are located on a 27"-high counter. The CPUs for the computers are located in lockable cabinets with louvered doors above the counter. A shallow "box" at the back of the counter (between the counter and the cabinets) covers all of the cords running between the monitors and the CPUs.

Some school and small public libraries purchase relatively inexpensive computer furniture from office- and library-supply catalogs. The furniture is available in a wide variety of standard sizes and configurations, including individual units and four-sided or six-sided modules. Purchasing from a library-supply catalog is an easy way to acquire furniture; however, many of the products in catalogs are manufactured by a company other than the one that publishes the catalog. In fact, the manufacturer's name is often provided with the

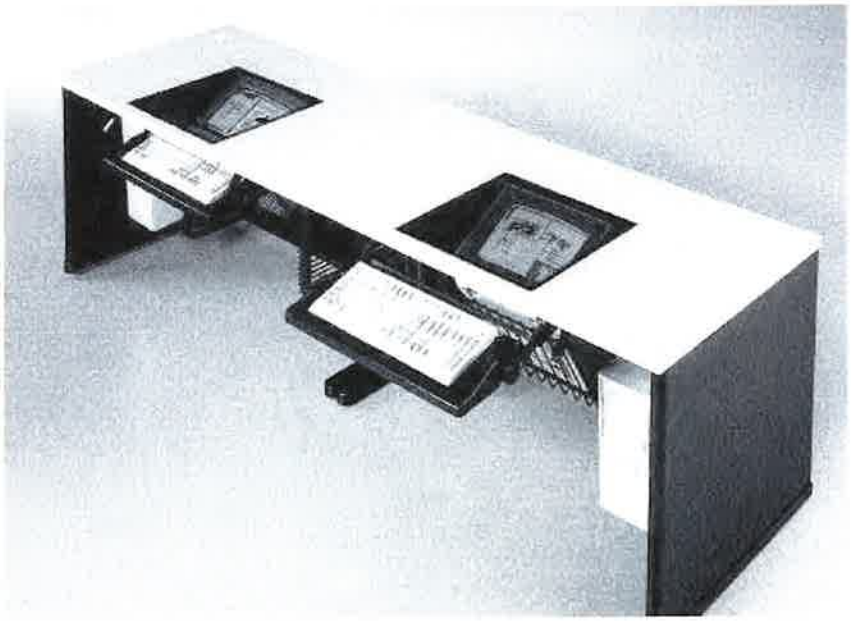


FIGURE 20

Computer table with recessed monitors. Manufactured by APW-Wright Line. Used by permission of APW-Wright Line. Photo credit: Bob Nash, Nash Photography, Worcester, Mass.

product in the catalog. In some cases, you may obtain the same product for a lower price by going directly to a dealer of the product rather than by purchasing through a catalog. Information about a manufacturer can often be obtained by locating the company's phone number on its home page on the World Wide Web. Call the company and ask for the name of a dealer or representative in your area. Then call the dealer to obtain more information about the product and to obtain the dealer's price.

Computer classrooms or labs are now considered a standard space for all types of libraries. Computer labs can be equipped with standard computer tables placed in rows in classroom style or with millwork counters built around the perimeter of the room. The disadvantage of built-in furniture arranged around the walls is that participants in a class or workshop have to turn their chairs to see the instructor. Computer classrooms may be furnished with tables for holding recessed or partially recessed monitors. Recessed monitors allow participants in training sessions to see the presenter easily when the instructor is at the front of the room; however, some trainers prefer to work at the back of the training area with information projected on a screen at the front of the room. When the presenter is at the back of the room and personal computers are placed on the tabletop, the instructor can view the screens of all hands-on participants and can see at a glance who is keeping up with the training.

Tables and Chairs

In many areas of the library, tables are a primary interior design element. In libraries where heavy use is expected, durability and performance are as important as aesthetics in selecting a table.

The American Library Association, through the staff of *Library Technology Reports,* supports an extensive program of performance-testing of library tables and chairs that began in the 1970s. Most of the work was carried out by Carl Eckelman, professor of wood science at the Forest and Natural Resources Product Laboratory at Purdue University. The data collected as the result of Eckelman's extensive performance-testing of tables provide library-furniture and other manufacturers with the information needed to engineer and design tables that will not fail with heavy use. From the performance-testing studies completed in 1977, designers know that the quality of a table depends on engineering that reflects the need for balanced construction; that is, each of the components must be as strong and as well made as any other so that the table does not fail because of one weak element.[3]

When selecting tables for libraries, consider how the top of the table will be used. In order to prevent a table from sagging, any table that is selected to hold heavy computer or microform equipment or index racks for heavy books must be built with double keels 8" to 12" deep running the length of the underside of the table. Even simple

study tables longer than 60" that lack an apron to provide support along the length of the table may require some kind of V-shaped steel brace or other supporting member to keep them from sagging or deflecting in the middle. Study tables 48" wide or wider by 72" long or longer usually require one or two wood keels for support.

Tables for libraries can be designed or specified in a wide variety of sizes and shapes. (See figures 21, 22, and 23.) When selecting tables for adults, it is important to keep in mind a person's desire to maintain personal space in a public facility. A table should be large enough to allow two or more individuals to sit at it comfortably and continue to feel secure in their own space. In a library where study tables are expected to be used for research, tables should be at least 48" wide and 72" long. In a genealogy library or room, large tables are needed to allow each user to spread out a number of books that are studied together. With small tables (30" or 36" wide × 60" or 66" long), only one person, or possibly two, may feel comfortable sitting at the same table.

Library tabletops may be supported by legs or by panel ends. Tables with full panel ends are massive in appearance and are used more suitably in large spaces where the tables are not out of proportion with other furnishings, as well as with the total size of the space. Tables with Mission-style end panels are not as massive as full-panel ends and can be used in smaller spaces. Small round tables are used in libraries in children's areas, in young adult areas, or in any space where conversing or working together is encouraged.

Many tables in libraries are wired to supply power and data at tabletop or to supply power for task lights. Any table wired to supply power and data must be specified with a chase that holds separate channels for power and data running from the floor or the wall of the



FIGURE 21

Law library, Kilpatrick Stockton LLP, Atlanta, Georgia. Tables and chairs manufactured by Thos. Moser Cabinetmakers. Photo used by permission of Thos. Moser Cabinetmakers. Photo credit: Thomas Watkins, Atlanta, Ga.

building up to the tabletop. On leg-base tables, the chase is usually attached to a table leg, or the leg itself is hollowed out to serve as a chase. On panel-end tables, the chase is hidden by one of the end panels. A table should also include a wire-management channel to hide cords from the power/data box on the table; the channel runs along the underside of the length of the table, to the chase.

In coordinating furniture and building plans, electrical plans should be prepared as an overlay of the furniture plans in order to coordinate the exact location of power and data floor boxes. Electrical locations should match one corner of leg-base tables or one of the ends of the panel-end tables where the power/data chase will carry power and data to the tabletop. All library-furniture manufacturers offer some type of box with a pop-up lid for public tabletop access to power and data.

The tables made by library-furniture manufacturers and those engineered for durability and made by commercial-furniture manufacturers are suitable for any library. In large library building projects, tables are often custom-designed by architects and interior designers in order to make the building's interior more distinctive and functional. Distinctive features for a smaller library project can be achieved by placing a customized design on the end panels of standard library furniture tables.

Library tables can have veneer tops or laminate-faced tops. Tables with laminate tops should have solid wood edges—tops self-edged with laminate are not durable. Veneer tabletops are usually specified for special collection rooms where use can be carefully monitored. One busy special library that opened with veneer table-



FIGURE 22

Shields Library, University of California at Davis. Chairs, tables, and carrels manufactured by Fetzers' Inc. Photo used by permission of Fetzers' Inc. Photo credit: Richard Springgate.

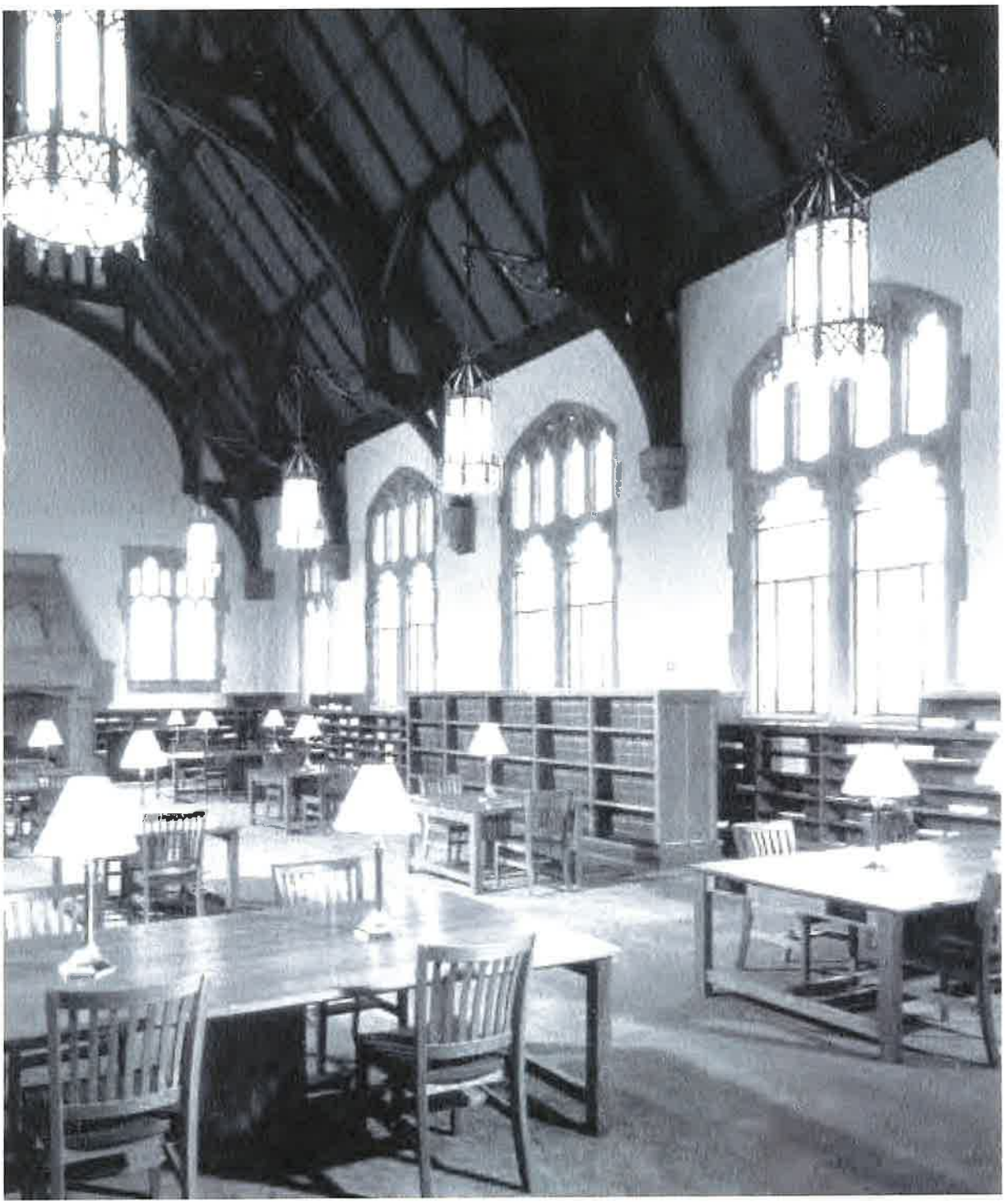


FIGURE 23

Library, Agnes Scott College, Atlanta/Decatur, Georgia. Furniture manufactured by Thos. Moser Cabinetmakers. Photo used by permission of Thos. Moser Cabinetmakers. Photo credit: Thomas Watkins, Atlanta, Ga.

tops added glass sheets over the veneer soon after the library opening, when it became clear that the veneer would not withstand heavy use.

While attractive tables are desirable for a library, a table is only as useful as the chair that is placed with it. Library users must be comfortable sitting in a chair for short and long periods of time. In busy school, academic, and public libraries, the durability and comfort of the reading chairs selected are as important as the look of the chairs. Effective interior design involves making decisions which ensure that library chairs will be attractive and useful for many years to come.

Like tables, the topic of chairs for libraries has been researched extensively for more than 20 years by the American Library Association, through the work of the staff of *Library Technology Reports* (*LTR*). In a report published in 1995, Howard S. White, former editor of *LTR*, said he hoped that performance-testing would "eventually lead to an American National Standard, which would expand the number and types of chairs that could be specified for library use while assuring they would not fail in the very demanding environment of libraries."[4]

White's comment is the key to selecting chairs for any library—chairs for school, public, and academic libraries must be strong enough not to fail with extensive use and abuse. It is the responsibility of design professionals and consultants to select chairs that will not fail for many years. In order to choose durable chairs for areas of the library with expected heavy use, select a chair that has been performance-tested to the *LTR* or comparable standards, or a chair that has been used in a busy library for 10 years without failure. The furniture maker Buckstaff, for example, tests to a British standard that is comparable to, or more stringent than, the *LTR* tests.

A chair that is designed specifically for a project or one that has not previously been used in a busy library should be sent to the Forest and Natural Resources Product Laboratory at Purdue University or some other independent facility to be tested to the *LTR* standards. The Dakota Jackson library chair selected for use in the main facility at the San Francisco Public Library was performance-tested twice at Purdue before it was specified. The designer altered the chair after each performance test, with the result that the final design met the stringent standards of the *LTR* tests.

The major library-furniture manufacturers in the United States have participated in the development of the *LTR* tests and are aware of the need for performance-testing. The *LTR* performance standards are more stringent than standards developed by the American National Standards Institute (ANSI) and the Business and Institutional Furniture Manufacturers Association (BIFMA). Chairs that are manufactured for commercial use—but not specifically for library use—often have passed the ANSI/BIFMA tests. Chairs made for commercial use that have passed ANSI/BIFMA standards may be durable enough for library use; however, check the durability of the chairs in previous settings with heavy use prior to purchasing them.

Chairs that have passed the ANSI/BIFMA standards may be acceptable only in areas where light use is expected.

Reading chairs to be used at tables or carrels in libraries do not have to be expensive to be durable. The same inexpensive Jasper chair that can be seen in hundreds of restaurants around the United States can be used successfully in libraries. All of the library-furniture manufacturers continue to supply standard leg- or sled-based library chairs with upholstered seats and backs. Many libraries are, however, selecting all-wood chairs rather than upholstered chairs, because of ease of maintenance. If chairs with arms are to be used at reading tables, make sure that the arms will fit under the tables and that library users won't smash their fingers if they pull the chair close to the table.

Instead of all-wood chairs, interior designers may select a chair with a wood seat and back and a steel frame and legs, an all-metal chair, or an upholstered chair with a steel frame. Regardless of the chair selected, its durability should be documented either by performance-testing data or by heavy use over a long period of time in a library or similar setting.

Because of the length of time now spent by library users at computers, an armless task chair with pneumatic height adjustment and built-in lumbar support is recommended at seated-height computers. Dozens of companies make task chairs available in a wide range of costs. Task chairs that have been performance-tested should be used, unless the library is prepared to replace the chairs every three to five years. The purchase of task chairs from an office-supply catalog is not recommended, unless the vendor can obtain performance-testing data for the chairs. All of the major office-furniture companies (such as Herman Miller, Knoll, and Steelcase) manufacture performance-tested task chairs with long-term warranties. The chair may cost more at the time of purchase, but will cost less per year with long-term service.

Most libraries have some type of soft or lounge seating in addition to reading chairs at tables and carrels. In many libraries, for example, those in large urban facilities, maintenance and durability are the most important factors in selecting lounge seating. In some public libraries, single lounge chairs, rather than two- or three-place sofas, are placed in some areas to discourage people who want to lie down to sleep in the library. On the other hand, in academic libraries where students may spend most of the night in the library, lounge seating may be provided with the intent of allowing students a chance to nap between study sessions.

Commercial, rather than residential, lounge furniture should be used in any library. The same concern about durability that applies to reader's chairs applies to lounge seating. Lounge seating expected to have heavy use in a library should meet stringent GSA Specification FNAE-80-214 or equivalent performance-testing standards. Lounge seating with wood arms or wood arm caps requires less frequent reupholstering or cleaning than chairs with fully

upholstered arms. In selecting lounge furniture, discuss with vendors how easily particular pieces can be reupholstered. Where maintenance is an issue, avoid chairs that have crevices where dirt can collect.

Many commercial-furniture manufacturers, as well as library-furniture manufacturers, sell lounge seating. Lounge seating with a designer label, made from the best materials and covered with leather, may be very expensive. On the other hand, a wide variety of attractive lounge chairs and sofas is available for a reasonable price. The cost of lounge furniture can depend on the design, the cost of the materials and durability of the frame, and the type of upholstery used. Lounge seating can be upholstered in a wide range of fabrics, leather, and vinyl. Vinyl upholstery that has the softness and appearance of leather is available.

In a public library where people of all ages use lounge seating, it is important to select a chair or sofa that anyone can sit down on and get up from easily. The chair needs to be proportioned for ease of use. It is disconcerting for people with short legs to sit down on a lounge chair that is so deep from front to back that it is necessary for them to perch on the edge of the seat in order to have their feet touch the floor. Older people need a chair with a firm cushion that keeps them from sinking so far into the chair that it is difficult to get up on their feet after sitting in it.

Benches are used in libraries as casual seating in waiting and browsing areas. Benches are available from many library- and commercial-furniture manufacturers as standard items, or they may be custom-designed on special projects. Standard benches may be supported by a sled base or by panel ends. A simple wood bench may have a wood or an upholstered seat. Larger benches are available with wood frames that include backs and arms. These benches may have wood seats or an upholstered seat pad. All-metal benches, or benches with a steel frame and an upholstered seat pad, are also available.

Sled-base or leg-base backless stools are used in special situations. Stools can be used at computer workstations that are meant for a quick reference to the catalog or other resources. Stools are also frequently used as seating at computers in children's areas.

Chairs designed specifically for children come and go on the market relatively frequently, because of the small quantities purchased relative to other furniture items. All of the major library-furniture manufacturers offer chairs for children. Some of the chairs are of similar design to a line of chairs for adults offered by the same manufacturer. A good children's chair is not an adult chair with the legs cut off; the entire chair should be proportioned, with shorter legs and smaller members. The height of the chair needed will depend on the age of the children expected to use it and the height of the table with which it will be used. Chairs with a seat height of 12" to 14" should be used with tables 20" to 22" high. Chairs with a seat height of 15" to 16" should be used with tables 24" to 26" high.

Chairs selected for a particular use should be in proportion to the other furnishings around them. If a library has a simple leg-based table for reading, for example, a large, plush, upholstered reading chair with arms might not be in proportion to the table.

It is very important to try out reader's chairs (and sometimes lounge chairs) before they are purchased. In some cases, library staff or board members may visit the booths of library-furniture manufacturers and sit on chairs that are available there. In any case, vendors expect to provide sample chairs for a design team to try out before a selection is made for purchase. No charge is made to a potential customer for borrowing a chair, but the chair should be returned to the vendor after it has been tried out, unless arrangements are made to buy the sample chair as part of the purchase process.

It is not uncommon for a professional design team or the local planning team to request chairs from several vendors to try out at their office or at the library for several days. Library staff and users are sometimes asked to sit in the chairs and comment on their comfort. It is important that the same chair be comfortable for a person of small stature as well as for a person of large stature. For example, the Harold Washington chair (designed for the Harold Washington Library Center in Chicago) manufactured by the F. W. Lombard Company has been tried out and found comfortable by a number of planning teams in various parts of the country.

In bidding situations, several similar chairs made by different manufacturers may be specified as approved items. Many manufacturers offer a simple wooden chair with a wooden seat and a slat back. In order to obtain the best price, the library may be willing to purchase any one of the several chairs that meet general specifications.

Millwork and Architectural Woodwork

Most of the furnishings in a library are purchased as separate items that are not attached to the building. Some items, designated as "casework" or "millwork," are built into the library space and are constructed as part of the building contract. Millwork consists of custom-fabricated components built with lumber. Millwork includes cabinetry, paneling, custom doors and frames, furniture, and special interior trim. Millwork items should be shown in detail in the library blueprints by the architect and should be reviewed by the planning team to ensure that the millwork is functional. Some of the items often provided as millwork in libraries include counter and overhead cabinets in work areas, shelves in offices, and special storage areas. Millwork is also used in public areas for computer workstations and service desks.

Architects who are familiar with designing cabinets and counters for other types of structures may not understand the needs of a library. For example, in library work areas, counters that will be used with computers should be a minimum of 30" deep. Cabinets

placed above counters must be high enough above the countertop to allow for a personal computer to be used below wall-attached cabinets. Library staff should inform the design team of any work counters that should be standing height (36" to 39") rather than seated height (29"). Seated-height counters must be built without an apron under the top, so that staff using the counter will have plenty of space to get their knees under the counter.

In children's work areas, staff may request large millwork drawers or shelves for storing large pieces of paper and special millwork bins for housing theme boxes. Staff should be asked to supply the dimensions for the items to be stored.

Computer counters for children and adults can be built as millwork. In designing the casework, the architect and interior designer must work closely with the staff to determine functional dimensions and discuss the use to be made of the millwork. The location of power and data outlets, wire management, and access to CPUs (in situations where they are housed in cabinets) should be determined in consultation with the library staff.

Millwork in the work areas of a library is often completely faced with laminate. In public areas, however, millwork may be finished in wood veneer to match other furniture pieces. In some library areas, such as special collection rooms, casework may be built by an architectural woodworking company with expertise in fine woodworking. Architectural woodworking may be used for the cabinetry where special collections of books and memorabilia are housed and on entrances and walls designed to be showplaces in a library. As noted previously, in selecting wood shelving, consideration should be given to the fact that the wood may put library materials at risk.

Planning and Furnishing Work Areas

In order to provide workable and comfortable spaces for staff, design professionals should conduct a workplace audit by interviewing library administrators, supervisors, and individual staff members. If a new library is planned, designers should observe how staff members are working in their current spaces. Unfortunately, an existing building situation is sometimes so poor that staff members find it difficult to tell planners what they would like to have in a new library, and design professionals can gain little knowledge of how a new building should function from looking at the current facility.

While it is necessary to confer with current staff in designing work spaces, it is the responsibility of the architect and interior designer to provide an objective perspective on planning work areas. It is sometimes necessary to point out flexible options to staff who want to design a space of their very own that may not be adaptable to the needs of future staff using the same space. Sometimes staff, including a library director, have to be reminded that this new building will not be theirs forever.

In small libraries, all the behind-the-scenes work may be done in a single workroom that is furnished with desks, paneled workstations, and tables or counters for staff and volunteers. In one carefully designed space, staff may handle library circulation and reference services; materials selection; the acquisition, cataloging, and processing of new materials; outreach services; library accounting; and programming activities for adults and children. In very small libraries, the workroom may be the home of the CPU and other equipment that run the library's automation system. In addition, workroom space must include storage areas for office supplies, small audiovisual equipment, and programming materials.

Larger libraries may contain all or some of the staff spaces listed here. A brief explanation of some of the work that occurs in each area is also provided.

Behind-the-scenes circulation work spaces. Books and other materials are checked in when they are returned, materials are sorted and put on carts to be returned to the shelves, and other circulation-related activities occur.

Reference work areas. Staff review newly received reference books, work at individual computer stations studying how to use new Internet sites and electronic databases, read reviews of books and other new materials for purchase, and prepare bibliographies and other teaching materials.

Collection-development work areas. In large public libraries, staff responsible for coordinating materials selection for the library system study reviews in periodicals and consider sample materials in preparation for ordering items for the library collections. (In large academic libraries, subject specialists responsible for developing various areas of the collection have individual offices.)

Technical-services work areas. Staff purchase materials to be added to the collections; check-in, catalog, and process materials for the collections; and maintain the library's cataloging records.

Work areas for school libraries and children's areas in public libraries. Staff prepare programs for children's activities, read reviews of books and other materials for purchase, and prepare special displays for children.

Technology work areas. Staff manage and maintain the library's network and automation system; repair hardware; load software on computers; generate computer reports; and work with other library departments, such as cataloging and circulation.

Outreach areas. In public libraries, staff select and store library collections and programming materials for mobile library services to day-care centers, nutrition sites, senior centers, retirement homes, and homebound individuals.

Receiving and delivery areas. Staff working in receiving and delivery provide support for the technical-services, outreach, technology, and other departments whose work is closely tied to materials and equipment coming into or going out of the library. In libraries with multiple outlets, staff in receiving and delivery sort and dispatch the delivery of items from one library to another within the library system.

Administrative spaces. Offices are provided for the library director and assistant or associate directors, as well as other administrative personnel, such as the receptionist, secretaries, business officer, and human resources officer. Administrative areas may also include work areas for copying and file storage, conference rooms or boardrooms, and coffee bars.

Public information offices. Staff responsible for publicizing and promoting the library prepare press releases for library events and regular activities; prepare and print library publications such as monthly calendars, flyers, and signs announcing special events; and prepare displays for the library.

Other staff areas. These may include preservation and archives, media production, and maintenance and custodial areas.

The kinds of furnishings selected for library work areas are related to the management philosophy of the library administration. Libraries that work in teams on a daily basis need more flexibility in the arrangement of the space and in the types of furnishings used than libraries where individuals work on assigned tasks alone. In some libraries, staff members change teams depending on the project or assignment on which they are working at any one time. In this kind of situation, each staff member may have an assigned "home base" in a cubicle or at a desk and may move to a conference area to work with other members of a team. Where team management is extremely flexible, staff members may have their home base moved as a team assignment is changed. In order to provide functional work areas and furnishings, architects, interior designers, and consultants must study the manner in which a particular staff operates in designing that staff's space. However, it is always necessary to keep in mind that the management philosophy may change in the future. Flexibility is the key to designing work areas that will be functional now and for many years to come.

Office-panel systems are touted as providing flexible work area arrangements; however, in libraries where an experienced maintenance staff is not available to reconfigure the panels, these systems cannot be changed easily. Also, unless power and data are provided in a work area with a raised floor or with a tight grid of conduit (for example, power and data every five feet), office configurations cannot be moved because power and data are not accessible. Nothing beats the flexibility of a freestanding desk that can be moved easily. Office-

furniture manufacturers offer furniture systems with freestanding components and attached panels that mimic traditional office-panel systems. Many commercial manufacturers have responded to the concept of team management by providing movable conferencing units.

Planning for work areas should involve discussing storage needs with the staff. The staff working in an existing building need to check plans for a new or renovated building in order to ensure that everything useful in the old building will have a space in the new building. Storage areas requiring shelving should be equipped with strong, four-post, industrial steel shelving of an adequate depth, rather than plywood shelves hung on pegs or K-V track.

In planning a new library, design professionals should make sure that every staff member and volunteer has a place to store a coat and other outer gear and a secure place, such as a locker, for personal belongings. Also, work areas in large libraries may include coffee bars for staff and conference rooms or areas for staff meetings. Library staff should be asked by design professionals whether they prefer one large conference table or several smaller tables that can be pushed together to form a larger conference table. Sometimes folding tables or special mobile activity tables are used for meetings in order to allow for moving some of the tables out of the conference area for use elsewhere.

The type of furnishings to be used for managers' offices in a library should be discussed with the library staff and the local planning team. Traditionally, a library director's office is furnished with wood furniture, while other managers' offices may be furnished with steel office furniture with laminate or wood-veneer tops.

In public libraries, apparent opulence in staff offices can be a public relations nightmare if local residents believe that more of the project budget should have been spent on furnishing the public areas of a new building. In some situations, local planning teams believe that old pre-computer furniture can be used in a new building. In such cases, it is the job of the design professionals to point out that the old furniture is no longer functional and that the library needs desks or workstations that are the ergonomically correct height and depth for computer work, with worksurfaces large enough to allow staff to work efficiently.

Circulation Workrooms

These usually include closed offices for one or more circulation managers and open workstations, desks, or counters for other staff. One area of the circulation work space will be used for checking in materials returned at outdoor or indoor book drops and at the circulation desk. In some libraries, books and other materials drop directly into the circulation work area or a sorting room through strategically placed return chutes outside the building or inside, near the circulation desk. The type of computer and security equipment needed by the library for check-in will determine the type of furnishings and

the layout of the return area. In order to design a functional area, the architect or designer should work directly with staff to determine the requirements for furniture and adjacencies in the materials-return area.

Close to check-in space, staff will place returned materials on steel library shelving. The returned materials on the shelves will be sorted by call number and placed on book trucks prior to being reshelved in public areas. Close to sorting shelves, floor space should be left open for storing book trucks. Design professionals should discuss the volume of circulation expected in order to determine how many sorting shelves and book trucks should be planned for a new or renovated building. (Keep in mind that, in a public library, circulation may increase greatly with a move into a new building.)

Depending on how large a library is and how it operates, a circulation work area may include space for checking the condition of returned audiovisual materials, preparing overdue notices, handling books put on hold or reserve by library users, and other circulation-related tasks. (Large libraries with substantial budgets may want to install one of the sophisticated computerized book-moving devices now available.)

Reference and Collection-Development Work Areas

These may be furnished with individual desks in shared space, desks in individual offices, or office-panel system cubicles. Shelves for holding new reference materials, professional book collections, and materials to be reviewed are provided in the work areas. A conference table for staff meetings may be part of an open area or may be in a separate conference room. Individual offices are usually provided for one or more managers of reference services or collection development. In large academic libraries, subject specialists responsible for collection development each have their own separate office.

Technical-Services Work Areas

These should be designed to reflect the flow of materials into the building and out to the shelves. The interior designer should work with the staff to develop a formal or informal flow chart that illustrates how materials move through the department.

Staff members in charge of the acquisitions function for the library order most materials online from companies that sell books and audiovisual materials to libraries and bookstores. When materials are received, they are checked in by a receiving clerk or by the acquisitions department. Usually, new materials will be moved next to the cataloging department. After cataloging has been completed, materials will be moved to the processing department, where property stamps and labels are placed on the items and, in some cases, plastic covers are placed on books.

The design of each technical-services workstation should be based on supporting the work to be done at that particular location.

For example, it is necessary for the interior designer to know the kinds of tasks to be performed at each workstation, the kinds and maximum amounts of materials to be stored, the kinds of equipment to be used, the power and data requirements, and any special furnishings to be used adjacent to the workstation.

Either individual desks or paneled workstations can be used in technical-services departments; however, some staff may prefer the privacy of a cubicle in order to have fewer distractions and less noise. Every desk or workstation in the technical-services area must have empty space next to it for one or more book trucks to hold work in process. Worksurfaces must be large enough to accommodate a computer with plenty of space around it for spreading out piles of books and other materials. Either an L- or U-shaped work space with more than one worksurface is preferred. All worksurfaces should be 30" deep and 29" high. Overhead shelves are convenient for holding manuals and other work materials.

The processing of materials may be done at large tables or deep counters, rather than at desks. Libraries that do a lot of their own processing (rather than buying materials preprocessed) sometimes have special storage requirements related to the processing worksurface. In some cases, a millwork counter built with shelves for plastic book covers and other supplies may be preferred by the library staff.

Work Areas for School Libraries and Children's Areas in Public Libraries

These are unique because of the kinds of programming activities offered to young people. In addition to offices for managers and individual desks for other staff and volunteers, work areas must include large tables or counter areas for preparing programming materials. Often tabletop or countertop space is needed for a laminating machine or a die-cut machine, such as an Ellison machine.

Children's staff require special storage areas not used by any other group of library employees. Ready-made flat files or horizontal millwork shelves large enough to hold poster paper are needed. Millwork should also be built to provide vertical spaces for holding large props and board books upright in slots 36" or higher.

Many children's librarians store dozens of bankers boxes or other cartons referred to as "theme" boxes. Each box contains the props and materials needed to present a program on a particular topic to toddlers, preschoolers, and school-age children. Library staff should provide information about the size and number of boxes required to the architect. The boxes are usually stored on millwork shelves built to the specifications of the library or on steel four-post shelving.

Children's librarians may require special puppet "trees" or other hanging devices for puppets, as well as storage space for portable puppet theatres. Children's librarians also keep paper, craft supplies, scissors, costumes, and a wide variety of unusual objects that are used for young people's programs. All of these materials require

storage in a closet supplied with open floor space, shelves, and hanging rods. In school libraries, a large storage area may be needed once or twice a year for a large number of boxes of books to be sold in a book fair. In public libraries, space may be needed to store a number of boxes of summer reading club material sent to the local library by the state library. (These storage spaces may not necessarily be in the children's area, but the architect and interior designer should know that empty storage space for these items should be included somewhere in the building.)

Technology Work Areas

These should be located adjacent to the computer room that houses the library's servers and its local area network (LAN) and wide area network (WAN) management systems. Desks or paneled workstations used by technology staff should be earth-grounded. The grounding provides static control when staff are working on the inside of computers with the cases removed. The planning team may desire separate paneled cubicles for each staff member in order to provide a quiet area for focusing on hardware and software problems. Technology staff may also require large tables or workbench areas for handling repairs and loading software. Storage for cables and other small peripherals should be located in cabinets or drawers close to the work areas. The technology department may require a large storage room or open space for housing new equipment not yet installed, old computers not yet removed from inventory, equipment boxes used for transporting computers, and equipment held in reserve.

The computer room itself will accommodate much of the equipment on racks; however, network servers can be housed on special LAN-management furniture, such as the system manufactured by APW-Wright Line. (See figure 24.) Computer equipment should be located in a secured area with temperature and humidity that are controlled to relate to the size of the area and the number of servers housed in the room. In order to have a dust-free environment, the computer room should have a hard-surface floor rather than carpet. The room should be located close to the power and communication feeds into the building. (The computer room and the phone closet should be two separate spaces.) Ideally, the computer room should have raised flooring to provide easy access to data and power when more equipment is added or when equipment is moved to a new location in the room.

Receiving and Delivery Areas

These are needed in even the smallest libraries. In small libraries, the receiving area should include a standing-height workbench for sorting mail and mail slots for each staff member. Sometimes interlibrary loan materials are prepared for shipping at the receiving counter. In this case, mailing supplies, a mail scale, and a postage meter may be located at the receiving counter.

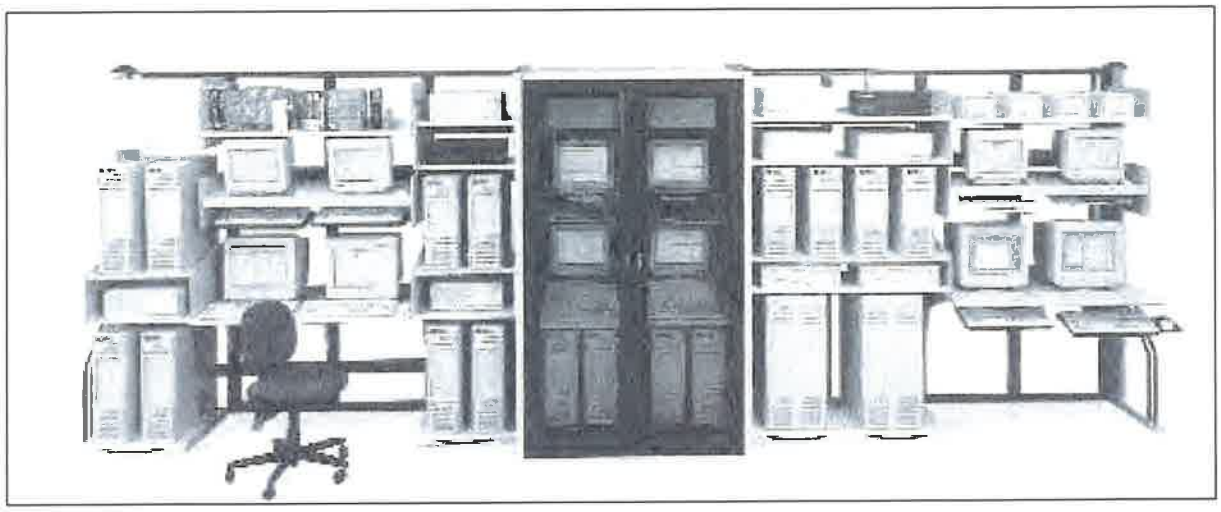


FIGURE 24

LAN-management furniture system. Manufactured by APW-Wright Line. Used by permission of APW-Wright Line. Photo credit: Bob Nash, Nash Photography, Worcester, Mass.

In large libraries with multiple outlets, the sorting of items going from branch to branch is usually done near the receiving area of the main library. The receiving area is equipped with large commercial steel shelves or bins to hold smaller bags or bins of returned library materials, new books and audiovisual items, office supplies, and interoffice mail moving from one library to another. The interior designer or consultant should discuss the size and number of bins and boxes that the library staff expects to store temporarily in the sorting area. Some libraries prefer to have large industrial tables for sorting in the receiving area.

In a large library system where office and other supplies are purchased centrally and sent out to branches as they are requested, the central supply area should be located close to the receiving area. Similarly, the arrangement of the library should allow new items coming from the technical-services area after cataloging and processing to move easily to the sorting area to be distributed to the various libraries. Because all items moving into and out of the building are stored temporarily in the receiving area, the space must be large enough to accommodate pallets of boxes, book trucks, furniture items to be delivered to other buildings, and a variety of other items that come in through the loading dock.

In public libraries, the receiving area often becomes the temporary home of large numbers of boxes of donated books. The receipt of these books is a mixed blessing for most libraries. In planning a new building, the architect should assist the library staff in designing space for donated books. Usually, the books are actually donated to the Friends of the Library organization, which subsequently sells the books, with the proceeds from the sale going to the library. Most Friends groups do not have space outside the library, so the library must provide a storage area for the book donations and must also

provide space for members of the Friends to sort the books in preparation for selling them. The handling of donated books sounds like a minor matter to an outsider, but to the library staff, space for handling donations is essential.

In some libraries, the space for storing and sorting books may be close to the receiving area. In other libraries, staff request that the Friends area be close to the library entrance so that the room can be open to the public at designated times for special book sales. In either case, the book-donation area needs plenty of shelving (maybe from the old library), empty floor space for piling boxes of books, and large tables for sorting books.

Administrative Spaces

These include offices for the library director and associate or assistant directors, as well as offices for other administrative personnel such as the business officer and human resources director. In some libraries, offices may also be provided for other staff, for example, library development and fundraising managers, staff-training personnel, and a coordinator of volunteers.

A basic fact in planning administrative spaces is that the director and other library officials want offices with windows. In small libraries, the director's office may have the same type of furnishings used in other work areas. In larger libraries, the director may have an office that is part of a group of spaces that include a private rest room, a boardroom or conference room, a separate work space that visitors do not see, a secretary or administrative assistant's work area, and a coffee bar. Many directors prefer an office that includes a large desk and appropriately handsome chair, a credenza or other storage area, a computer workstation (if one is not incorporated into the desk), a small conference table with four to six guest chairs, bookshelves, and sometimes an informal seating area with a small sofa and coffee table. Filing cabinets may be located in the office or in a nearby work area. An office with all of these items may seem ostentatious; however, it is important to keep in mind that the director is the person most responsible in the organization for meeting with the officials of the library's funding body. The image that the director projects to officials, contributors, and policy-makers is important for the entire library.

NOTES

1. Ann Massman, "The Wood Shelving Dilemma," *Library Resources and Technical Services* 44, no. 4 (October 2000): 209–13.

2. For detailed descriptions of wood and steel shelving systems, see Carol R. Brown, *Planning Library Interiors: The Selection of Furnishings for the Twenty-First Century* (Phoenix: Oryx, 1995), 34–43.

3. For a discussion of the performance-testing of tables, see Brown, *Planning Library Interiors*, 73.

4. Carl A. Eckelman, "Library Chairs: An Overview of the Library Technology Reports Test Method with Test Reports on 30 Chairs," *Library Technology Reports* (March–April 1995).

Signs and Wayfinding

CHAPTER 5

In a successfully planned library interior, all the design elements work together in harmony to provide a functional, convenient, and attractive building. If any one feature of the library is ignored in planning an integrated design, the overall success of the library will suffer. Unfortunately, one area that is sometimes ignored or left out of the budget in small library projects is a sign system. The result is the tacking-on of homemade or uncoordinated signs that detract from other successfully designed elements of a new or renovated library interior.

In large projects, the sign system for a new or renovated building should be planned by a sign consultant hired specifically for the job or by the interior designer, architect, or consultant. In small projects, the library staff can plan the sign system. The design of the sign system involves consideration of both functional and aesthetic aspects. Signs should accomplish their purpose in making the facility convenient for library users, and should enhance rather than detract from the "overall visual experience" as quoted from John Pile in the first chapter.

In large projects, an architect, interior designer, or sign consultant designs and specifies all aspects of the system, including the shape, size, and type of lettering; fabrication; finish; and materials. (See figure 25.) The signs are manufactured by a company specializing in the fabrication of signs. In projects where bidding is required, the fabrication of the signs is bid according to the specifications developed by the design professionals.

In smaller projects, the architect, interior designer, consultant, or staff may select standard sign products from a vendor, such as ASI's Interior 20 PaperFlex system. Small libraries may also purchase signs from a library-supply catalog. Some sign vendors offer standard products and also use their standard materials to fabricate custom signs.

When planning a sign system, consideration must be given to the following functional types of signs:

Orientational signs enable users to orient themselves within the library and identify how to get to various areas within the building, such as the reference area, children's area, and adult bookstacks. Orientational signs include, for example, directory boards and mounted floor plans.

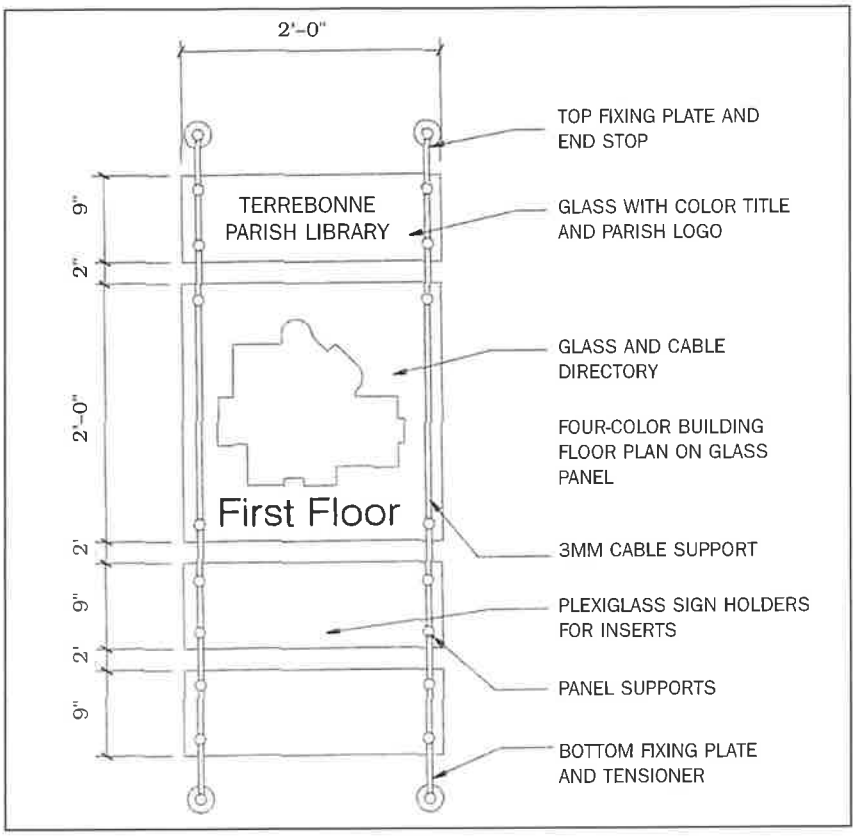


FIGURE 25

Drawing of lobby directory for Main Library, Terrebonne Parish, Houma, Louisiana. Sign designed by Phillips Swager Associates, architects. Used by permission of Phillips Swager Associates.

Directional signs guide users to particular locations or services within the building. Signs with arrows pointing to a particular location, for example, are directional signs.

Identification signs identify or label particular destinations or features. They include, for example, signs on the end panels of bookstacks; signs that identify particular rooms or service areas, such as rest rooms, auditorium, or information desk; donor signs; and signs that identify particular collections, such as genealogy, adult fiction, and periodicals.

Instructional signs provide instructions; for example, on how to operate a piece of equipment, such as a copier.

Regulatory signs provide library users with information on regulations or required procedures, and warn users about emergency procedures; for example, no smoking, no eating or drinking in this area, and use of pencils required in the genealogy room.

Informational or current-awareness signs provide information needed by library users, such as hours, announcements of special programs, library services offered, and out-of-order signs for equipment.

The planning of a sign system for a new library involves identifying and making a list of the types of signs that will be needed and deciding where these signs should be located. The task of making that determination can be accomplished by taking a virtual tour of the library using a computer model, or by simply "walking" through the building by looking at a blueprint. The goal of this is to anticipate what signs a user will need to become oriented to the general layout of the building; to find particular services, areas, and rooms; and to receive the instructions and information needed for a satisfactory library experience.

In an existing library, new signage may be planned as a special project initiated to improve the appearance and use of the building. The project should begin with an assessment or audit of existing signs. A list of signs and their locations in the building is developed. Photographs of signs and their surroundings can be taken to support the list. Pictures of existing signs are helpful in determining where an overabundance of signs exists in one place, where signs are inconsistent, and where they are unattractive. Photos also serve as useful reference devices when staff members are discussing the results of the sign audit. The list of existing signs and photographs is studied to determine which signs should be eliminated, which signs should be replaced, and what additional signs may be needed. Recommendations for future signage can be compiled using the audit information.

The following are some examples from an actual public-library sign audit accompanied by recommendations for improvements:

Identification of collections or parts of collections

"Basic skills for Self-Help"—handmade, attached to end panel.

> Replace with sign consistent with other end-panel signage.

"Adult paperback nonfiction"—computer-generated, mounted on top of book racks and on end panels.

> Replace with sign consistent with other end-panel signage.

"Biographies"—individual letters of various colors mounted vertically to a column and missing the "s."

> Where are the biographies in relation to this sign? Will an end-panel sign be sufficient?

"Fiction paperbacks"—signs mounted on top of revolving racks to indicate content.

> Leave these as they are. Consider in relation to other changes made.

"Periodicals, back issues"—mounted back in a corner on the wall—not easily seen.

> Is this necessary?

"Catalogs"—the only signs are on the computers themselves.

Consider the impact of a hanging sign.

"How to find a book"

Information mounted on a dark board and laminated. Placed on the end panels of stacks in several areas of the building.

Do people really read this? Is it accurate? Is it better for users to ask a librarian than read this? If you must have it, replace it with a changeable sign holder like those to be used by the typewriters.

Three instructional and informational signs by copier

Three different signs placed on the column by the copier—one sign is white with a red border, one is yellow, and one is white.

Can these three signs be replaced by one sign in a changeable sign holder?

"No bicycles; no skateboarding" at main entrance

Computer-generated sign taped to the glass.

Make these instructions consistent with hours posted on the glass.

"No food, drinks, etc."

Orange letters attached to the vinyl wall covering in the foyer.

Consider how to display these regulations in relation to the directory board.

"Quiet please, please be considerate . . ."

Mounted at several locations around the library.

Are these really necessary?

Announcement of children's and other programs

Taped to glass at the main entrance and on glass on the inside set of doors. Also, an announcement taped to a computer shield at the circulation desk.

Purchase a directory/announcement board that allows for posting info about special events. Users will soon learn to look there for news.

Fines, number of videos and nonfiction books that can be borrowed, borrowing period, etc.

Variety of signs providing information about borrowing attached to wall behind circulation desk. Signs are white, pink, blue, and yellow with black lettering. One has a red border.

Consider which of these signs is really necessary. Do people really read these signs, or do staff end up telling most people anyway and pointing to the sign? Can all of

these regulations be handed to new users on some kind of bookmark or flyer so the signs aren't needed? For those that are needed, replace the numerous signs with one large changeable sign to hold all of the regulations.

"Vertical file may be checked out"

Computer-generated sign mounted on top of vertical file. Undoubtedly means "vertical file material may be checked out."

Replace with a changeable sign holder consistent with others.

Based on the information collected during the sign audit and the accompanying recommendations, the library staff can work alone, with a consultant, or with a vendor to develop a sign system (as discussed below) and to purchase and install signs.

In academic and special libraries, a sign system sanctioned by the parent institution or organization may determine the details of the system to be used in the library. In new or renovated libraries without a sign policy and a carefully designed system, plans for new signs should be designed in close consultation with the library staff and with other project team members. The essential word here is "system." Signs used initially in the library should be part of a coordinated system with detailed specifications that can be replicated as the library needs replacement or additional signs in the future. The system should be easily understandable and flexible enough that, after the construction project is finished, library or institutional staff will be able to maintain the consistency of the system over time.

Consistency in signage throughout a building allows users to learn the system quickly and easily. Signs of the same type (directional, instructional, etc.) throughout a building should have the same shape, size, layout, type style, and placement, if possible. The sign system should be logical and should be given in a progression from the general to the specific. Signs should avoid the use of library jargon, such as "Bibliographic Information Center." Words should be as descriptive as possible and easily recognizable by library users. Terminology should be used consistently—only one term should be applied to any one area, service, etc.

The signs in libraries, as in all public buildings, must comply with the Americans with Disabilities Act of 1990 and any other applicable state or local regulations. The *ADA Accessibility Guidelines for Buildings and Facilities* require that all signs have a width-to-height ratio between 3:5 and 1:1 for letters and numbers. Letters and numbers are required to have a stroke width-to-height ratio between 1:5 and 1:10. Signs placed overhead must be placed a minimum of 89" above the floor and must have letters and numbers at least 3" high. Permanent signs for rooms and spaces that are installed on a wall next to a door must be mounted on the latch side of the door, 60" above the floor to the center line of the signs. Letters and numbers on permanent signs must be at least 5/8" and no more

than 2" high, must be raised 1/32", and must be accompanied by Grade 2 Braille. If pictograms are used for permanent signs, the verbal equivalent must be placed directly below the symbol. The characters must contrast in color with the background. Signs should have light-colored characters on a dark background or dark-colored characters on a light background. In addition to compliance with the ADA, the details of sign systems may be controlled by local or other building codes. The Uniform Building Code, for example, has requirements for exits, stairway and door identification, room capacities, and accessibility.

A sign system should complement the architecture and the rest of the interior design of a library. The same elements of good design that apply to planning each feature of a building should be considered when designing the sign system. The dimensions of signs should be in proportion to the scale of the building and, if they are mounted on furnishings, in proportion to the scale of the furnishings. The colors and materials of the signs should coordinate with the colors and materials used throughout the building. Throughout the library, signs should be mounted and positioned in a consistent manner in relation to other building elements, so that users know where to look to obtain information. (See figure 26.)

Signs can be ceiling-hung, wall-mounted, mounted on a column, or freestanding. Freestanding signs may be large signs mounted on a metal stand or small signs designed to sit on a desk or countertop. An architect, designer, or consultant who designs the sign system will decide how signs should be mounted. In small projects where library staff plan the signs, a sign vendor will assist in determining how and where signs should be mounted. The signs used in a library may include the following:

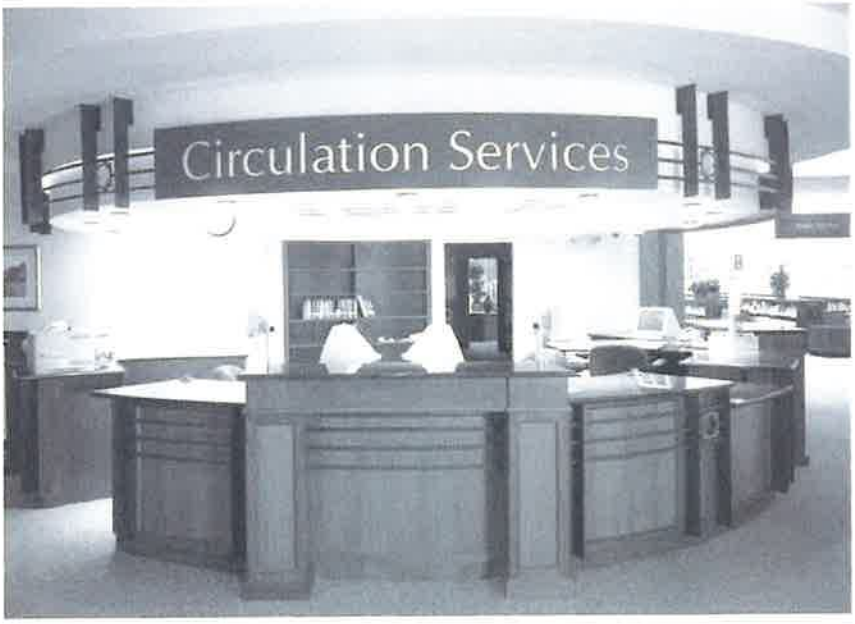


FIGURE 26

Council Bluffs Public Library, Council Bluffs, Iowa. Leo Daly Architects. Circulation services sign manufactured by ASI Sign Systems, Grinnell, Iowa. Used by permission of Jim Godsey, Council Bluffs Public Library. Photo credit: Paul Brokering.

Building plaques that list the names of elected or institutional officials and provide other details about the construction of the building

Directory boards or maps showing the location of various departments; in a multistory library, floor locations

Boards or signs that announce library policies, special services, or events occurring in the library

Signs that indicate the location of service points—check-out and check-in desks, reserve desks, information desks, etc.

Signs that indicate the location of major functional areas—periodicals, youth department, adult nonfiction, special collections

Signs that indicate collections within a larger area, usually used in public libraries—mysteries, science fiction, picture and easy books, etc.

ADA-required room-identification signs

Signs with arrows that indicate the location of areas or services that are not visible from a main corridor

Signs at stairways or elevators that indicate that a specific area or service is located on another floor

End-panel signs on bookstacks that indicate the contents of a range. (These must be designed to allow for changing the content of the signs easily and quickly.)

Signs that indicate regulations—no smoking, emergency exit

Signs that provide instructions—how to use the copier, how to search online databases

Instructional signs for equipment or library procedures are among the most difficult kinds of signs to control in a library. When someone is not available to help every user, the tendency of the staff is to put up a handmade sign. Brief instructions for repetitive processes like using a copier can be computer-generated and placed in a sign holder that coordinates with the signs in the rest of the building. The sign can then be mounted on the wall close to the equipment or mounted directly on the equipment.

When designing a sign system, the library staff and local project team should agree on the extent to which signs will be used in the library. The staff should agree during the planning process that most library policies and instructions for complicated procedures should be presented to users by word of mouth or in a handout or flyer, rather than a sign. One of the problem areas in a public library is the circulation desk. Staff have a tendency to place signs on the desk or on a wall behind the desk to provide information about a wide variety of check-out policies and procedures. Most people will not take the time and effort to stop and read a proliferation of signs, and the signs detract from the satisfactory interior design of the area. An attempt should be made during the design process to get the staff to

"buy into" the idea of limiting signs to where they are appropriate or necessary.

Signs are fabricated from a variety of materials. (See figure 27.) Plastic is one of the most common materials used for making signs. Some of the types of plastic used are acrylic, polycarbonate, butyrate, fiber-reinforced polyester, and PVC. Acrylic is the most commonly used type of plastic for signs. Plastic signs are durable, relatively inexpensive, easy to fabricate in a variety of forms, and can be supplied in almost any color. Metal signs are produced from aluminum, stainless steel, brass, and bronze. Aluminum is strong, lightweight, durable, and easy to cut. Stainless steel can be used in signs in a manner similar to aluminum. Brass and bronze are most commonly used for making individually cut letters or for cast plaques. Other types of signs available include custom-designed banners, vinyl die-cut letters, transfer lettering, neon, and electronic signs. The application of vinyl die-cut letters or symbols to glass doors, walls, windows, or some type of plastic sign holder is one of the simplest methods for making signs in-house. The signs are inexpensive to produce; however, the letters can be a target for vandalism on signs that are easy to reach from the floor. Many libraries

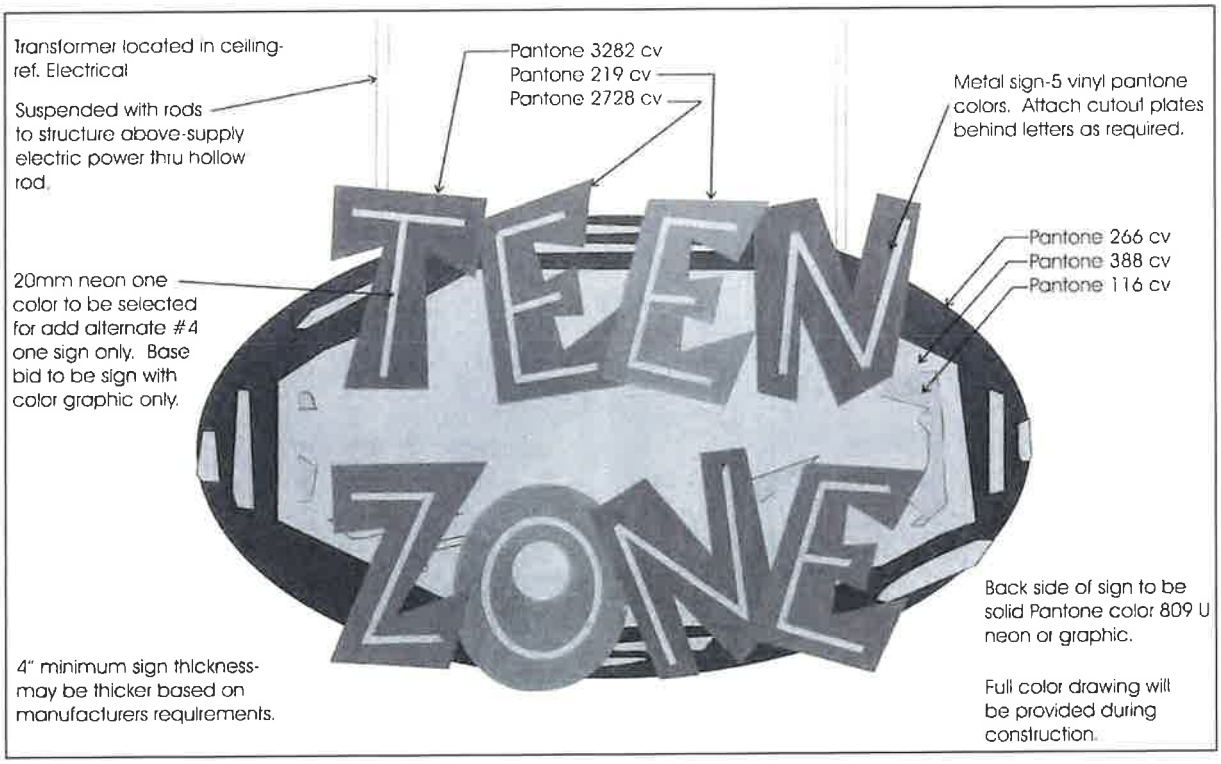


FIGURE 27

Drawing of hanging sign for Grapevine Public Library, Grapevine, Texas. Sign designed by Phillips Swager Associates, architects. Used by permission of Phillips Swager Associates.

now produce the copy for changeable signs using a computer and a laser printer. The computer-designed signs are then used in a custom or standard plastic or metal sign holder.

Generally, the interior design of a sign system must be coordinated with the other elements in the building. Wayfinding should be considered when developing the architecture of the building; users should not have to depend entirely on signs to move about the library. The arrangement of the library should enhance the ability of users to move easily through it; paths should be as direct as possible from one area to another in order to minimize the need for signs. Architectural and interior design details should be planned to allow for the bracing and wood blocking needed to mount signs in appropriate spaces. Building finishes should also allow for mounting signs where they are needed. Small building details, such as thermostats, fire extinguishers, and light switches should not be located where they will interfere with signage. Power supply for lighted signs and adequate light for viewing signs should be provided.

CHAPTER 6

Selecting Materials, Finishes, and Colors

The task of selecting the materials, finishes, and colors to be used in a library's interior should be done by design professionals—architects and interior designers—in consultation with the local planning team and, perhaps, a library consultant. Design professionals should offer the planning team several options for materials and colors and should be prepared to provide other options if their initial selections are rejected. The members of the planning team should, however, acknowledge the expertise of design professionals and carefully consider the recommendations made by architects and interior designers. In most library-planning situations, preconceived ideas about the finishes and colors to be used in the library should not be imposed on design professionals by members of the planning team prior to receiving options proposed by the designers.

In *Interior Design*, John Pile states that the primary functional criterion to consider in selecting materials for a building is their suitability to their basic utilitarian purpose.[1] Secondary considerations include durability, ease of maintenance, resistance to damage and vandalism, safety characteristics, and acoustical performance. The selection of materials also involves the consideration of aesthetic criteria, such as color, textures, patterns, and visual suitability. The cost of a material is often another important consideration in selecting materials.

In small and medium-sized projects, the project budget may be a primary determining factor in selecting materials for the library; some desired materials may be too expensive for the budget. In many library projects, the materials and finishes selected must be ones that can be maintained without expensive equipment, without contracting for expensive outside services, and which can be maintained by the local custodial staff. Custom materials and finishes should be ones that can be easily replicated in the future.[2]

Floor Coverings

Carpet

Because of its appearance and acoustical properties, carpet is used throughout the public areas and in some staff areas of all types of

libraries. In many small and medium-sized projects, carpet may be one of the first items that an interior designer selects. The colors in the carpet may provide the basis for the selection of other colors to be used in the interior design of the library. Some interior designers use several different types of carpets in the same library. For example, one carpet may be used as the "field" carpet to cover most floors in the library, while another may be used to make decorative elements such as "paths" or borders. Other designers prefer to use one carpet throughout large areas in order to have as few seams as possible in the carpet.

Denelle Wrightson, an architect and interior designer with Phillips Swager Associates, says she likes to initially present one square sample each of six to eight carpets for a client to consider. The carpets are looked at in several lights. On the basis of the first review, she shows the client larger samples, six to eight squares, of carpets that the local planning team preferred in its first review.

The interior designer or architect should educate the local planning team about their choices in selecting carpet. Maintenance issues are important for every library, and the person who will be in charge of carpet maintenance should be involved in the carpet selection process.

Prior to the 1960s and the introduction of numerous synthetic products, carpets were made of wool fibers. Wool is a natural fiber that is very durable, wears well, and is flame-resistant. Unfortunately, wool carpets are now too expensive for most library projects. According to *The Carpet Primer* (developed by the Carpet and Rug Institute), 99 percent of the face fiber used in carpet now is synthetic.[3] Carpets are made of synthetic fibers using nylon, olefin (polypropylene), acrylic, and polyester.

Nylon carpet is the most frequently used carpet for commercial buildings and is the carpet of choice for many libraries. It is relatively inexpensive and durable, and its fibers are strong and have high stain- and crush-resistance. Nylon carpet can be dyed a wide variety of colors and can be cleaned easily. Acrylic and modacrylic fibers have wool-like characteristics and have less abrasion-resistance than nylon. Like nylon, acrylic fibers can be dyed many colors, have good crush-resistance, and are easy to maintain. Polyester carpet is highly crush- and abrasion-resistant and cleans well. Olefin fibers are used primarily for indoor-outdoor carpet.

Carpets are characterized as woven or tufted. Woven carpets account for a smaller percentage of commercial installations than tufted carpets; however, they are specified for some libraries because they have an extremely dense pile and tightly woven construction. Woven carpets allow an interior designer to specify custom designs and patterns. Wilton, velvet, and axminster are types of woven carpets that are distinguished by the methods of weaving used to produce them. Woven carpets are typically backed during the manufacturing process with polypropylene, polyester, or other synthetic materials. (Note that jute backings are not recommended in situations

where flooding could occur; jute is a natural fiber that may rot when it stays wet for an extended period of time.)

Tufted carpet is used in most commercial carpet installations. In the manufacture of tufted carpet, the pile yarn is punched through a backing with rows of needles. When the needle goes through the backing, the yarn is caught and held while the needle makes the next loop. Tufted carpets may be constructed with level loops, with multilevel loops (usually with two or three different loop heights to create pattern effects), with cut pile (loops are cut, leaving individual yarn tufts), or with a combination of cut and loop pile (providing a variety of surface textures, including sculptured effects). In some libraries, level-loop carpet may be used for high-traffic areas, with a coordinating cut-pile carpet used as a border or trim in areas with less traffic.

Tufted carpets usually have a primary backing of woven polypropylene fabric or of nonwoven polypropylene or polyester into which the pile yarn is tufted. A secondary backing of tufted carpets is usually made of latex, polypropylene, or polyester.

Carpets are available in broadloom (long rolls of carpet 6' or 12' wide) and in carpet tiles (18" × 18" or 36" × 36" squares). Carpet tiles are manufactured with fusion bonding that embeds the pile yarn in a backing of liquid vinyl.

Carpeting can be installed by the direct glue-down method, in which the carpet is installed with only an attached cushion that is glued directly to the floor. Carpet tiles are installed using this method. A double glue-down method involves first gluing a cushion to the floor and then gluing the carpet to the cushion. Most public areas of libraries have carpet that is installed using the glue-down method.

Broadloom carpet is also installed using the stretch-in method. The stretch-in method is used where a separate carpet pad is desired under the carpet. A power stretcher is used to stretch the carpet over the pad. The carpet is held in place with some type of tackless strip around the perimeter of the room. According to *The Carpet Primer*, stretch-in installations should be avoided where heavy rolling traffic (like loaded book trucks) is likely.

Library architects and consultants each have their own opinion about whether to use carpet tiles or broadloom in a library. Carpet tiles have been used successfully in many libraries. When carpet tiles are installed properly, they stay in place and can accommodate rolling book trucks. In other libraries, carpet tiles have not stayed in place and have caused problems. Any carpet, regardless of whether it is broadloom or carpet tiles, is only as good as the installation done to put it in place.

It is imperative that library staff notify the general building contractor or the carpet installer if carpet develops problems after a building is open for use. Poor installation or carpet not manufactured to specifications should be reported immediately to those responsible for the building and the carpet.

Design professionals working on a library project should present both options (broadloom and carpet tiles) to the planning team. If the planning team is unsure about the kind of carpet desired, they should visit nearby libraries with carpet squares and with broadloom before making a decision. In some libraries, broadloom carpets (which are less expensive than carpet tiles) are used in areas like bookstack spaces, while carpet tiles are used in high-traffic areas and areas that may change occasionally. Several carpet manufacturers produce both broadloom and carpet tiles in the same colors and patterns.

Carpet selection may involve consideration of a number of other technical aspects of the carpet: dye method, colorfastness, fade-resistance, durability, appearance-retention, crush- and abrasion-resistance, flammability, and acoustical properties.[4] In projects where architects and interior designers familiar with libraries are selecting carpets, the members of the local planning team usually rely on the design professionals to choose carpets that meet the technical requirements of the project.

The library staff of small and medium-sized public libraries are sometimes responsible for selecting carpet for a new building or to replace existing floor coverings. It is important for architects, designers, and library staff who have not worked on commercial projects to understand that residential carpet is not the same as commercial carpet. Residential carpet is often not as expensive as commercial carpets that are manufactured to last for 15 years or more in a high-traffic library.

Library staff responsible for selecting carpet without the assistance of a design professional should do the following:

- Work with one or more reliable carpet dealers or manufacturer's representatives who regularly handle commercial carpet. If possible, contact and talk to more than one such dealer or representative. Make sure the vendor understands your project; most libraries require commercial carpet manufactured for extra-heavy traffic areas in public places. Carpet designed for private offices may not be the best choice. Inform the vendor of the maintenance issues in most types of libraries.
- Ask the vendor to discuss the technical specifications of the carpet, including, for example, flammability, static control, colorfastness, durability and wearability, stain-resistance, tuft-bind, moisture-absorption rates, the possibility of edges of seams unraveling, ease of maintenance, indoor air-quality issues with the carpet and adhesives, and warranties.
- After an initial carpet selection has been made, ask the vendor to provide references to other commercial buildings, preferably libraries, where that same carpet has been used for several years. Call the referenced libraries and ask the library staff about the appearance of the carpet over time and the ease of maintenance of the carpet. If possible, look at the carpet at a library or a similar commercial installation.

The written specifications for a particular carpet provide information that can be used in selecting a satisfactory product. Carpet quality is based on density factors or values that indicate how much yarn is packed into a given area. Carpet selected for busy libraries should have a relatively high density value that provides a more compact carpet. Carpets with high density values provide a firm walking surface and a firm surface for rolling loaded book trucks.

The density factors for tufted carpet include the gauge, the stitches or tufts per square inch, and the pile height and weight. The *gauge* of a carpet indicates the number of ends of surface yarn per inch across the width of the carpet. In selecting carpet for libraries, the gauge should be no less than 1/10, or 10 ends per inch. Stitches per inch (number of tufts lengthwise on the carpet) should be no less than 10 per inch. "Pile height" refers to the height of the carpet from the backing to the top of the yarn. For example, a satisfactory pile height for a library carpet is .187 inch. Pile weight is measured in ounces per square yard. The average pile weight refers to the surface pile of the carpet or its face weight. Pile weights for carpets to be used in busy libraries are often in the range of 20 to 28 ounces per square yard.

The specifications for carpet that will be bid should include performance requirements such as functionality factors (tuft-bind, colorfastness, etc.), appearance and wear properties, indoor air-quality requirements, safety requirements, and aesthetic considerations (pattern, color, texture, etc.).

Except in unusual circumstances (such as earthquake-prone areas where bookstacks are attached to concrete floors), shelving should be moved to allow for carpeting under the stacks, rather than carpeting around the stacks. Carpeting under bookstack areas allows for rearranging the shelving in the future. In some instances where existing carpet is to be replaced by new carpet, a carpet-installation schedule must be coordinated with a schedule for moving furnishings and bookstacks. Often the carpet installation is done by one company and the moving by another.

A specific schedule for carpet installation and moving will depend on the drying time required by the adhesive used to install the carpet. In a simple scenario, however, on day one, movers may move all of the furnishings and shelving from one side of a space or room to the other side. On day two, old carpet is removed and new carpet is installed on the empty side of the room. On day three, all of the furnishings and shelving are moved to the side of the room that now has new carpet. On day four, old carpet is removed and new carpet is installed on the empty side of the room. On day five, all of the furnishings are returned to their designated locations. (A carpeting project provides library staff an opportunity to rearrange the furnishings.)

The color and pattern of a carpet are important considerations that affect how long a carpet continues to look good. A carpet vendor or interior designer may show the planning team books of small carpet samples in order to get an impression of what colors and pat-

terns are acceptable to the team. Larger carpet samples that are considered possibilities for the library space can then be obtained from a vendor or manufacturer. A 4" × 4" carpet sample does not provide a very accurate picture of how a carpet will look in a room. Even an 18" × 18" sample may not be sufficient for evaluating a particular carpet, especially if the product has a large pattern. Vendors will supply photographs of carpet installations that show the pattern and appearance of a carpet when it is installed. Library staff responsible for selecting carpet may want to obtain the names of reliable carpet dealers, representatives, or manufacturers from an architect, designer, or library consultant.

Carpets that are one color throughout will show stains more quickly than carpets that have a patterned or tweedy look or that have individual tufts of many different colors. Light-colored carpets, or carpets with many white tufts among other colors, are more difficult to keep clean than darker carpets. Experienced maintenance staff should be involved in selecting specific carpets and should study the ease of maintenance of products under consideration for purchase.

Hard-Surface Flooring Materials

While large areas of libraries are often carpeted, small areas, such as the entrance foyer, are usually covered with some type of hard-surface flooring material. For example, stone, terrazzo, or tile may be used in a library entrance because of their durability, ease of maintenance, and aesthetic properties. Wood flooring is sometimes used in special libraries and in rooms that house special collections in public or academic libraries. The type of material used in a particular area of a library often depends on the amount of funding available for a project.

Several different types of stone are used as flooring materials in libraries. Stone used as an interior material may have a polished finish with a mirror gloss, a honed finish with a dull sheen, a fine-rubbed finish with no sheen, a rubbed finish with occasional scratches, or a thermal or flame finish that has a coarse finish. Because of the danger of having people slip, polished finishes should not be used on stairs or on areas that might get wet, such as those directly inside a building entrance.

Granite and marble are used in libraries on floors, on walls, and on the tops of service desks and counters. Coatings are available to make a smooth-finished stone slip-resistant. Granite is available in a wide range of colors, including gray, beige, white, pink, red, blue, green, and black. Marble, like granite, is available in a wide variety of colors and patterns, ranging from white to greens and reds with streaked patterns. Marble is an expensive flooring material and requires special care, including buffing and polishing. Marble is not as durable as granite, so its use should be carefully considered.

Limestone is most often used as an exterior material, but travertine (a type of limestone) is used for interior flooring and walls. The

patterned surface of travertine is pitted with a network of holes that are sometimes filled with epoxy resin when the stone is used as a flooring material.

Slate is a fine-grained rock that can be split into thin slabs that are used for flooring, as well as roofing, materials. Slate is available in a range of colors that include gray, black, green, brown, and deep red. A slate tile has a rough, uneven texture with a surface level that may vary by about 1/8". Slate may have a sand-rubbed finish or a honed finish that is semi-polished without a sheen.

Another hard-surface flooring material used in libraries and commercial buildings is terrazzo. Terrazzo is a composite or aggregate mixture of small stone particles set in a cement binder that is poured, smoothed out, and polished to create a smooth surface. (See plate 5A.) Because it is durable, water-resistant, and easy to maintain, terrazzo is typically used on floors in high-traffic areas in commercial buildings.

Ceramic and quarry tile are small, flat flooring units made of clay or clay mixtures. Ceramic tiles are durable, water-resistant (if glazed), easy to maintain, and are available in a wide variety of colors, sizes, and patterns. Glazed ceramic tile is often used in public rest rooms and in other locations where water is present. Ceramic tile is waterproof and can be cleaned easily. Quarry tile is sometimes used in library entrance lobbies. The tiles are set in mortar and finished with grouted seams. Slip-resistant quarry tiles with an embossed texture on the surface are available.

Resilient Flooring

"Resilient flooring" is a term used to describe certain materials made from synthetic resins, fibers, plasticizers, and fillers. Thin sheets or tiles are formed under heat and pressure. In libraries, resilient-flooring materials are used in rest rooms, halls, closets, work areas, and in children's activity rooms. Small and medium-sized public libraries with a limited budget may also select resilient-flooring materials for the entrance lobby.

Vinyl floors (available as pure vinyl, vinyl composition, vinyl tiles, and sheet vinyl) are durable, easy to install, and available in a wide variety of colors and patterns. Rubber flooring (made from synthetic rubber) is available with a smooth surface or a patterned, raised surface in either tiles or sheets. This material has great resistance to wear and abrasion; however, only a limited number of colors can be produced.

Wall Coverings

Because paint is relatively inexpensive and can be applied easily, most libraries have painted walls. Paint is also desirable because of the wide range of colors and textures available. Painted areas can be renewed easily and quickly. In busy libraries, an architect or interior

designer should be reminded to select paint that can be cleaned and touched up by maintenance staff on a regular basis.

Vinyl wall coverings are more expensive than paint, but they are durable and easy to clean. Vinyl wall coverings are available in a wide variety of colors and patterns and typically come in rolls 52" to 54" wide and 30 yards long. Three grades of vinyl wall coverings are available; type III vinyl wall coverings should be used in busy libraries. These wall coverings may be used throughout a library or may be used in selected areas, such as in halls and around columns that tend to get marred easily.

Vinyl or fabric wall coverings may be used in areas where tackable surfaces are desired. A design professional can select a vinyl with a texture that seems to be self-repairing and that does not show pinholes when displays are removed. In public libraries where 42"-high picture-book shelving is used against a wall, the area of wall above the shelving is often covered with fabric or vinyl to provide a tackable surface. A completely tackable wall is more attractive than a metal-framed bulletin board and looks satisfactory even without a display. (Plastic corner guards should be used on either painted or vinyl-covered surfaces on corners and columns that are apt to be knocked by book trucks.)

Another material that is used for small wall areas in libraries is slat wall, a versatile prefabricated material that consists of slats or strips finished with wood or laminate that are applied horizontally to a backing. The spaces between each of the slats provide a holder for specially designed plastic or wire display items. The slats can be finished to match other laminates or wood finishes in the building. Slat wall is available without inserts between the slats or with plastic or metal inserts. Metal inserts provide the most finished look, but are also the most expensive. Display furnishings made with slat wall are available from library- and bookstore-supply companies. The material can be used on the wall behind a small circulation desk where the staff may want to display a wide variety of information. Slat-wall end panels for bookstacks can be finished with vinyl or solid wood edge bands to provide a more finished appearance. Solid wood edges on the end panels may have a bullnose or other special shape that reflects wood edge bands on other furniture in the library.

Furniture Finishes

The most commonly used finishes for wooden library furniture are catalyzed lacquer and alkyd-urea conversion varnish. Catalyzed lacquer is a nitrocellulose-based finish with a catalyst added to improve its performance. Conversion varnish is a catalyzed alkyd-based finish. Both finishes are considered to be extremely durable and wear-resistant.

Tables with wood-veneer tops are sometimes used in libraries, especially in special collection areas where use is somewhat restricted.

Reading and computer tables in libraries with heavy use, however, often have laminate tops. Laminates are used to provide color to an area of the library and to furnish easy-to-clean surfaces on tabletops, cabinetry, doors, countertops, end panels of bookstacks, and vertical surfaces of service desks.

The major disadvantage of laminate is that it chips easily. In order to prevent laminate edges on furniture from chipping, surfaces should be edged with solid wood, PVC, or other types of bands. A piece of millwork or furniture that is faced with laminate and also has a laminate edge is called self-edged. Self-edged millwork can be used in work areas, but in public areas, self-edged furnishings are likely to chip. When the vertical surfaces of service desks are faced with laminate with no protective band of another material at the bottom, the laminate is likely to be chipped by someone accidentally kicking the desk or by the accidental hit of a book truck.

Color

The selection of colors to be used in a library is one of the most interesting and complex aspects of interior design. Whenever possible, a library should rely on an experienced interior designer whose technical knowledge of light and color can guide a planning team through the selection of colors. If no architect or interior designer is involved in a project, or if a local planning team wants to know more about color, detailed information about selecting colors can be found in *Color in Interior Design* by John Pile.[5]

Sometimes members of a planning team come to a project with a preconceived color scheme in mind. In this situation, the planning team should be encouraged to keep an open mind about options that will be presented by the architect or interior designer. A color scheme that looks great in the director's house may not work in a new library.

The overuse of a particular color scheme in libraries is familiar to anyone who has seen a library designed in the 1960s that still has its original colors. The harvest gold, lime green, and orange upholstered furniture from the '60s provides obvious clues to the age of the library. In the 1970s, library interior design went through a mauve and blue phase.

Like other aspects of interior design, color is affected by the other design elements in a building. A color is affected, for example, by other colors in surrounding areas and by the light that falls on it. Colors viewed under an incandescent light source will appear different from the same colors viewed under a fluorescent light. In selecting colors, therefore, it is important to view them under the same lighting source (artificial or daylight) that will be used in the final building situation.

The psychological effect of colors is usually one of the determining factors in selecting them for a library. Generally, blues, greens,

and violets are considered cool, restful colors while red, yellows, and oranges are considered warm, active, stimulating colors. Neutral colors are perceived as having less psychological impact and less emotional content.

As the color of fire and blood, red has the psychological implications of heat and intensity that lead to an association with danger. In library design, bright reds are seldom used as the main color in an area; however, they are sometimes used in children's areas in combination with the other primary colors (yellow and blue), or in adult areas as accent colors.

Yellows are easier to use than reds, because they are considered to have fewer aggressive implications. Like bright reds, yellows are often used in children's areas. Oranges may be used as accents in libraries, but those of us who lived through libraries in the 1960s are reluctant to select bright oranges as the predominant colors in a library.

Unfortunately, some green color schemes are associated with what we refer to as "institutional green" or "military green." Other greens are perceived, however, as calming, stable colors that have associations with colors in nature. According to John Pile, "blue is said to encourage thought, contemplation, and meditation and so [it] is the color of intellectual activity."[6] Perhaps, then, blues are a good choice for quiet study areas in the library.

Texture and pattern on a material may also affect a viewer's perception of color. An item with a smooth finish may appear lighter than an item with a heavy texture. The process of selecting upholstery is similar to the process of selecting carpet. It is impossible to select a patterned fabric from a tiny sample and see how the fabric will really look when it is used in the library. For example, a fabric that has a mauve and blue-gray pattern that can be easily seen up close on a small sample may look slightly purple when viewed on a large chair. It is difficult to successfully select a fabric with a large pattern from a small sample. It is necessary to see a large piece of the material in order to see the complete pattern and to see how the pattern repeats.

When interior designers are charged with selecting colors for a building, the designer usually makes some initial color selections and combinations of colors to show to the local planning team. The task of selecting satisfactory colors is so familiar to experienced designers that they apply their knowledge of color theory easily and quickly. Sometimes a library director and other staff members are given the job of selecting colors for small building projects or for library refurbishing projects. In these situations, the people charged to do the color selection should follow the same procedures as those followed by interior designers and should study some basic information on color theory.

In selecting colors for upholstery and furniture finishes, an interior designer, architect, or local planner must coordinate selections with the other materials and colors that are selected for the building. Colors for furnishings should be selected along with other interior

finishes, including the color of laminates or wood to be used on built-in millwork, doors, window and door frames, floors, walls, ceilings, columns, and building trim. Some interior colors will be determined by materials used in the building, for example, granite or marble used on walls and floors or metal used in the rails of a stairway.

Steel shelving is expected to last the lifetime of a library. For this reason, shelving should be purchased in a neutral, rather than a trendy, color that will continue to coordinate with library furnishings as other colors in the library change over time.

In public libraries, one color scheme may be used in the adult area while a different color scheme is used in the children's area. The two color schemes may be coordinated by having the same wood color and finish in both areas.

Colors may be used in a library to identify particular functions. For example, if a building has several service desks, the desks may all be designed using the same colors and finishes in order to provide library users with a visual cue regarding where to obtain information. In multistory libraries, the use of colors in the same relative locations and in the same manner on every floor helps to assist users in finding specific areas.

In some projects, carpet is one of the first interior finishes selected. The predominant colors in a carpet may determine the selection of other colors in the building. In recent years, many libraries have selected carpets with neutral colors. Carpet may initially be viewed in books of samples with each sample about 2" × 2" in size. As previously stated, it is impossible to know how a large expanse of carpet will look based on seeing a tiny sample. A carpet vendor will supply one or several squares of carpet to be viewed in making a selection. When a standard carpet is to be used, the planning team may be able to view the carpet in use at a nearby installation. As with any color selection, carpet samples should be viewed in the same light that will be used in the completed library. Carpet samples should also be considered in relation to other building finishes and materials that have already been selected. Carpet samples should be placed on top of a neutral-colored floor for viewing rather than on top of another carpet.

Most commercial carpet manufacturers will customize colors in a carpet if a minimum number of square yards is to be purchased. For example, if a designer and planning team like the pattern in a particular carpet, but would like more of a certain color, the carpet manufacturer will prepare one or more samples of a standard carpet with customized colors for the team to use in selecting a particular carpet. In large projects, interior designers may work with a manufacturer to develop a totally customized carpet with custom colors.

The process of selecting colors begins with a plan that is based on looking at color samples without having a definite scheme in mind. John Pile suggests that color ideas can begin with solid color areas cut from magazines or brochures, paint charts, or other colored papers. Ideas may come from some element of the community in

which the library is located. Daria Pizzetta, an interior designer at Hardy Holzman Pfeiffer, says that her department sometimes looks at textiles to gather inspiration for a color scheme. Small wood samples can be obtained from furniture vendors. Wood finishes and colors can also be based on wood-grain laminate samples. In some academic and special libraries, colors for new interiors may be predetermined by standard colors or finishes adopted by the larger organization of which the library is a part.

In selecting colors for a library, keep in mind that books and other materials housed in the library provide a lot of color. Local staff charged with selecting colors should note that color has an effect on a viewer's perception of objects and spaces. Bright colors make an object look larger, while dark colors make an object look smaller. For example, a small room or space in a library should not be painted a dark color, since that will make the room appear even smaller.

An array of prospective colors is developed by using either color samples collected earlier or by using actual samples of fabric, laminate, wood, etc., provided by vendors. Architects and interior designers often have a library of finishes and colors from which to select samples for projects. It is difficult to see how a color will work in a particular situation without viewing the color in a large piece. Even an 8" × 10" piece of bright yellow laminate may look quite different when the same color is used on a 24" × 66" end panel. If only small samples are shown to a local planning team, the interior designer should be asked to provide larger samples.

Selected color samples should be arranged in a scheme that shows how the colors will look next to each other in a library space. If possible, color samples should be proportionate to the size of the surfaces to be colored in the library. For example, an accent color used in upholstery may be shown in a smaller sample than one of a wall color or a carpet. Interior designers or a local planner can prepare a preliminary color board to be shown to a library board or other approving body.

After all colors and finishes in the building design have been approved, the interior designer will prepare a final color board and a final finish board (and sometimes a board showing furnishings), or one board that shows both colors and finishes. (See plate 4.) In large projects, interior designers may demonstrate selected colors by preparing mock-ups or models or by providing color renderings of building elevations or plan views (bird's-eye views). Computer models of the library spaces may also be used to show the color relationships within a library. In addition to preparing color boards or other demonstrations of colors, an interior designer will prepare a color schedule that lists every color and where it will be used in the library.

NOTES

1. John F. Pile, *Interior Design*, 2nd ed. (New York: Harry N. Abrams, 1995), 218.

2. For more detailed information about building materials and finishes, see William R. Hall, *Contract Interior Finishes: A Handbook of Materials, Products, and Applications* (New York: Whitney Library of Design, 1993).

3. Carpet and Rug Institute, *The Carpet Primer* (Dalton, Ga.: Carpet and Rug Institute, 1995).

4. For detailed information on the technical specifications of carpets and sample specifications for bidding, see S. C. Reznikoff, *Specifications for Commercial Interiors: Professional Liabilities, Regulations, and Performance Criteria,* new rev. ed. (New York: Whitney Library of Design, 1989).

5. John F. Pile, *Color in Interior Design* (New York: McGraw-Hill, 1997).

6. Ibid., 148.

The Interior Design of Spaces for Children and Teens

CHAPTER 7

Children's Areas

Library spaces provide one of the first environments for ensuring that babies will grow up to become lifelong library users. It is essential that a child's early experiences in a library be positive and inviting. The children's area of a public library should be easily accessed from the main entrance to the building. In all but the largest libraries, children should be able to see their area when they walk into the building. The interior design of a children's area should make the location of the space obvious through a welcoming entrance or through the overall design of the space. Ideas for successful children's areas can be obtained by studying how children's museums and other spaces for children are designed. (See plates 5B, 6A, and 6B.)

In planning the location of a children's area in a building, several important adjacencies should be considered. Children should not have to walk through the adult area to get into their space. Nor should young people have to walk through an adult area when they walk to the circulation desk, the children's programming area, or to rest rooms. Many children's areas in libraries of all sizes plan children's rest rooms or family rest rooms adjacent to the children's area. Rest rooms in a children's space should include baby-changing tables that are safe and easy to maintain.

School-age children should not have to walk through the preschool area to get to their books. All children should be able to walk directly from the children's area to the programming area. Most adult library users prefer children's spaces that are separated from the rest of the library by glass walls or by the shape of the building.

Library spaces for babies, toddlers, and school-age children through about fifth grade have received a great deal of attention in the library media. Highly decorated spaces for children are common in medium-sized and large public libraries. Children's areas for preschoolers and young school-age children are often designed with elaborate two- or three-dimensional artwork. The decorative elements in a children's area are often based on a theme. But interior designers should be wary of theme-based decorative elements that may look outdated in a short time. In the book *Creating Ever-Cool: A Marketer's Guide to a Kid's Heart,* Gene Del Vecchio identifies some of the recurring themes that children love, such as animals and historical

figures.[1] Small decorative buildings or towns, book characters, and trees are also used by designers in children's areas. In most situations, the complexity of the design of the children's area is determined by the creativity of the architect and the interior designer, and by the amount of funding available for the project. (See figure 28.)

In designing special artwork for children's areas, keep in mind that book and other characters are protected by copyright. It is necessary to obtain permission to use any copyrighted characters and, in some cases, to pay a fee for using the characters in library design.

The interior design of a children's area should take into consideration other factors besides the desire to make a strong aesthetic impact on young library users. Children's areas should be designed to be appropriate for the ages of the users and to be safe for everyone. Children should be comfortable with the furnishings, arrangement, and materials offered. Children need unobstructed spaces that they can explore safely. A children's space should include furnishings and objects that they can use and touch freely without an adult saying "don't do that." In other words, children's space should include items that do not have to be protected from children and that children do not have to be protected from using. Expect that some heavily used items in a children's area—such as stuffed animals and other hands-on items—will need to be replaced on an ongoing basis.

While designers and librarians often build story pits and story platforms, experience has shown that a space that is designed entirely with a flat floor is the best for safety and access. Any construction in a children's area that encourages climbing, jumping, and running (such as ramps or multilevel story areas) must be closely monitored for safety reasons. Changes in the level of the floor create negative situations for children who are frequently corrected by parents, caregivers, or librarians. Flat floors are also a necessity for parents with babies in strollers and people in wheelchairs. If designers or library staff are insistent that a children's area must have platforms or pits for story hours, the area with varying floor levels should be equipped with doors or gates that can be closed when the space is not in use for story hours or other activities. Also, pits or stairs must be accompanied by ramps to make them accessible to everyone.

Children's furnishings should be appropriate for the age and size of the young people using them. Open floor space should be planned in a preschool area for toddlers and preschoolers who often sit on the floor to look at books and play with manipulatives (toys). Chairs with a seat height of 12" to 14" and tables with a height of 21" should be provided for preschoolers. Reading tables in a children's area should be round. Round tables are safe (no corners) for small children and encourage reading and working together.

The color of toys marketed successfully to children provides a clue to colors that may be used successfully in children's areas. Consider using primary colors (red, yellow, and blue) and warm colors, with quiet areas of natural lighting. The use of patterns in



FIGURE 28

Davis Library, Plano, Texas. Architects, Phillips Swager Associates. Used by permission of the photographer. Photo credit: Copyright King Graf 2001.

children's spaces should be studied carefully. For example, if a highly patterned carpet is used, the upholstery on sofas should have very little pattern. The basic interior design of a children's area is sure to be enhanced by a number of "busy" elements added by the library staff, such as hanging objects, stuffed animals, and elaborate displays on tackable surfaces and on the tops of low bookstacks.

Parents and caregivers should have comfortable seating in the children's area, so that they will have a positive library experience with their children and will want to bring them back to the library. Sofas and rocking chairs should be provided for parents and caregivers reading with children. Comfortable seating for adults should also be provided near a children's discovery area, so that parents or caregivers have a place to sit while watching children play with a Lego table, puzzles, or other educational manipulatives. Adults also need a convenient place to sit with toddlers while older children attend programs. Children's spaces in a public library are often areas for parents and caregivers, as well as children, to socialize. (See figures 29 and 30.)

A quiet, semiprivate area should be provided for nursing mothers. For example, a small room with a glass wall and comfortable seating may be located adjacent to an area where young children read and play. The mother has a quiet place with the baby and can still keep an eye on an older child.

Chairs for young children should be all wood for the sake of easy maintenance. Chairs should have sled bases and should be stable enough for a child to push around without the chair tipping over. Children just learning to walk may push a tiny chair (with 12" seat height) around as support.

Young children like small nooks or portals that are in scale with their own size. The interior design of children's space can include two or three small intimate spaces that children crawl into or through. Children's areas should be designed with plenty of display space. Display areas should not be planned with framed bulletin boards. Display areas, such as a wall above 42"-high shelves for picture books, should be provided by installing tackable walls covered with vinyl or fabric. A tackable wall does not draw attention to the area when no display is mounted on the wall.

The shelving for preschool picture books and easy readers should be 42" high. Picture-book shelving is 12" deep. Shelves for picture books are supplied with backs and are slotted to accommodate dividers that help to keep the books upright.

In public libraries, books and other materials for school-age young people should be shelved on bookstacks that are a maximum of 66" high. In some school libraries, library staff prefer a height of 42" or 48" for all bookstacks. Tables for school-age library users can be 25" to 27" high, with chairs having a seat height of 16". In public libraries, the area for young people should also be furnished with one or more round adult-height tables and chairs for parents and caregivers. In some libraries, the adult tables are located close to the parenting section of the collection.

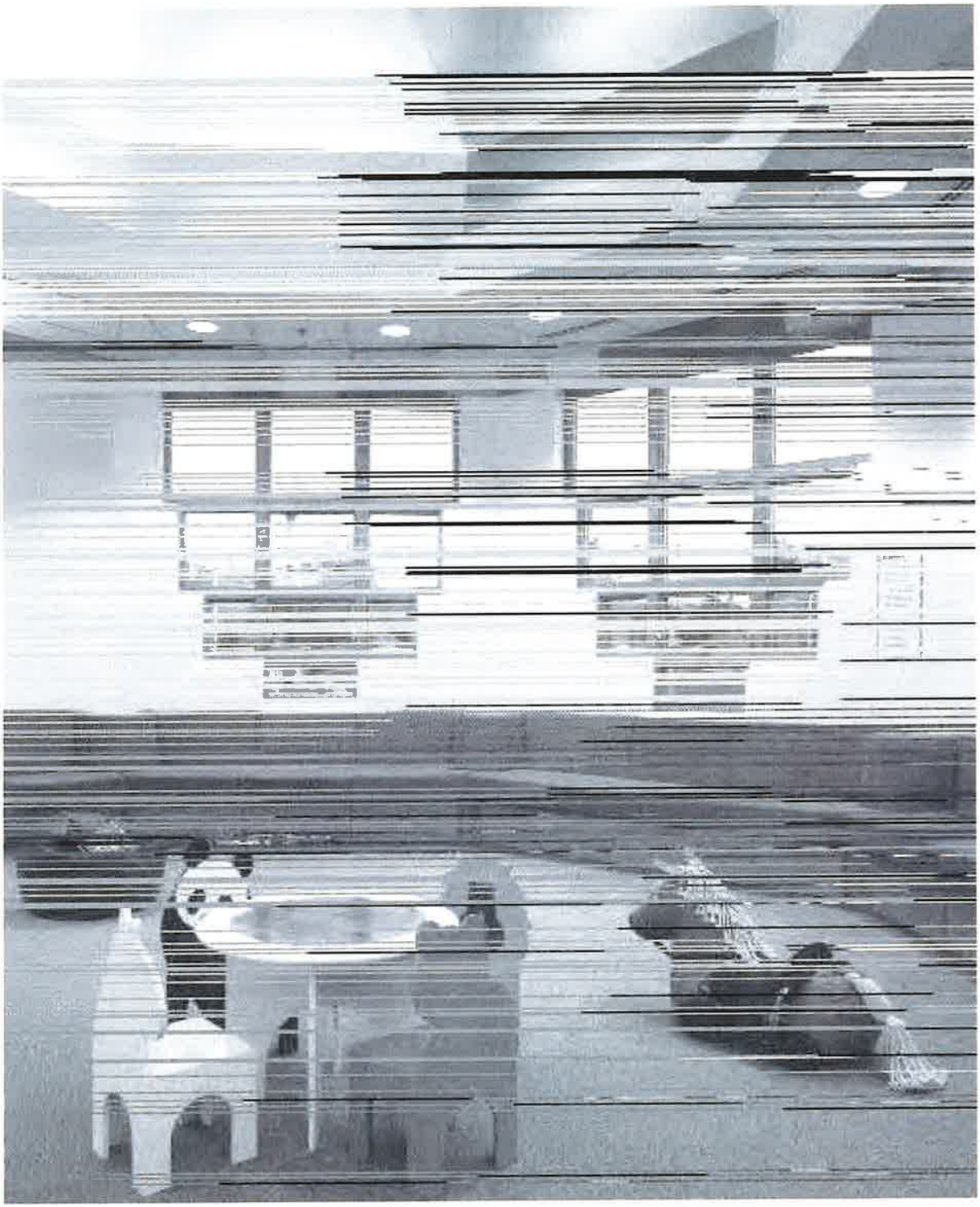


FIGURE 29

River Falls Public Library, River Falls, Wisconsin. Architects, Brown, Healey, Stone & Sauer/A Howard Green Company. Used by permission of the architects. Photo credit: Dale Photographics, Inc.



FIGURE 30

Pella Public Library, Pella, Iowa (a town described as "a touch of Holland in Iowa"). Architects, Brown, Healey, Stone & Sauer/A Howard Green Company. Photo credit: Dale Photographics, Inc.

In some libraries, computers may be used by people of all ages in a children's area. Computer tables for children should be 27" high. More than one seat should be provided at each computer. Young children work with computers collaboratively with parents and caregivers. Moreover, two or three school-age children often use a computer together. Backless stools or chairs can be provided for computer use. The computer area should be supplied with stools or chairs that have 16"-high seats for children and 18"-high seats for adults. Seating for computers should be light enough to allow users to move them around as necessary.

Because families tend to collaborate on computers, a family computer room may be designed. The room would house one or two computers for family use and empty floor space supplied with a few books and toys to occupy toddlers while older children use computers with parents or caregivers.

In small libraries, children's activities and programs are held in the library's meeting room. In larger libraries, programs for small groups of children are held in a special story-time room adjacent to the children's area, while programs for larger groups are held in the library meeting room or auditorium.

In public libraries with ample space, the children's area may include a story-time room, as well as a special activity room for arts and crafts programs. Activity rooms usually have an easy-to-maintain vinyl floor and are furnished with height-adjustable folding tables and stacking chairs. Rooms designed for arts and crafts activities often include a sink and lockable cabinets to hold programming materials. Tackable walls may be provided for displaying items made by young people during library-sponsored events.

Teen Spaces

For many years, libraries have had spaces designated as "young adult" areas. These spaces are relatively small and include several tables with chairs, books and audiovisual materials on shelves and racks, and display capabilities. The target users of young adult spaces vary from library to library.

Until recently, teenagers were, for the most part, left out of library planning. Library staff assumed that teens would use materials, services, and computers in the library's adult area. No attempt was made to create spaces specifically designed for (or by) this age group. Although parents and caregivers recognized that teens want to "hang out"—for example, at the mall—neither design professionals nor library staff addressed the possibility of teens having a large space in a public library dedicated to their use.

In some communities, public libraries are considered important places for young children, and perhaps for adults. Lack of emphasis on the library needs of teens turned some young people away from libraries during this crucial time in their lives. Because of our relative

neglect of this segment of youth, public libraries lost an opportunity to make lifelong library users of many teens.

Society's current interest in youth development has renewed the commitment by public libraries to design spaces for teenagers. Teen spaces and services are a special focus of libraries all over the United States. Large teen spaces are part of public libraries in Los Angeles, Phoenix, Tucson, and Brooklyn, for example. The Wallace–Reader's Digest Funds awarded three-year grants of $400,000 each to nine public libraries to create innovative and educationally enriching programs for youth, and the American Library Association recently recognized excellence in after-school programs for young adults.

The process used for designing successful library spaces for teenagers is not the same as the process used for planning other areas of the library. Spaces for teens should be designed *with* teens, not *for* teens. Teen library spaces should be designed to fulfill the concept of the library as "destination" by providing a safe, comfortable place for young people to hang out.

To ensure the success of a teen space, teens should be involved in the planning process from the very beginning of the project. Teens should be empowered to work with library staff and design professionals to plan their own library space; empowerment will lead to a feeling of ownership.

Planning for teen areas may begin with the formation of youth councils that represent young people in the community. In libraries with branches, each branch and the main library may have a youth council. Interior planning for teens may also be carried out using teen focus groups.

The Phoenix Public Library implemented an elaborate, successful process in planning a teen space.[2] The library's goal was to plan a safe, comfortable place for teens that was developed *by* teens. In preparation for designing the space, the planning team visited other libraries and read literature about teenagers.

The participants for teen focus groups were obtained by using newspaper ads, press releases, and flyers and by contacting schools, teen centers, and relevant organizations. Architect Will Bruder, a teen representative, and library staff developed questions for the series of focus groups used in planning the teen space.

Teens participating in the focus groups were given disposable cameras and asked to take pictures of furniture, neon signs, colors, and any other items that they thought were good ideas to be introduced into the planning process. The adults working on the project discovered that teenagers want food, music, and computers.

During part of the planning process, the teens participating in the focus groups were divided into five groups. After the architect explained layout principles, each of the groups used cardboard cutouts of furniture and equipment to develop a possible layout of the teen space. The architect used the focus groups' input to develop plans that were later reviewed by the focus groups.

Teens participating in the Phoenix focus groups voted on the colors provided on color boards. Possible colors for the teen space were also mounted on a web site. Interested teens voted for their favorite colors on postcards that were self-addressed to the library. Teenagers' favorite colors for the library space in Phoenix were blue, bright red, lime green, and burnt orange.

In summary, at the Phoenix Public Library, teens provided input at every planning meeting; voted on the name of the space; picked out colors, fabrics, and furniture; designed the room layout; and picked out the library materials. In addition to books, magazines, audiovisual materials, and comic books, the completed teen space at the Phoenix Public Library houses 20 new computers, a surround-sound stereo system, a color printer for public use, and a large-screen cable television (for watching MTV).

Teen areas may include quiet study areas behind glass walls and round or oval tables for socializing. Study or meeting room space may include white markerboards and tackable vinyl wall coverings. Teens may request computers for individual use or for group use. Other possibilities for teen spaces include special lighting, a dance floor, a living room-type space, a café area, and a variety of seating. The various functions of the spaces will dictate floor coverings. For example, wood will be used on a dance floor, vinyl tile in an eating area, and carpet in a computer and bookstack area. Walls and ceilings may require acoustical treatment. Display capabilities in a teen space may include walls with special surfaces for creative art, tackable walls for display, a message board, and lighted display shelving for books and other materials that are "teen picks." Teen spaces should be flexible, so that the area can be changed easily as "cool" factors for teenagers change over time.

NOTES

1. Gene Del Vecchio, *Creating Ever-Cool: A Marketer's Guide to a Kid's Heart* (Gretna, La.: Pelican, 1997).

2. From the presentation "Teen Central, State-of-the-Art Planning," Phoenix Public Library, developed by Michele Howard, February 20, 2001.

CHAPTER 8

Lighting and Acoustics

Library Lighting

The design of effective lighting for a library is highly technical work done by engineers and architects. In all except the smallest building projects, it is recommended that a lighting consultant, hired by the architect, plan the lighting for a library. The cost of using a lighting consultant should be included in the project budget determined at the project's beginning. The lighting consultant selected should have experience with libraries. In some situations, an architect may work with an electrical engineer with extensive library experience who provides lighting design services.

The cost of hiring a consultant and designing library lighting correctly during initial building planning is less than hiring a consultant later and replacing the initial lighting scheme. Libraries are extremely difficult to light correctly. The need to see clearly the book titles on the top and bottom shelves of a 90"-high bookstack is well known to both library staff and users. If lighting is not designed correctly, dark areas in the stacks, poor lighting at tabletop level, and glare around computers create problems for both users and staff.

The following information is not intended to provide the kind of technical details needed to design lighting for a library. However, the suggestions given here may help a local planning team to work more effectively with lighting professionals. The information here was provided by David Malman, the owner of Architectural Lighting Design, in San Francisco, and has been used with his permission. The material was initially presented at an American Library Association annual conference in 1995 with the title "Lighten Up: How to Write a Library Lighting Program." Malman provided additional information that updated the 1995 material for the writing of this section of the book. Malman was the lighting designer for the San Francisco Main Library as well as other libraries.

In small library building projects where neither a lighting consultant nor an electrical engineer with library experience is involved, the following information should be passed on to the architect designing the new building or renovation.

Recommended lighting levels for various areas of the library, based on the latest edition of the *Illuminating Engineering Society Handbook*, are the easiest variables to measure. The lighting stan-

dards of the Illuminating Engineering Society (IES) do not, however, have the legal status of a code. The IES lighting levels do provide a starting point for discussion between a local planning team and the design professionals—architects, interior designers, and engineers—involved in a library project.

Lighting levels are only one of several factors to be considered in guaranteeing successful lighting in a library. Lighting design must also address glare control, spatial definition, orientation, and variety, all of which have more of a bearing on the library user's perception of "good lighting" than do certain lighting levels. (See figure 31.)

In designing lighting, a consultant plans for "maintained" lighting levels, rather than lighting levels on opening day of a library. A lighting consultant calculates "light loss factors" (such as dust on fixtures, age of light bulbs, etc.) to predict the "maintained" lighting level at some point in the library's future.



FIGURE 31

Scott County Public Library, Georgetown, Kentucky. Johnson Romanowitz Architects, Charles L. Witt, principal. Furniture manufactured by the Worden Company. Photo used by permission of the photographer. Photo credit: Copyright Walt Roycraft Photography.

The IES recommends that the lighting levels of reading areas should be 30–40 foot-candles average, measured horizontally at desktop, with task lighting added where it is appropriate in carrels and at tables. For bookstacks, the IES recommends 30 foot-candles average, measured vertically on the stack face at a height of 30". This standard fails to address lighting on the level of the bottom shelf or the evenness of illumination from top to bottom across the entire height of the stack.

The firm Architectural Lighting Design (ALD) suggests an alternate standard to the IES recommendations. ALD suggests that bookstacks should have a lighting level of 36 foot-candles at the top shelf and no less than six foot-candles at the bottom shelf to keep the maximum-to-minimum ratio within reasonable limits. ALD suggests this alternate standard because its experience has indicated that the evenness of illumination across the stack face is more important than achieving a high lighting level at any single point.

The IES recommends, for service desks, a lighting level of 50 foot-candles average, measured at countertop, with careful coordination of computer-screen locations and orientations to avoid reflected glare. Small conference and group study rooms are recommended by the IES to have a lighting level of 30–40 foot-candles average, measured horizontally at desktop. Staff work areas are recommended by the IES to have 50 foot-candles average on desks and worktables, measured horizontally at desktop. According to ALD, the desired lighting level in staff areas can be achieved through a combination of general and task lighting, with 50 foot-candles on desks or tables and approximately 30 foot-candles elsewhere in the work area.

The IES recommends that large meeting rooms have 40 foot-candles average with all lights on, and separately controlled lighting for the podium or presentation area at the front of the room. The meeting-room lights should be dimmable or switchable to produce approximately two foot-candles for note-taking during audiovisual presentations; note-taking light should not spill onto a projection screen. ALD notes that to achieve flexibility in meeting-room lighting, several different "layers" of light or separate lighting systems should allow for combining lights in various ways to suit different activities occurring in the meeting room.

Light fixtures should effectively control glare throughout the library. Lighting in areas with intensive computer use should meet the "preferred" standards for visual display terminal (VDT) lighting in the IES publication "American National Standard Practice for Office Lighting," ANSI/IESNA RP-1-1993. The RP-1 document covers all aspects of office lighting, but its recommendations for VDT lighting generally apply to situations in which people use computers for more than approximately four hours every day. ALD notes that there are many ways to control glare, including deeply shielded parabolic louvers in downlight-type fixtures, various kinds of uplighting, or a combination of techniques. The best controls, according to ALD, meet glare-control requirements and also coordinate with the architectural design of the library.

According to ALD, well-designed fluorescent lighting is the best choice for energy efficiency, good color-rendering, and long lamp-life in bookstack, reading, and staff areas with ceilings lower than 15'. This recommendation should not, however, preclude alternate designs using other light sources in nontypical areas such as large, high-ceilinged places. The effective lighting of high-ceilinged spaces is difficult to design and should be developed carefully by qualified lighting designers.

The most commonly used fluorescent lamps are T8 lamps. T8 lamps with a Color Rendering Index (CRI) minimum of 82 offer the most cost-effective combination of energy efficiency and improved color. T8 lamps are available in warm, medium, and cool color temperatures. The appropriate lamp color for a project should be selected based on studying a mock-up or color board of interior-finish samples lit with each of the three lamp options. ALD suggests that "daylight"-color lamps should be avoided, because they are expensive and inefficient.

T5 high-output lamps are also used now. T5 lamps produce more light than T8 lamps, but they are more expensive than T8 lamps and produce more glare. T5 lamps should be used only in indirect uplight fixtures.

All fluorescent lamps require ballasts to start the lamps and regulate current while the lamps are running. Electronic ballasts from major manufacturers have a proven track record of reliability, flicker-free quiet operation, and significant energy savings. Because many different types of electronic ballasts are available, lighting designers should select the best balance between light output and energy consumption.

Because of its low efficiency and short lamp-life, in general, incandescent lighting should be avoided, except in special situations. Incandescent sources should be used only where no other source can meet the needs for precise beam control, small fixture size, easy dimming, or historical accuracy. (See plate 7.)

Daylighting can substantially reduce energy costs when it is combined with an appropriate control system for electric lights. Although ultraviolet light is the most damaging wavelength of light, any light can cause cloth, paper, and ink to degrade over time. Except in rare-book collections, it is better to keep books away from direct sunlight than to install costly ultraviolet filtering in electric lights.

The lighting fixtures selected for a library must last a long time; therefore, it is important that high-quality fixtures be specified. Table or desk lamps should be of durable construction and should be designed to spread light evenly across the worksurface. In public areas, table lamps should be securely mounted to furniture and should not obstruct the librarian's view across the room. Emergency and exit lighting should meet local requirements. Exit signs should use low-energy fluorescent, LED, or electroluminescent sources.

Library lighting should be in compliance with all applicable accessibility guidelines, including the 1990 Americans with

Disabilities Act. Compliance with the ADA requires that in walks, corridors, passageways, and aisles, no portion of a wall-mounted light at a height between 27" and 80" above finished floor should project more than 4" from the wall. In elevators, the minimum light level on the floor and on the controls should be five foot-candles. Signs should be adequately lit. Lighting controls should be mounted no more than 48" above the finished floor.

In large libraries, lighting circuits should be turned on and off by a lighting-control system that allows flexible, timed programming for each circuit. A master control station should be located at the circulation desk or other central location, for manual override of groups of lights. This type of lighting-control system is sometimes part of an overall "building energy-management system" that controls lighting and heating, ventilation, and air-conditioning (HVAC) loads. Lights near windows or skylights should be switched separately from other lights. Consider dimmable fluorescents for areas that receive significant daylight. Occupancy sensors should be considered to reduce energy consumption in areas that are not in continuous use, such as closed stacks or meeting rooms.

Maintenance issues should be a prime consideration in designing a lighting system for a library. The number of different lamps selected should be minimized to simplify lamp-stocking. Also, consideration should be given during the design process to the purchase of any special equipment that may be needed to change out lamps in fixtures that are difficult to reach using more than a ladder.

Sound Control

Libraries are no longer quiet spaces where the staff shush noisy undergraduates or children. Although quiet areas in libraries remain, library users and staff now talk out loud to each other on a regular basis in the public areas of all types of libraries. Computers and printers add to the noise level of a library; children are allowed to act like young people in their designated area; and in areas where the collaborative use of computers is encouraged, conversations occur.

Acoustical issues for libraries were discussed by Jack Wrightson (principal acoustical consultant with Wrightson, Johnson, Haddon, and Williams, Inc.) and Jeffrey Scherer (principal with Meyer, Scherer & Rockcastle) at a 1998 American Library Association program entitled "Not Just Shhh Anymore: Improving Library Acoustics." Wrightson identified three categories of acoustical problems that may occur in libraries: intrusive noise or noise that is not wanted in a particular space (such as noise from adjacent meeting or activity rooms), overly reverberant spaces (such as spaces with vaulted ceilings), and lack of speech privacy, especially in staff areas.

Intrusive noise in a building may be controlled by the grouping of spaces and by the layout of rooms within the library. Architects have traditionally grouped noisy elements of a building next to other

noisy spaces. For example, main HVAC units are usually placed close to a receiving or mechanical area, rather than next to a quiet reading area for the public. Sometimes large bookstack areas where little conversation occurs serve as a buffer between a noisy area such as the reference center and a quiet area like the periodical reading area.

Where lifelong use of libraries is the accepted norm, public library users accept the fact that children's areas will be noisy. Babies and toddlers (and their parents) cannot enjoy a trip to the library if children are constantly told to sit still and be quiet. In order to keep the noise of a children's area from annoying adults, children's areas are usually placed in a different wing of a library from adults, placed on a different floor of multistory libraries, or separated from adult areas by glass or walls.

Overly reverberant spaces may be avoided by consideration of acoustical treatments in building design. The materials used on walls, floors, and ceilings; the location of doors and windows; and the acoustical treatment of ductwork all affect sound control in a library. Hard, reflective surfaces on walls, floors, and ceilings result in a noisy space. A monumental library entrance or circulation desk area constructed with granite walls and floors and plenty of glass may be an aesthetic masterpiece but an acoustical nightmare. Architects and interior designers are responsible for selecting building materials and architectural elements that will provide adequate sound control in a library. Local planners should be aware of the need for sound control in their buildings and should ask architects about acoustics during building design.

Public, school, and academic libraries are expected to provide areas for quiet study and reading, as well as for computer use. Jeffrey Scherer suggests that libraries should be designed with computer-free zones, where users wanting traditionally quiet library spaces can enjoy relative quiet in a library. With computers in use in many areas, library planning should include the design of quiet rooms with soft, comfortable seating, as well as seating at carrels and tables. For the sake of visual control, quiet rooms may have some glass walls to allow for visibility into the room.

In large library projects, an acoustical consultant should be hired to plan the sound-control elements of a new or renovated building. In libraries with large meeting rooms or auditoriums, an acoustical consultant is a necessity. In many small and medium-sized projects, the architect and the interior designer are responsible for handling the acoustical decisions in the project. Local planners should be aware of the need for sound control in their buildings and should ask their architects and interior designers about the acoustical treatments to be used in their library.

CHAPTER 9

Conclusion

The interior designers who were interviewed in the course of gathering information for this book were asked how library interior design differs from the design of other types of buildings. One designer replied, "It's not your house." The scale is entirely different in a library than in smaller buildings. Another designer said that library projects are difficult because there are so many parts and pieces of different sizes and uses that have to fit into a library. Academic libraries are sometimes difficult to design because of the large number of organization officials involved in the process.

All of the interior designers who were interviewed asked that clients trust the judgment of the architect and the interior designer. Everyone involved in the planning process should come to the project with an open mind. When a client offers a suggestion to a designer, the client should explain the logic behind an idea and explain where the idea came from. Clients should work along with the pace of the architects and interior designers. Many decisions must be made during the design process, but there is an order to the timing of decision making. Some decisions are made early in the process and others are made later.

Interior designers, architects, and building owners need to have a shared understanding about their expectations for a new facility. Architects and interior designers need to know the internal chain of command of the client—who is going to make the final decisions. Likewise, the clients should know the chain of command of the design team. In order to keep the project on schedule, the client, as well as the designers, needs to make timely decisions. Both the client and the design professionals should feel free throughout the project to ask why something is being done, why a particular finish has been selected, etc.

Except in unusual circumstances, funding for a new project is always a concern. Both the design professionals and the client must understand the budget expectations at the beginning of a project. Jeffrey Scherer, principal with Meyer, Scherer & Rockcastle, tells clients that in cases where funding is an issue, they can dictate two out of three considerations in building a new facility: cost, size, and quality. For example, a client may pay for the high cost of quality and sacrifice some of the size of the building. Or a client may want a

larger building, but is willing to sacrifice some of the quality in materials in order to get the desired number of square feet in the facility.

Much of the information provided in this book is related to the functional aspects of library interior design. Effective adjacencies, the use of durable materials, and satisfactory lighting should result in a functional building; however, the truly distinctive elements of outstanding interior design in any library are the result of the creative work of architects and interior designers. (See plate 8.) Unusual architectural features; effective use of windows and varied ceiling heights; creative use of color, materials, and decorative details; and custom furnishings and floor coverings are just some of the elements that design professionals combine with functional components to create an award-winning library interior.

APPENDIX A

Interview Questions for Obtaining Information from Library Staff

The following list of questions can be used by architects, interior designers, and consultants when they are gathering information in preparation for programming, planning, and selecting furniture for a library. Interviews and meetings with staff in the early stages of a project are an essential part of the planning process. Participants in information gathering are more likely to take ownership in a project when they have had an opportunity to offer their input. Library staff who have toured or worked in other libraries may have an informed opinion about what they want in their new library. On the other hand, staff who are familiar only with their existing work situation may not be able to provide very meaningful information. Some libraries are so inadequate that the employees don't have a clue about what they want and need in a new space. If staff have no informed opinion concerning the new space, it is up to the architect, designer, or consultant to offer options to which the staff can react during the interview process. At some point in the planning process, it may become necessary to remind participants that the furnishings selected now will be used by many other employees in the future. (This list of interview questions was developed in response to discussions with Bev Moris of Simon, Martin-Vegue, Winkelstein, Moris.)

Shelving

What kind of steel shelving is preferred—welded-frame or European-style starter/adder (like that of BCI)?

What type of shelves is desired for books—flat shelves or shelves with an integral back? (If sliding book supports are to be used, shelves must have an integral back.)

What height of shelving will be used for various books—42" and 66" for children's areas? What about other areas—66", 78", 84", or 90" standards, or special heights like 48"?

What depth of shelves will be used—12" deep for picture books and reference books? What about adult fiction and nonfiction—10" deep or 12" deep?

Which shelving should have matching steel canopy tops, which should have no tops, and which shelves should have custom wood or laminate tops?

What kind of book supports will be used?

Will all ranges of shelving have end panels? Will the panels be steel, wood, laminate, or custom-designed?

How will signage be handled on the end panels? Ready-made signs or custom signs?

What special shelving will be needed? How will each type of audiovisual material be housed (videos, single audiotapes, audio books, CDs, DVDs, CD-ROMs, books on CD)? Will any lighted shelving be needed to highlight special collections?

How will paperbacks be housed? Paperback shelving on steel frames, paperback rounders, slat-wall shelving?

How will periodicals be shelved? Hinged or fixed periodical shelves? Plexiglas covers for current issues of newspapers? Oblique files for back issues of newspapers?

Will some special collections be shelved on wood shelves? (Consider preservation issues in this regard.)

Circulation Desks

Will the circulation desk consist of one monumental desk where all circulation functions take place? Or will the library have separate check-out and return desks?

What is the maximum number of computer stations needed at the desk? What equipment is expected to be used—flat-screen computers or larger personal computers? Will other equipment, such as a typewriter, be used at the desk? How will all of the computer peripherals be accommodated on the desk? How will printing be handled? How will the desk accommodate any equipment needed for the book-theft detection system?

In a public library, where will books held on reserve be stored in relation to the desk? Are the reserved books centrally located so that all people working at the desk can retrieve them?

Will any reference materials in book format be stored at the circulation desk?

What small paper items will be stored at the desk next to each check-out or return station? Registration forms for library cards, library cards, informational brochures about library policies, etc.? What size are these items? Will they be stored in custom-designed slots in the desk or in drawers?

Where will money be handled? Will the desk have one or more cash registers? Does only one person at a time handle money? Or does the cash drawer or register need to be located so that more than one person on duty can handle cash?

Are staff on duty expected to stand at all times, or are knee spaces provided at each computer station in order to allow an employee to sit on a high swivel stool?

Where will the ADA/children's check-out module be placed in the desk? Will the unit allow for pulling a wheelchair under the desk, or will it allow only for pulling alongside?

Does the library need special storage areas at the circulation desk?

What is the relationship between the circulation desk and the work area?

How will power and data be distributed from the building through the desk? How will wire management be handled?

Is a work area required behind the circulation desk that will need a secondary work desk?

Are returned books collected on book trucks behind the desk as they are returned? How many book trucks should the area accommodate? Will most books be checked in at the desk, or will they be moved to the workroom to be checked in?

Will the desk have returned-materials slots? Will books drop from the desk into the work area?

Will furniture for self-check machines be needed now or in the future? Where should these machines be located?

Reference Desks

Most of the questions about circulation desks listed above are also relevant to designing reference desks.

Will reference staff be at a seated-height desk of 29", or will the staff be seated on high swivel stools behind a 39" desk? Will a desk with a work area at 29" have a transaction top at, say, 36" high?

Will a private, sit-down station for lengthy reference interviews be required?

What will be stored at the desk? Ready-reference materials, interlibrary loan forms, fax request forms, etc.?

How many computers will be at the desk? How will printing be handled? Will the desk hold a fax machine? A scanner?

Public Computer Stations

What kind of work will users be doing at the computers? Will some computers be used mainly for quick catalog searches? Should these be at standing height? Which computers will be used for researching topics on the Internet and electronic databases?

Who will be using the computers? Adults or children? Will all information be loaded on the LAN or will some computers for children have individual pieces of software loaded on each CPU?

How many people may use the computer at one time?

What type of seating will be used at each computer?

What equipment will be used at each workstation—monitor and keyboard, CPU, printer, speakers, scanners? Will printing be networked? Where will the printer sit? How much space will this equipment occupy on opening day?

What should the dimensions of each workstation be?

How will power and data be handled at each workstation? Wired data to the workstation? Wireless data transmission? How many outlets will be needed at each workstation? Integrated electrical system in the furniture, or individual plugs in the floor for each computer? How will wire management be handled?

Reading Tables

Decisions about reading tables are more aesthetic than functional. Ask whether the client wants leg-based or panel-end tables or some of both. Adults like rectangular tables in order to maintain their personal space. Teens and children like round tables (which are also safer for little kids) because they encourage conversation and collaboration. Ask about access to power and data and task-lighting at reading tables.

Reading Chairs

Does the owner want upholstered or unupholstered reading chairs? Arms or no arms?

In the children's department, what size chairs are needed?

Lounge chairs—emphasize the need for wood or wood-capped arms.

Teen and Children's Areas (Public and School Libraries)

What age youth will be served by the children's area? What age youth will be served by the teen or young adult area?

Repeat the questions asked about reference desks as they relate to youth areas.

How many computers will be housed in the children's area? The teen area? Repeat the relevant questions regarding computer workstations as they relate to youth areas.

Will the library have a separate story-time room and a separate activity room (with resilient flooring)? How many children should the story-time room accommodate? Will the children sit on the floor or on small stacking chairs? Should some adult-height chairs be supplied for the room? How many children should be accommodated at tables for craft activities in the story-time room or in a separate activity room?

Should a special waiting area with lounge chairs be supplied for parents or caregivers waiting for children attending programs?

In addition to seating at tables, should the children's area include lounge chairs, rocking chairs, or sofas for children and parents reading together?

Should the furniture in the children's area reflect the furnishings in the adult area? Or should the children's area be designed as a separate entity?

Should the children's area include some specially designed features or artistic features based on a theme?

Work Areas

What is the library's philosophy regarding management? How much administration is done by teams? How does management by teams affect the selection of furnishings?

If the owner selects office-panel systems for staff workstations, does the library have maintenance staff that can reconfigure panels easily? Will the building power and data grid support reconfiguring workstations easily?

Would ordinary desks or a system that looks like a panel system, but is really freestanding (like Steelcase Context), work better than a true office-panel system in some situations?

Circulation Work Areas

Where will materials be returned? From an outside book or audiovisual drop? From a materials drop in the foyer? From the circulation desk?

What is the relationship between the materials-return points and the check-in stations? Where will returned materials be checked in? What equipment is needed for check-in? How many check-in stations are needed? Where will checked-in materials be moved for sorting?

How many sorting shelves will be needed? How much room will be needed for parking book trucks by check-in stations and by sorting shelves?

How many individual desks or workstations will be needed in the circulation workroom? Are work spaces needed for volunteers? Can some work areas be shared space at built-in counters? Will more than one manager require a separate office? What furnishings are needed in the office? Where will employees lock up their belongings and hang up their coats? Will an individual coffee bar be located in the department? Where is the nearest staff rest room?

Will a conference room be needed? How large should the room be? Or should conferences take place at a table in the workroom?

Where will audiovisual checking take place? In another department?

What is the relationship between the circulation workroom and the delivery area where books and audiovisual materials will be returning from branches?

Reference and Collection-Development Work Areas

How many separate work desks or stations are needed here? What should each workstation include—files, shelves, desktop, guest chairs, etc.?

Is a separate office for one or more managers needed? What should each office include in regard to furnishings?

How many shelves will be needed for incoming reference books, special collections, and collection-development tools?

A related question: does the library continue to have a collection of back issues of magazines and newspapers? Where are these stored? Are they available directly to the public or are they retrieved by staff? Where are these back issues in relation to the reference desks? How much shelving will be needed for this collection? Is the library reducing the size of the collection as more titles become available in electronic format?

Where will employees lock up their belongings and hang up their coats? Will an individual coffee bar be located in the department? Where is the nearest staff rest room?

Will a conference room be needed? How large should the room be? Or should conferences take place at a table in the workroom?

Are there any other special requirements for the reference work area?

Technical-Services Work Areas

How will new materials flow through the work area? What are the relationships between acquisitions, receipt and check-in, cataloging, and processing? Where is the library loading dock and receiving area in relation to the technical-services work area?

Individuals in each part of the department need to be asked about the specific requirements for their work area: types of equipment used, types of materials stored, number of book trucks stored near their work area, height of work area needed, special storage needs. How many desks or workstations are needed? Will space be needed for volunteers?

Where will employees lock up their belongings and hang up their coats? Will an individual coffee bar be located in the department? Where is the nearest staff rest room?

Will a conference room be needed? How large should the room be? Or should conferences take place at a table in the workroom?

Is more than one separate office for the department needed? How much privacy does each individual need? (Sometimes catalogers like a private area and individuals who process books like to chat while they work.)

Technology Work Areas

What is the relationship between technology work areas and the location of the main computer/server room?

How many and what configuration of LAN-management furnishings will be needed in the computer room?

How many separate offices and individual desks or workstations will be needed? How much privacy will each person need? What are the power and data requirements for the area?

Where will computers awaiting repair (or computers kept for spare parts) be stored? Where will new computers awaiting installation be stored?

Will large workbenches, as well as individual desks, be needed for loading software and making repairs on hardware? What types of materials will require storage close to workbenches?

Where will employees lock up their belongings and hang up their coats? Will an individual coffee bar be located in the department? Where is the nearest staff rest room?

Will a conference room be needed? How large should the room be? Or should conferences take place at a table in the workroom?

What is the relationship between the technology work area and the loading dock and receiving area?

Work Areas for Youth Services Staff (Public and School Libraries)

How many individual desks and offices will be needed?

What are the special storage requirements for the area? Is storage needed for large pieces of paper and other programming supplies? Storage for theme boxes for programs? What size are the theme boxes? How many boxes will require storage? Storage needed for puppets? How many puppets? Audiovisual equipment to be stored? Vertical storage for large props? Storage for costumes? Storage for a portable puppet theater?

What types of furnishings are needed for preparing for children's programs? Standing-height counters? Large tabletops?

Where will employees lock up their belongings and hang up their coats? Will an individual coffee bar be located in the department? Where is the nearest staff rest room?

Will a conference room be needed? How large should the room be? Or should conferences take place at a table in the workroom?

Computer-Training Rooms

What type of computer stations will be used? Monitors set on the tabletop, partially recessed monitors, or fully recessed monitors?

Will computers be on long tables or individual stations? Will rooms be arranged in classroom style or with computers around the perimeter of the room (in which case millwork counters can be used)?

What type of chairs will be used? Task chairs? Stacking chairs?

What other equipment will have to be accommodated by the furnishings? Printers? Presentation stand? Ceiling-mounted video projector? Screens?

Will the training room be adjacent to breakout rooms? Will breakout rooms have small tables that can be rearranged or one large conference table?

Outreach Areas (Public Libraries)

What is the relationship of the outreach area to the loading dock?

What furnishings will be needed for staging? Large tables? Numerous book trucks?

How much shelving will be needed for outreach collections? What types of materials are in the collections?

How many private offices and workstations will be needed? What are the requirements for these spaces?

Will storage be needed for boxes or bags of programming materials to be taken to outreach sites? What size? How many? Can millwork cubbyholes be used for these materials? Or industrial steel shelving?

Also, talk about the specifics of built-in millwork: heights, sizes, how spaces will be used, etc.

APPENDIX B

Directory of Contributors

APW-Wright Line
160 Gold Star Boulevard
Worcester, MA 01606
508-852-4300

Architectural Lighting Design
370 Brannan Street
San Francisco, CA 94107
415-495-4085

ASI Sign Systems, Inc.
3890 W. Northwest Highway
Suite 102
Dallas, TX 75220
214-352-9140

Brown, Healey, Stone & Sauer
A Howard Green Company
8710 Earhart Lane SW
Cedar Rapids, IA 52404
319-841-4000

F & S Partners
8350 North Central Expressway
Suite 500
Dallas, TX 75206
214-559-4851

Fetzers' Inc.
1436 South West Temple Street
Salt Lake City, UT 84115
801-484-6103

Hardy Holzman Pfeiffer Associates, LLP
902 Broadway, 19th Floor
New York, NY 10010
212-677-6030

Hermes Architects
7915 Westglen Drive
Houston, TX 77063
713-785-3644

Johnson Romanowitz Architects
300 East Main Street
Lexington, KY 40507
859-252-6781

Kirksey
6909 Portwest Drive
Houston, TX 77024
713-850-9600

Libra-Tech Corporation
1115 Thornridge Court
Argyle, TX 76226
940-464-3033

Meyer, Scherer & Rockcastle, Ltd.
119 North 2nd Street
Minneapolis, MN 55401
612-375-0336

MJ Industries
P. O. Box 259
Carleton Drive
Georgetown, MA
978-352-6190

Parkhill, Smith & Cooper, Inc.
4222 85th Street
Lubbock, TX 79423
806-473-2200

Phillips Swager Associates
7557 Rambler Road
Suite 670
Dallas, TX 75231
469-232-5200

Ray Bailey Architects
4100 South Shepherd
Suite 100
Houston, TX 77098
713-524-2155

Simon, Martin-Vegue, Winkelstein, Moris
989 Market Street, Third Floor
San Francisco, CA 94121
415-546-0400

Thos. Moser Cabinetmakers
72 Wright's Landing
P. O. Box 1237
Auburn, ME 04211
207-784-3332

The Worden Company
119 East 17th Street
Holland, MI 49423
616-392-1848

Wrightson, Johnson, Haddon & Williams, Inc.
4801 Spring Valley Road
Suite 113
Dallas, TX 75244
972-934-3700

BIBLIOGRAPHY

Ballast, David K. *Interior Design Reference Manual.* Belmont, Calif.: Professional Publications, 1992.

Bazillion, Richard J., and Connie L. Braun. *Academic Libraries as High-Tech Gateways: A Guide to Design and Space Decisions.* 2nd ed. Chicago: American Library Association, 2001.

Brawner, Lee B., and Donald K. Beck Jr. *Determining Your Public Library's Future Size: A Needs Assessment and Planning Model.* Chicago: American Library Association, 1996.

Brown, Carol R. *Planning Library Interiors: The Selection of Furnishings for the Twenty-First Century.* Phoenix: Oryx, 1995.

Carpet and Rug Institute. *The Carpet Primer.* Dalton, Ga.: Carpet and Rug Institute, 1995.

Cohen, Aaron, and Elaine Cohen. *Designing and Space Planning for Libraries: A Behavioral Guide.* New York: R. R. Bowker, 1979.

Del Vecchio, Gene. *Creating Ever-Cool: A Marketer's Guide to a Kid's Heart.* Gretna, La.: Pelican, 1997.

Eckelman, Carl A. "Library Chairs: An Overview of the Library Technology Reports Test Method with Test Reports on 30 Chairs." *Library Technology Reports* (March–April 1995).

Feinberg, Sandra, Joan F. Kuchner, and Sari Feldman. *Learning Environments for Young Children: Rethinking Library Spaces and Services.* Chicago: American Library Association, 1998.

Hall, William R. *Contract Interior Finishes: A Handbook of Materials, Products, and Applications.* New York: Whitney Library of Design, 1993.

Holt, Raymond, and Anders C. Dahlgren. *Wisconsin Library Building Project Handbook.* 2nd ed. Madison: Department of Public Instruction, 1989.

Howard, Michele. "Teen Central, State-of-the-Art Planning." Presentation at the Phoenix Public Library, February 20, 2001.

Leighton, Philip D., and David C. Weber. *Planning Academic and Research Library Buildings.* 3rd ed. Chicago: American Library Association, 1999.

Lushington, Nolan, and Willis N. Mills. *Libraries Designed for Users: A Planning Handbook.* Hamden, Conn.: Library Professional Publications, 1980.

Malman, David. "Lighten Up: How to Write a Library Lighting Program." Paper presented at the annual conference of the American Library Association, 1995.

Massman, Ann. "The Wood Shelving Dilemma." *Library Resources and Technical Services* 44, no. 4 (October 2000): 209–13.

McCabe, Gerard B. *Planning for a New Generation of Public Library Buildings.* Westport, Conn.: Greenwood, 2000.

Pile, John F. *Color in Interior Design.* New York: McGraw-Hill, 1997.

———. *Interior Design.* 2nd ed. New York: Harry N. Abrams, 1995.

Reznikoff, S. C. *Specifications for Commercial Interiors: Professional Liabilities, Regulations, and Performance Criteria.* New rev. ed. New York: Whitney Library of Design, 1989.

Sannwald, William W. *Checklist of Building Design Considerations.* 4th ed. Chicago: American Library Association, 2001.

Scherer, Jeffrey, and Jack Wrightson. "Not Just Shhh Anymore: Improving Library Acoustics." Paper presented at the annual conference of the American Library Association, 1998.

INDEX

A

Academic libraries
  carrels in, 29
  computer areas in, 30
  furniture choices in, 49
  Hedberg Library, Carthage College, Kenosha, Wisconsin, 36–39
Acoustics, 122–23
Acquisition/deacquisition. *See* Weeding
ADA Accessibility Guidelines for Buildings and Facilities, 31–32, 91–93
Adjacencies
  building program and, 13
  children's area and, 2–3, 109
  circulation desk and, 14–15
  space planning process and, 2–4
Administrative work areas, 80, 86
Agnes Scott College, Atlanta/Decatur, Georgia, 73
Aisles, 42. *See also* Shelving
American Library Association
  "Not Just Shhh Anymore: Improving Library Acoustics," 122
  teen programs and, 116
American National Standards Institute (ANSI), 74–75
Americans with Disabilities Act (ADA)
  ADA Accessibility Guidelines for Buildings and Facilities, 31–32, 91–93
  book drops and, 17
  circulation desk and, 129
  furniture/shelving layout and, 28, 31–32
  lighting and, 121–22
  planning process and, 14
  signage and, 91–93
  wheelchair accessibility and, 49–50
Architects. *See* Designers; Planning process
Architectural drawings. *See* Construction-drawing phase
Archival work areas, 80
Atriums, 27

B

BCI, 57–58
Beck, Donald, 9
Beeville Public Library, Beeville, Texas, 46
Berlin Peck Memorial Library, Berlin, Connecticut, 63
Bids/bidding. *See* Construction-drawing phase
Book drops
  Americans with Disabilities Act (ADA) and, 17
  location of, 15
Book returns. *See* Book drops
Book trucks, 15, 82
Bookstacks. *See* Stack layout
Bookstores compared to libraries, 1–2
Brawner, Lee, 9
Brigham Young University, Provo, Utah, 47
Budgets
  computer furniture and, 69–70
  construction-drawing phase and, 21–23
  design development and, 20
  determination of furniture cost, 43–44
  do-it-yourself design and, 41–42
  floor coverings and, 96
  planning process and, 10–11
  shelving (end panels) and, 63
  understanding expectations in planning, 124–25
Building Blocks for Library Space: Functional Guidelines, 10
Building plaques, 93
Building program. *See also* Shelving
  furniture choices and, 48–49
  Hedberg Library, Carthage College, Kenosha, Wisconsin, 36–39
  Maribelle M. Davis Library, Plano, Texas, 32–34
  planning process and, 12–13
  River Oaks Baptist School, Houston, Texas, 39–41
  Sugar Land Branch, Fort Bend County Libraries, Sugar Land, Texas, 34–36
Business and Institutional Furniture Manufacturers Association (BIFMA), 74–75

C

Carmel Clay Public Library, Carmel, Indiana, Plates 5A–B
Carpet, 96–101, 106
Carpet Primer, The, 97–98
Carrels. *See also* Furniture
  arrangement of, 29
  planning process and, 10
Carroll High School, Southlake Independent School District, Southlake, Texas, 68
Carrollton Public Library, Carrollton, Texas, Plate 6A
Carthage College, Kenosha, Wisconsin, 36–39
Cash registers, 128
Catalyzed lacquer, 103
Ceiling heights, 25
Chairs. *See* Furniture; Seating; Tables/chairs
Chatham-Effingham-Liberty Regional Library, Savannah, Georgia, 7
Children
  adjacencies and, 3, 109
  chairs and, 76
  color selection and, 105–6
  comfortable libraries and, 7
  copyright of artwork and, 110
  furniture/seating and, 110, 112, 131
  interview questions for staff regarding, 130–31

Children (cont'd)
millwork/woodwork for, 78
planning process and, 11–12, 109–10, 112
public computer stations and, 129
scale as design principle for, 1
separate room for services for, 32–34
shelving and, 29, 59–60
sound control and, 123
staff work areas and, 79, 83–84
teen spaces, 115–17
water as aesthetic element and, 27
work areas and, 133
Circulation desks/work areas
design/function of, 45–56
do-it-yourself design and, 42
interview questions for staff regarding, 128–29, 131–32
layout for movement of people/materials and, 5
location of, 2
planning process and, 14–17
shelving and, 16
signage and, 90–91
sound control and, 123
staff work areas and, 79, 81–82
Cleveland Public Library, Plate 3A
Collection-development work areas
interview questions for staff regarding, 132
planning/furnishing of, 79
staff work areas and, 82
Color in Interior Design, 104
Color Rendering Index, 121
Color selection
children's area and, 110, 112
importance of, 104–7, 125
Comfort, 6–7
Community meeting room, 3
Computers. *See also* Power/data transmission locations; Technology
aesthetics and, 52–53
children's area and, 115
collaborative learning using, 65–66, 69
color selection and, 107
comfortable libraries and, 6
"computer-free" zones and, 123
family rooms for, 115
furniture for, 64–70
furniture/shelving layout and, 29–31
internal flexibility and, 8
interview questions for staff regarding, 129–30
laminate tabletops for, 104
lighting and, 120–21
noise control and, 3
planning process and, 10, 12
power/data transmission locations and, 25–27, 67–68
recessed monitors, 69–70
at reference desks, 129
signage and, 94–95
in technical-services departments, 18
technology work areas and, 84
training areas and, 14
use of CAD in furniture arrangement, 27
Conference rooms, 131–34
Construction-drawing phase
design development and, 20
development of drawings, 20–23
do-it-yourself design and, 41–42
service desk descriptions and, 53–56
Consultants
signage and, 87, 91
sound control and, 123
Conversion varnish, 103
Copyright in children's areas, 110
Council Bluffs Public Library, Council Bluffs, Iowa, 92
Creating Ever-Cool: A Marketer's Guide to a Kid's Heart, 109–10
Current-awareness signs, 88

D

Davis Library, Plano, Texas, Plate 2B, 26, 32–34, 48, 111
Daylight, 121
Del Vecchio, Gene, 109–10
Design
ceiling heights/window locations and, 25
color selection and, 104–7
development, 20
library shape determination, 24
use of principles in, 1
Designers
being one's own, 41–42
computer furniture and, 64–65
floor coverings and, 96
on library projects, 124
planning of signage and, 87, 93–94
planning process and, 10–11
recommendations of, 8
schematic design and, 19–20
testing chairs, 77
Desks. *See* Furniture; Tables/chairs
Determining Your Public Library's Future Size, 9
Directional signs, 88, 93
Directory of contributors, 135–36
Display space for teens, 117
Distance-education laboratories, 31
Duct systems, 26–27

E

Eckelman, Carl, 70
Education
collaborative learning, 65–66, 69
computer areas for, 30
distance-education laboratories and, 31
in interior design, 1
interview questions for staff regarding computer training, 134
Electrical outlets. *See* Power/data transmission locations
Elevators
do-it-yourself design and, 42
location of, 4
in schematic designs, 20
signage and, 93
Emergency procedures and signs, 88
Ergonomics at circulation desk, 15, 128

F

Family computer rooms, 115
Floor coverings
carpet, 96–101, 106
custom, 125
hard-surface materials, 101–2
resilient flooring, 102
sound control and, 123
for teen area, 117
wall coverings and, 102–3
Forest and Natural Resources Product Laboratory, 74
Form as design principle, 1
Fountains, 27
Friends of the Library
planning process and, 12
work areas and, 85–86
Funding. *See* Budgets
Furniture. *See also* Floor coverings; *specific item, i.e.,* Tables/chairs
administrative work areas and, 86
arrangement of, 27–31
budgeting for, 10–11
for children, 110
circulation desk, 15–16

color selection and, 105–6
computers and, 64–70
construction-drawing phase and, 21–23
custom, 125
design development budget and, 20
determination of cost, 43–44
do-it-yourself design and, 41–42
finishes for, 103–5
interview questions for staff regarding, 130–31
staff work areas and, 80–86
and workflow, 4

G

Gardens, 27
Genealogy collections
identification signs and, 88
planning process and, 10, 12
Grapevine Public Library, Grapevine, Texas, 94
Grommets, 51–52, 67–68

H

Handicapped patrons. *See also* Americans with Disabilities Act (ADA)
children's area and, 110
comfortable libraries and, 7
planning process and, 14
wheelchair accessibility and, 49–50
Hard-surface flooring materials, 101–2
Hardy Holzman Pfeiffer, 107
Harold B. Lee Library, Brigham Young University, Provo, Utah, 47
Harold Washington chair, 77
Heating, ventilation, and air-conditioning (HVAC)
atriums and, 27
lighting and, 122
sound control and, 123
Hedberg Library, Carthage College, Kenosha, Wisconsin, 36–39
Houston, Texas, 39–41

I

Identification signs, 88
Illuminating Engineering Society Handbook, 118–19
Information/reference area. *See also* Reference
location of, 2
in multilevel libraries, 4
Informational signs, 88
Instructional signs, 88, 91, 93
Interior 20 PaperFlex system, 87
Interior Design, 96
Interlibrary loan (ILL) work areas, 84–85
Internal flexibility, 7–8

K

Kenosha, Wisconsin, 36–39
Kilpatrick Stockton LLP, Atlanta, Georgia, 71

L

Laminate, 103–4. *See also* Furniture
Lancaster Veterans Memorial Library, Lancaster, Texas, Plate 6B
Layout for movement of people/materials. *See* Workflow
Leesburg, Virginia, 62
Library shape, 24
Library Technology Reports (*LTR*) chair testing, 74
"Lighten Up: How to Write a Library Lighting Program," 118
Lighting
on bookstacks, 56
color selection and, 104
design development and, 118–22
Local area networks (LANs)
public computer stations and, 129
technology work areas and, 84–85, 133
Local history collections, 10, 12
Longview, Texas, 46
Los Angeles Public Library, Plate 8
Loudoun County Public Library, Leesburg, Virginia, 62
Lounge seating, 28, 75–76. *See also* Tables/chairs
Lubbock, Texas, 6, 30, 66

M

Maintenance factors
as design issues, 7–8
lighting and, 122
staff work areas and, 80
of work areas, 131
Malman, David, 118
Maribelle M. Davis Library, Plano, Texas. *See* Davis Library, Plano, Texas
Massman, Ann, 56
Media production work areas, 80
Millwork/architectural woodwork, 77–78
Mira Mesa Branch Library, Mira Mesa, California, 61
Mission/philosophy of library
importance of, 2
interview questions for staff and, 131
Modular designs, 24–26
Multilevel libraries
adjacencies and, 4
movement of people/materials in, 5
Multimedia
interview questions for staff regarding, 128
shelving and, 59–60
staff work areas and, 80

N

Noise control, 3, 122–23
"Not Just Shhh Anymore: Improving Library Acoustics," 122
Nursing mothers, 110

O

Occupancy, 13. *See also* Seating
Orientational signs, 87
Outlets. *See* Power/data transmission locations
Outreach areas
interview questions for staff regarding, 134
planning/furnishing of, 79

P

Paint. See Color selection; Wall coverings
Parr Library, Plano, Texas, 64
Patron movement. *See* Workflow
Patrons. *See also* Children
handicapped, 7
personal space and, 28
planning process and, 11–12
teens as designers, 116–17
use of signs by, 89–91
Pella Public Library, Pella, Iowa, 114
Performance testing for chairs, 74–75
Periodicals
identification signs and, 88–89
location of, 2–3
shelving and, 59
signage and, 93
storage of back issues of, 132
Personal space, 28
Phillips Swager Associates, 97
Phoenix Public Library, 116–17
Pile, John, 96, 104–5
Pizzetta, Daria, 107

Planning process
adjacencies and, 2–4
assessments/recommendations and, 9–10
attitudes during, 124
budgeting and, 10–11, 124–25
building program for, 12–13
carpets and, 96, 99
for children's area, 109–10, 112
circulation desk and, 14–17
construction-drawing phase and, 20–23
design development and, 20
do-it-yourself design and, 41–42
furniture choices and, 44–45, 48
lighting and, 118–22
power/data transmission locations and, 51–52
schematic design and, 19–20
of sign system, 89
sound control and, 123
staff work areas and, 78–79
technical-services departments and, 17–18
for teen area, 116–17
use of CAD in furniture arrangement during, 27
wheelchair accessibility and, 49–50
Policies, 91, 93
Power/data transmission locations. *See also* Computers
circulation desk and, 129
computer furniture and, 67
planning process and, 25–27, 51–52
signage and, 95
staff work areas and, 80–81
tables/carrels and, 71–72
Preservation/archive work areas, 80
Printers, 66–67
Professional designers/consultants/architects. *See* Designers
Public information offices, 80

Q

Quiet. *See* Noise control

R

Reading tables. *See* Tables/chairs
Receiving/delivery work areas, 80, 84–86
Reference
design/function of desks for, 45–56
do-it-yourself design and, 42
interview questions for staff regarding, 129, 132
location of, 2
planning process and, 12, 14
staff work areas and, 79, 82
Regulatory signs, 88
Relationships of space. *See* Adjacencies
Resilient flooring, 102
Rest rooms
identification signs and, 88
interview questions for staff regarding, 132–33
for staff, 4
River Falls Public Library, River Falls, Wisconsin, 113
River Oaks Baptist School, Houston, Texas, 39–41

S

San Francisco Public Library, Plates 1A–B
Scale as design principle, 1
Scheduling
of carpet installation, 100
furniture delivery and, 45
Schematic design, 19–20
Scherer, Jeffrey, 122–23
Scott County Public Library, Georgetown, Kentucky, Plate 2A, Plate 3B, Plate 7, 119
Seating. *See also* Tables/chairs
children's area and, 112, 115
furniture/shelving layout and, 29
interview questions for staff regarding, 130
planning process and, 10
security and, 3
Security
adjacencies and, 3
book-theft detection systems and, 14
circulation work areas and, 81–82
emergency regulatory signs, 88
Self-check machines
interview questions for staff regarding, 129
locations for, 55–56
Service desks. *See also* Furniture
design/function of, 45–56
signage and, 93
Shelving. *See also* Stack layout
budgeting for, 10–11
canopy tops/end panels, 60–64
children's area and, 112
in circulation area, 16
circulation work areas and, 82
color selection and, 106
dimensions of, 58–60
interview questions for staff regarding, 127–28
location of windows and, 25
outreach and, 133
planning process and, 28
reference/collection-development work areas and, 82, 132
standard sizes for, 31–32
steel types of, 57–58, 60
in technical-services departments, 18
and workflow, 4
Shields Library, University of California at Davis, 72
Signage
children's area and, 112
comfortable libraries and, 6
types/considerations of, 87–95
Size as design principle, 1
Slat wall. *See* Wall coverings
Sound control, 122–23
Southlake, Texas, 68
Springhill Elementary School, Longview, Texas, 46
Stack layout
do-it-yourself design and, 42
furniture/shelving layout and, 29, 31–32
identification signs and, 88
security and, 3
sound control and, 123
Staff. *See also* Work areas
adjacencies and, 4
carpet problems and, 98
carpet selection by, 99
at circulation desk, 15–16
furniture/furnishings selection by, 43
interview questions for, 127–34
personal space/belongings and, 132
planning of signage and, 91
planning of signage by, 87
planning process and, 11–12
policies in building program regarding, 49
testing chairs, 77
Standards for lighting, 120
Stone. *See* Floor coverings
Story pits/platforms, 110
Study areas
comfortable libraries and, 6–7
planning process and, 14
Sugar Land Branch, Fort Bend County Libraries, Sugar Land, Texas, 34–36, 52

T

Tables/chairs
arrangement of, 29
children's area and, 115

as design elements, 70–77
do-it-yourself design and, 42
furniture finishes for, 103–4
interview questions for staff regarding, 130
lighting and, 121
Technical-services departments
freight elevator location and, 4
interview questions for staff regarding, 132–33
planning process and, 17–18
staff work areas and, 79, 82–83
Technology. *See also* Computers
internal flexibility and, 8
interview questions for staff regarding, 133
staff work areas and, 79, 84
Teen spaces, 115–17, 130–31
Teleconferencing, 31
Telephones. *See* Power/data transmission locations
Terrazzo. *See* Floor coverings
Terrebonne Parish, Houma, Louisiana, Plate 4, 88
Texas Tech University, Lubbock, Texas, 6, 30, 66
Theft. *See* Security
Tile. *See* Floor coverings
Training. *See* Education

U
Under-floor duct systems, 26–27

V
Varnish, 103
Vertical files' signs, 91
Vinyl. *See* Wall coverings
Volunteers' area, 41

W
Wall coverings, 102–3
Wallace–Reader's Digest Funds youth grants, 116
Water as aesthetic element, 27
Wayfinding. *See* Signage
Weeding, 9
Wheelchair accessibility. *See* Americans with Disabilities Act (ADA)
White, Howard S., 74
Wide area networks (WANs), 84
Windows
administrative work areas and, 86
location of, 25
sound control and, 123
tables/carrels and, 2–3
unusual, 125
"Wood Shelving Dilemma, The," 56
Woodwork, 77–78. *See also* Furniture; Shelving
Work areas. *See also specific area, i.e.*, Reference
interview questions for staff regarding, 131–34
planning process and, 78–79
Workflow
furniture/shelving layout and, 4–5
planning process and, 12
technical-services departments and, 18
Workstations. *See also* Computers
computer furniture and, 64–70
interview questions for staff regarding, 129–31
power/data transmission locations and, 25–27
Wrightson, Denelle, 97
Wrightson, Jack, 122

Y
Young adult area
location of, 36
teen spaces, 115–17

Carol R. Brown is currently assistant director of the Fort Bend County Libraries in Richmond, Texas. She holds a B.A. in fine arts and English from Cornell College in Iowa and an M.A. in library science from Indiana University. She previously held library positions at Indiana University and the Houston Public Library. For 10 years she worked as a library planning consultant with her own firm, Carol Brown Associates. Brown is the author of two other books on library interior design and furnishings.

Appendix
GMW144001

```
leader  00791nam a22002297a 4500
001     991017600489708514
005     20250717050205.0
008     981203s1998    xxu           f000 0 eng d
035     ##$a(ol-ua)b22448196
035     ##$atmp97136841
040     ##$aMvI $cMvI
049     ##$aAKRO
074     ##$a0314-A-09
086     0#$aD 7.15/2:98/4
086     0#$aD 7.15/2:98/4
245     00$aHOW TO GET IT:  A GUIDE TO DEFENSE-RELATED INFORMATION RESOURCES...  LIBRARIANS' EDITION JULY 1998.. DTIC/TR-98/4.. U.S. DEPARTMENT OF DEFE
260     ##$a[S.l. : $bs.n., $c1998?]
500     ##$aShipping List #: 99-0079-M
500     ##$aShipping List Date: 12/01/98
710     1#$aUnited States. $bDefense Logistics Agency
907     ##$a.b22448196 $b06-20-19 $c12-07-98 $9LOCAL
998     ##$abierc $b12-07-98 $cm $da   $ez $feng $gxxu $h0 $9LOCAL
```

BOOK

HOW TO GET IT: A GUIDE TO DEFENSE-RELATED INFORMATION RESOURCES... LIBRARIANS' EDITION JULY 1998... DTIC/TR-98/4... U.S. DEPARTMENT OF DEFE

United States. Defense Logistics Agency

1998?

Available at Bierce Library, Microfilm Government Document Collection (D 7.15/2:98/4) — Locate

TOP
SEND TO
GET IT FROM OH...
GET IT FROM ON...
DETAILS

Send to

SHARE | QR | EXPORT TO EXCEL | MENDELEY | EXPORT RISTEX | EXPORT RIS | EASYBIB | ENDNOTE | PRINT | CITATION | PERMALINK | EMAIL

Get it from OhioLINK or other libraries

For more accurate results please sign in — Sign in

Resource sharing is only allowed under specific terms and conditions

Get it from University of Akron Libraries

Please sign in to check if there are any request options. — Sign in

BACK TO LOCATIONS

LOCATION ITEMS

Bierce Library

Available , Microfilm Government Document Collection ; D 7.15/2:98/4 — Locate

(1 copy, 1 available, 0 requests)

Item in place

Loanable

Details

Title	HOW TO GET IT: A GUIDE TO DEFENSE-RELATED INFORMATION RESOURCES... LIBRARIANS' EDITION JULY 1998... DTIC/TR-98/4... U.S. DEPARTMENT OF DEFE
Creator	United States. Defense Logistics Agency
Identifier	GOVDOC : D 7.15/2:98/4
Publisher	S.l. : s.n.
Creation Date	1998?
Source	Library Catalog
Local Notes	Shipping List #: 99-0079-M Shipping List Date: 12/01/98

Virtual Browse



Handbook for Users, Defense Technical Information Center, ...



Defense Tenchnical Information Center, Handbook For ...



HOW TO GET IT: A GUIDE TO DEFENSE-RELATED INFORMATION ...

1998?



DoD hazardous materials information system ...

19??



Environmental Impact Statement for the Defense Logistics

2022

Links

Display Source Record

Appendix
GMW144002

D 7.15/2:98/4

HOW TO GET IT: A GUIDE TO DEFENSE-RELATED INFORMATION RESOURCES... LIBRARIANS' EDITION ... DTIC/TR-98/4... UNITED STATES DEPARTMENT OF DEFENSE... JULY 1998

1 OF 6
24X
SUPTDOCS/GPO
P. 0001-0088

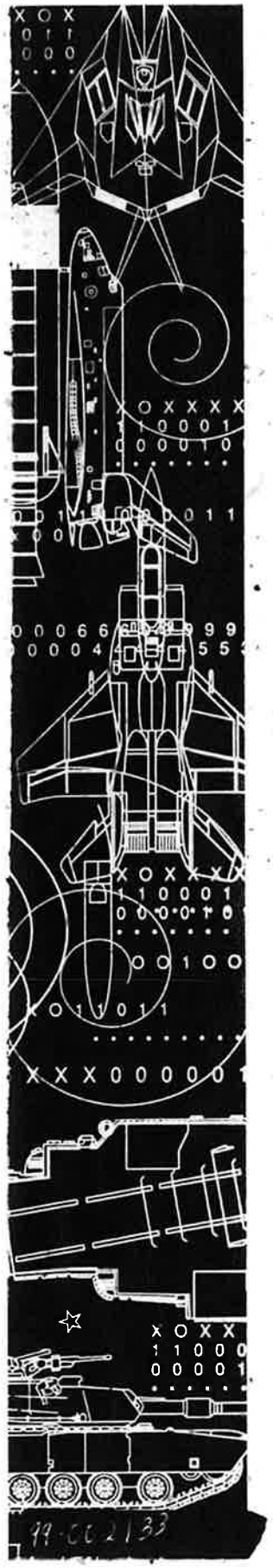
UNIV. OF AKRON
HOW TO GET IT: A GUIDE TO DEFENSE-RELAT
D 7.15/2:98/4

3 1002 90240862 2

UNIVERSITY OF AKRON/477-C
BIERCE LIBRARY

DEC 10 1998

RECEIVED DEPOSITORY



C314-A-07

DTIC/TR-98/4

D 7.15/2:98/4

AD-A346513

HOW TO GET IT:

A Guide to Defense - Related Information Resources

Librarians' Edition
July 1998

99-00133

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	July 1998	Final

4. TITLE AND SUBTITLE

HOW TO GET IT: A GUIDE TO DEFENSE-RELATED INFORMATION RESOURCES

5. FUNDING NUMBERS

6. AUTHOR(S)

June C. Doezema, Compiler
Barbara J. Fox, Compiler

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Defense Technical Information Center (DTIC)
STINET Management Division
8725 John J. Kingman Road, Suite 0944
Ft Belvoir, VA 22060-6218

8. PERFORMING ORGANIZATION REPORT NUMBER

DTIC/TR/98-4

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

LIBRARIANS' EDITION; Supersedes ADA298436, 1995 edition which it revises and updates

12a. DISTRIBUTION AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

How To Get It: A Guide to Defense-Related Information Resources is a reference tool to identify and/or obtain government published or sponsored publications, documents, maps, patents, specifications, standards, regulations, and other information resources of interest to the defense community. Entries are arranged alphabetically in a single directionary listing, by document type, source, acronym, series description, or short title.

Each entry consists of an identification of the item and detailed acquisition information including: originator, order source, forms necessary, cost information, telephone and fax numbers, e-mail addresses, and the Internet URL when known. There are four appendices: Appendix A: Ordering Information; Appendix B: Forms for Ordering; Appendix C: Foreign Sources for Scientific and Technical Information; Appendix D: Topic Links for Subject Access to Information Sources Categories.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Directories, Information Exchange, Information Retrieval, Catalogs, Information Systems	564
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

Standard Form 298 (Rev. 2-89) (EG)
Prescribed by ANSI Std. 239.18

I

DTIC/TR-98/4

AD-A346 513

HOW TO GET IT:

A guide to Defense-Related Information Resources

Librarians' Edition

July 1998

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

Compiled by
June C. Doezema
Barbara J. Fox

Prepared by
Defense Technical Information Center
STINET Management Division
8725 John J. Kingman Rd.
Suite 0944
Ft. Belvoir, VA 22060-6218

HOW TO GET IT

CONTENTS

Acknowledgments iv

Introduction ..... v-vi-vii

Numerical Entries ..... Numerical 1

Alphabetical Listing of Entries ..... A-1 – X-1

Ordering Information ..... Appendix A

Forms ..... Appendix B

Foreign Sources for Scientific and Technical Information ..... Appendix C

Topic Links ..... Appendix D

Acknowledgments

We are indebted to the many librarians who contributed their time and energy to this major project. The HOW TO GET IT Advisory Group consisted of librarians Patricia A. Ames, Lawrence E. Clemens, Lorna A. Dodt, Harriet H. Foster, Dolores M. Knight, Catheryn Lee, Susan K. Lundgren, Lily A. Waters, and Information Specialist Larry Goldberg.

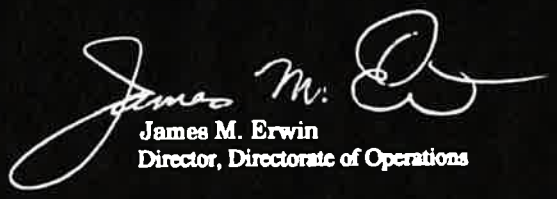
We appreciate the efforts of originating offices and agencies which cooperated by updating data about their documents and services.

Special thanks are extended to the librarians who assisted significantly with the editing and cross referencing of this edition. They are Patricia Alderman, Ellen Barber, Julie A. Gibson, Rebecca A. Hamil, Wendy S. Hill, Marie T. O'Mara, Candy S. Parker, and Sharon L. Serzan.

Special recognition must be given to Phyllis Levine and Mary Jane Brewster. Phyllis created and graciously allowed us to use the Webpages of Topic Links in which she used DTIC's Subject Categories to link to pertinent Websites. This became Appendix D. Mary Jane compiled the Foreign Scientific and Technical Information Sources which became Appendix C.

Our deep appreciation is extended to Gwen P. Marshall, whose data entry and composition skills created the uniformity and style of the document.

The work reported in this document was compiled and updated by the Defense Technical Information Center. The publication of this guide does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of this agency.



James M. Erwin
Director, Directorate of Operations

HOW TO GET IT

INTRODUCTION

Background

A Directory that would identify sources and channels for the acquisition of types of government-published or government-sponsored documents of interest to the Defense community was conceptualized in the early 1970's by the Committee on Information Hang-ups' Subcommittee on Document Procurement. It was based on the recurring problem that documents which were not indexed, announced or distributed by the major government information services were difficult to locate, and searches by letter and telephone were time consuming and not always successful. No directory existed, except in the minds of experienced librarians and information specialists and in their working notes accumulated during years of experience.

The guide, first published in 1973, was well received by the Defense information services community. This Librarians' Edition is the sixth revision.

Purpose

The guide is intended to assist librarians and information specialists as well as other individuals who need to identify or acquire Government-published, Government-sponsored, or Defense-related information resources.

Scope

The contents are limited to technical documents and information resources prepared for or of particular interest to the Department of Defense and its contractors (or potential contractors).

Information was gathered from written and Internet sources, such as the official regulations, directives and instructions which establish the formal, preferred channels for acquiring these documents, and from telephone calls, fax, e-mail and traditional correspondence. Information on maps, patents, translations and databases is included. New to the publication is the inclusion of URL's for Internet locations of sources whenever they are known.

Arrangement

Individual entries are arranged alphabetically in a dictionary type list. Each entry consists of an identification of the items and the following information whenever available:

Originator: The agency that produces or sponsors that type of information resource.

Order from: Sources from which the item may be ordered, with notations indicating who may order from those sources.

Forms: Forms that should be used to order from each source cited.

HOW TO GET IT

Cost: Where there is a charge, the word "yes" is entered ; where there is no known charge the word "no" is entered.

Telephone: Telephone numbers, fax numbers, and e-mail addresses of offices from which the item may be ordered, or from which additional information can be obtained.

Restrictions: Any restrictions on the distribution or use of the item, including who may order it.

Indexed in: Publications in which that type of information resource is indexed.

Notes: Comments on the history, status, or content of the information resource.

URL: Uniform Resource Locator: a protocol for specifying addresses on the Internet.

Contractor Reports

With some exceptions, contractor-generated reports are not included. The procedure for the acquisition of these reports is fairly standard. Most contractor reports are indexed and distributed by the Defense Technical Information Center (DTIC) and National Technical Information Service (NTIS). Reports not in DTIC or NTIS usually are controlled by the specific agency for which the contract work was performed. These reports must be requested from (or through) the controlling agency. That is, the request for the document, with need-to-know certified by the requester's contract monitor, must be sent to the office which controls distribution of the report. That office may transmit the report directly to the requester, or may direct the contractor to transmit the report. For additional information see the entries under Defense Technical Information Center (DTIC) and National Technical Information Service (NTIS).

Forms

In general, the forms used for ordering a specific type of document from DTIC, NTIS, or the Government Printing Office (GPO), are included in Appendix B. Appendix B also includes a form to send in updated or corrected information for the entries in this publication. There is an electronic form for updates on DTIC's STINET Website under "Librarians' Edition Entry Form" at: http://www.dtic.mil/stinet/htgi/

Agencies often will honor a document request submitted on other than the prescribed form.

Publications Centers

The Air Force, Army and Navy each maintain Publication Centers which are responsible for stocking and distributing publications produced by and of interest to the community they serve. For information on these centers see Appendix A.

The Defense Technical Information Center is the central repository, disseminator, and referral center for the information needs of the Department of Defense (DoD) and its

contractors. For more information see the entry under the Defense Technical Information Center and Appendix A.

The National Technical Information Service (NTIS) handles the announcement and sale of unclassified, unlimited documents available for general public distribution. For more information see the entry under the National Technical Information Service.

Other Government publications centers announce and distribute documents, many of which are of interest to the Defense community. For examples, see Appendix A.

Corrections and Updates

The Department of Defense has undergone numerous reorganizations and consolidations. These changes have had a major impact on the revision and updating of the HOW TO GET IT. Inevitably the organizations are experiencing a loss of institutional memory. Often knowledge of what happened to the publications of a former organization or where to go for information on the newly formed organization is very difficult to obtain.

Consequently, the editing of the HOW TO GET IT is a work in progress. We are depending on the users of this document to help us correct and update information. There are some gaps and inaccuracies in the data. We have included incomplete entries in the belief that some information is better than none. DTIC would appreciate receiving corrections and new information to be included in the next revision.

Please either fill out the form in Appendix B and fax it to Barbara J. Fox at (703) 767-8032; or send E-mail to Barbara J. Fox at: bjfox@dtic.mil; or call (703) 767-8041; DSN 427-8041. If you have access to the Internet, there is an electronic form on DTIC's STINET Website under "Librarians' Edition Entry Form" at: http://www.dtic.mil/stinet/htgi/

Your input, comments, and criticisms are welcome. We will investigate errors and will post the new information on the DTIC Users Listserv (User-L) and the Federal Reference Librarians Listserv (FedRef-L) sponsored by the Library of Congress.

A Web version of the HOW TO GET IT is our next project.

Barbara J. Fox
Project Manager
July 1998

Numerical Entries

61A1-Series Air to Surface Series

See: Joint Munitions Effectiveness Manuals (JMEM)

61B1-Series - Anti-Air Series

See: Joint Munitions Effectiveness Manuals (JMEM)

61S1 Series: Surface to Surface Series

See: Joint Munitions Effectiveness Manuals (JMEM).

61JTCG/ME-1-2 - Joint Service Index to Specialized Technical Handbooks

See: Joint Service Index to Specialized Technical Handbooks (61JTCG/ME-1-2)

61JTCG/ME-xx-x Special Reports

See: Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) Publications

7N series

See: NASA Accession Numbers for unclassified reports N(YR)-xxxx

7X series

See: X(YR)-xxxx

HOW TO GET IT

AN Air Force-Navy Aeronautical Standard

See: Specifications and Standards, Military

AN, AND and MS Index (Air Force-Navy Aeronautical Standards)

Originator: National Standards Association, Inc. (NSA)

Order from: Information Handling Services
P.O. Box 6800
Englewood, CO 80155-6800

Forms: Letter

Cost: Yes

Telephone: 1-800 525-7052; (301) 548-4880

Notes: This product is available on CD-ROM. It is a catalog of services and price listings for standards and specifications.

URL: http://www.ihs.com

AN Naval Air Systems Command Manual

See: Naval Air Systems Command (NAVAIRSYSCOM) Publications

ANA

See: Air Force-Navy Aeronautical Bulletins (ANA)

ANC Bulletin Air Force-Navy Civil Committee on Aircraft Design Criteria Bulletin and Air Force-Navy Aeronautical Design Standard

See: Specifications and Standards, Military

ANL-7411 - The National Energy Software Center: Compilation of Program Abstracts

Originator: Department of Energy
Energy Science & Energy Software Center
PO Box 1020
Oak Ridge, TN 37831-1020
Email: estec@adonis.osti.gov

Restrictions: Available to DOE and Nuclear Regulatory Commission offices and contractors.

Catalog of EIA and JEDEC Standards and Engineering.....Continued

Joint Electron Device Engineering Council (JEDEC) of EIA. Beginning in 1979, the abbreviation TEPAC (Tube Engineering Advisory Council) is used to identify EIA documents dealing with electron tubes. Documents adopted by the DoD community are stocked at Defense Automated Printing Services in Philadelphia. (See Appendix A)

URL: http://www.eia.org/eng/default.htm
http://global.ihs.com

Catalog of Nautical Charts

See: National Imagery and Mapping Agency (NIMA)
National Ocean Service
Naval Oceanographic Office (NAVOCEANO) Publications

Catalog of Naval Oceanographic Office Publications

See: Naval Oceanographic Office (NAVOCEANO) Publications

Cataloging Handbook on CD-ROM

See also: Federal Supply Classification Handbook
Federal Supply Codes and Handbooks (H1, H2, H4/H8)

Originator: Defense Logistics Information Service
ATTN: DLIS-VPC
74 Washington Avenue N Ste7
Federal Center
Battle Creek, MI 49017-3084

Order from: Defense Logistics Information Service (DLIS) (See Appendix A)

Telephone: DTIC 1-800-225-3842
NTIS 1-800-553-6847
DLIS 616-961-4725; Fax: 616-961-5305
E-mail: dlsc-cso@dlsc.dla.mil

URL: http://www.dlsc.dla.mil/cage_welcome.htm

Cataloging Tools

See: Defense Logistics Information Service (DLIS) Procedures Manual (DoD 4100.39M)

GIDEP

See: Government-Industry Data Exchange Program (GIDEP)

GILS

See: Defense LINK Locator

GIRDER

See: Government Industry Reference Data Edit and Review (GIRDER)

GLC - Global Loran Navigation Chart

See: National Imagery and Mapping Agency (NIMA)
National Ocean Service Aeronautical Charts and Related Products

Global Change Master Directory

See: NASA Master Directory/ Global Change Master Directory

Global Command and Control System (GCCS)

Originator: Center for Integration (CFI)
Sterling, VA

Telephone: (703) 695-0671; DSN 225-0671

Notes: The Global Command and Control System (GCCS) is an automated information system designed to support deliberate and crisis planning with the use of an integrated set of analytic tools and the flexible data transfer capabilities. GCCS will become the single C4I system to support the warfighter from foxhole to command post. For additional information on the GCCS, refer to the C4I for the Warrior Brochure.

URL: http://spider.osfl.disa.mil

Global Engineering Documents

Originator: Various government sources

Order from: IHS Group
Global Engineering
Mail Stop C303B
15 Inverness Way E
Englewood, CO 80112

Forms: Call or write

Global Engineering Documents.....Continued

Cost: Yes

Telephone: 1-800-854-7179; Fax (303) 397-2740;
E-mail: global@ihs.com

Notes: Deposit accounts are available as well as using major credit cards. Global has exclusive distribution contracts with: American Petroleum Institute, Aerospace Industries Association of America, Electronic Industries Association, Delphi Automotive Systems, GM, John Deere, National Committee for Information Technology Standards, National Electrical Manufacturers Association, Navistar International, New Holland, Telecommunications Industry Association, and Underwriters Laboratories. Global maintains ASTM, ANSI, ISO and other standards in addition to U. S. military and other Government standards and documents.

URL: http://global.ihs.com

Global Loran Navigation Chart (GLC)

See: National Imagery and Mapping Agency (NIMA)
National Ocean Service Aeronautical Charts and Related Products

Global Mobility Database

See: SAE WebDEX

Global Navigation Chart (GNC)
Global Plotting Chart (GPC)
GNC Global Navigation Chart
Gnomonic Tracking Chart (GT)

See: National Ocean Service Aeronautical Charts and Related Products

GO General Order

See: Army Administrative Publications

GOR General Operational Requirement, Navy (Superseded by Science and Technology Objectives (STO) which are No Longer Published)

Government Information Locator Service (GILS)

See also: DefenseLINK Locator

Telephone: POC at the Defense Technical Information Center is Ms. Virginia Becks: (703) 767-8046; DSN 427-8046

237

National Research Council (NRC)

See: National Academy of Sciences (NAS) Publications

National Security Affairs Conference Proceedings

See: National Defense University Press Books

National Security Affairs Monograph Series (No Longer Published)

National Standards Association (NSA) Index

See also: Specifications and Standards

Originator: National Standards Association, Inc. (NSA)
Information Handling Service
P.O. Box 6800
Englewood, CO 80155-6800
1-800-525-7052

Order from: Originator
Government Printing Office (GPO) (See Appendix A)

Forms: Letter

Cost: Yes

Telephone: (301) 548-4880 Outside of Maryland 1-800-525-7052
GPO (202) 512-1800

Indexed in: Catalog of Services and Price Listings for Standards and Specifications.
Not available to the general public in CD-ROM.

URL: http://www.ihs.com

National Stock Number (NSN)

See: Federal Logistics Data on CD-ROM (FED LOG)

National Technical Information Service (NTIS)

See also: NTIS Bibliographic Database

Originator: National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Order from: National Technical Information Service (NTIS) (See Appendix A)

Appendix
GMW144003



DECLARATION OF MINA CHING

1. I am a Records Request Processor at the Internet Archive. I make this declaration of my own personal knowledge.

2. The Internet Archive is a website that provides access to a digital library of Internet sites and other cultural artifacts in digital form. Like a paper library, we provide free access to researchers, historians, scholars, and the general public. The Internet Archive has partnered with and receives support from various institutions, including the Library of Congress.

3. The Internet Archive has created a service known as the Wayback Machine. The Wayback Machine makes it possible to browse more than 450 billion pages stored in the Internet Archive's web archive. Visitors to the Wayback Machine can search archives by URL (i.e., a website address). If archived records for a URL are available, the visitor will be presented with a display of available dates. The visitor may select one of those dates, and begin browsing an archived version of the Web. Links on archived files in the Wayback Machine point to other archived files (whether HTML pages or other file types), if any are found for the URL indicated by a given link. For instance, the Wayback Machine is designed such that when a visitor clicks on a hyperlink on an archived page that points to another URL, the visitor will be served the archived file found for the hyperlink's URL with the closest available date to the initial file containing the hyperlink.

4. The archived data made viewable and browseable by the Wayback Machine is obtained by use of web archiving software that automatically stores copies of files available via the Internet, each file preserved as it existed at a particular point in time.

5. The Internet Archive assigns a URL on its site to the archived files in the format http://web.archive.org/web/[Year in yyyy][Month in mm][Day in dd][Time code in hh:mm:ss]/[Archived URL] aka an "extended URL". Thus, the extended URL http://web.archive.org/web/19970126045828/http://www.archive.org/ would be the URL for the record of the Internet Archive home page HTML file (http://www.archive.org/) archived on January 26, 1997 at 4:58 a.m. and 28 seconds (1997/01/26 at 04:58:28). The date indicated by an extended URL applies to a preserved instance of a file for a given URL, but not necessarily to any other files linked therein. Thus, in the case of a page constituted by a primary HTML file and other separate files (e.g., files with images, audio, multimedia, design elements, or other embedded content) linked within that primary HTML file, the primary HTML file and the other files will each have their own respective extended URLs and may not have been archived on the same dates.



6. Attached hereto as Exhibit A are true and accurate copies of browser screenshots of the Internet Archive's records of the archived files for the URLs and the dates specified in the attached coversheet of each screenshot.

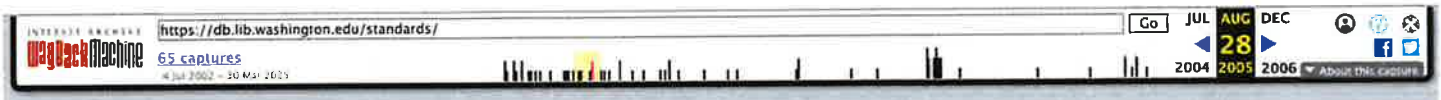
7. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

DATE: August 30, 2025

Mina Ching

EXHIBIT A

https://web.archive.org/web/20050828045404/https://db.lib.washington.edu/standards/



Engineering Standards Database Search

The standards held in the Engineering Library collection are primarily engineering related. For standards related to other subjects, check with other libraries. For example, the Health Sciences, Forest Resources, and Architecture Libraries all have standards in their collections.

The edition held by the Engineering Library, may ***not*** be the most current edition. To check for other editions of a standard, search ILI Standards Infobase [UW Restricted] or Global Engineering Documents.

Several series of standards that are held at the Engineering Library are ***not*** entered into this database. These series include: AASHTO, ASTM, Mil-Specs, Mil-Stds, NAS, SAE J-series, and UBC standards. Check in the UW Libraries Catalog or ask at the Reference Desk for help finding these standards.

IEEE standards are ***only available*** via IEEE Xplore from 1988 to the present, in full-text. We no longer have any print IEEE standards.[UW restricted]

Questions about the content of this database or our collection can be directed to englib@u.washington.edu.

Standard database search tips
More information about standards

If you experience problems, please call the Engineering Library Reference Desk at (206)543-0741.

	Acronym (Choose an acronym from the list or leave blank)
Additional Acronym	
Letter	
Number	
Keyword	

Submit Query | Reset

Retrieval software: DB/Text *WebPublisher*, provided by INMAGIC

Appendix
IHS01

https://web.archive.org/web/20030901000000*/http://www.global.ihs.com/ August 14, 2024

INTERNET ARCHIVE | WEB | BOOKS | VIDEO | AUDIO | SOFTWARE | IMAGES | SIGN UP | LOG IN | UPLOAD | Search

ABOUT | BLOG | PROJECTS | HELP | DONATE | CONTACT | JOBS | VOLUNTEER | PEOPLE

DONATE

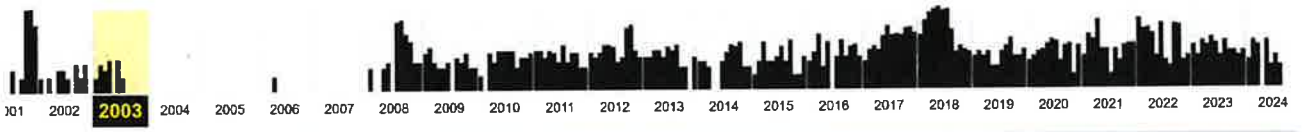
INTERNET ARCHIVE Wayback Machine

Explore more than 866 billion web pages saved over time

http://www.global.ihs.com/

Calendar · Collections · Changes · Summary · Site Map · URLs

Saved **1,777 times** between December 21, 1996 and August 10, 2024.



Sat, 19 Jul 2003 19:24:02 GMT (why: alexa_ds, alexacrawls)

JAN

		1	2	3	4	
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	**22**	23	24	25
26	27	28	29	30	31	

FEB

						1
2	3	4	5	6	**7**	8
9	**10**	11	12	**13**	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

MAR

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	**24**	25	26	27	28	29
30	31					

APR

		1	2	3	4	**5**
6	7	8	**9**	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	**25**	26
27	28	29	30			

MAY

			1	2	3	
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

JUN

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	**20**	**21**
22	23	24	25	26	27	28
29	30					

JUL

		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	**19**
20	21	22	23	24	25	26
27	28	29	30	31		

AUG

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

SEP

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

OCT

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

NOV

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

DEC

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

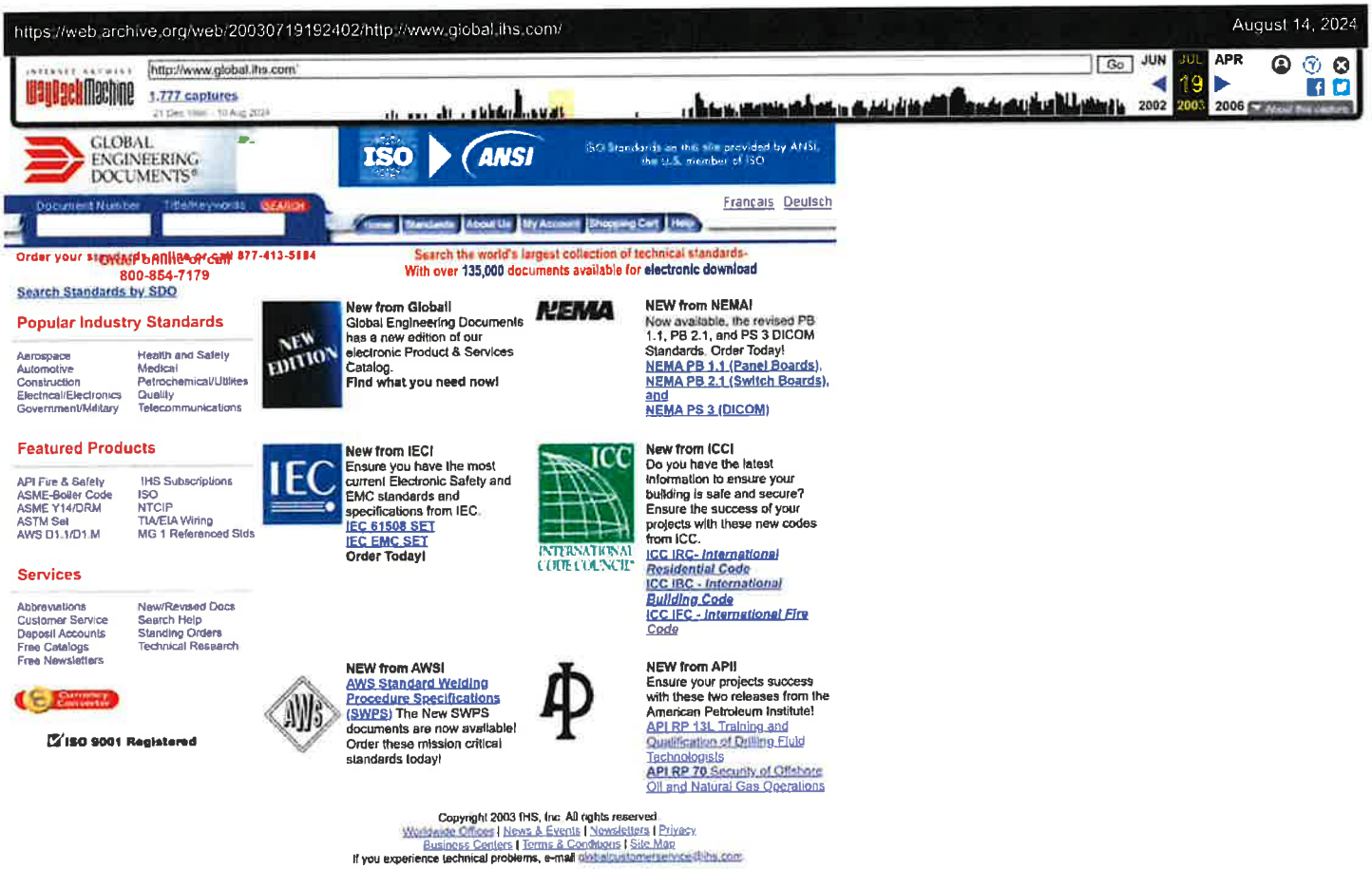
Note

This calendar view maps the number of times **http://www.global.ihs.com/** was crawled by the Wayback Machine, *not* how many times the site was actually updated. More info in the FAQ.

FAQ | Contact Us | Terms of Service (Dec 31, 2014)

The Wayback Machine is an initiative of the Internet Archive, a 501(c)(3) non-profit, building a digital library of Internet sites and other cultural artifacts in digital form. Other projects include Open Library & archive-it.org

Your use of the Wayback Machine is subject to the Internet Archive's Terms of Use


https://web.archive.org/web/20030719192402/http://www.global.ihs.com/
August 14, 2024
http://www.global.ihs.com
1,777 captures
JUN JUL APR
19
2002 2003 2006
GLOBAL ENGINEERING DOCUMENTS
ISO ANSI
ISO Standards on this site provided by ANSI, the U.S. member of ISO
Français Deutsch
Document Number Title/Keywords SEARCH
Home Standards About Us My Account Shopping Cart Help
Order your standards online or call 877-413-5184
800-854-7179
Search the world's largest collection of technical standards-
With over 135,000 documents available for electronic download
Search Standards by SDO
Popular Industry Standards
Aerospace
Automotive
Construction
Electrical/Electronics
Government/Military
Health and Safety
Medical
Petrochemical/Utilities
Quality
Telecommunications
Featured Products
API Fire & Safety
ASME-Boiler Code
ASME Y14/DRM
ASTM Set
AWS D1.1/D1.M
IHS Subscriptions
ISO
NTCIP
TIA/EIA Wiring
MG 1 Referenced Stds
Services
Abbreviations
Customer Service
Deposit Accounts
Free Catalogs
Free Newsletters
New/Revised Docs
Search Help
Standing Orders
Technical Research
ISO 9001 Registered
NEW EDITION
New from Global!
Global Engineering Documents has a new edition of our electronic Product & Services Catalog.
Find what you need now!
NEMA
NEW from NEMA!
Now available, the revised PB 1.1, PB 2.1, and PS 3 DICOM Standards. Order Today!
NEMA PB 1.1 (Panel Boards),
NEMA PB 2.1 (Switch Boards), and
NEMA PS 3 (DICOM)
IEC
New from IEC!
Ensure you have the most current Electronic Safety and EMC standards and specifications from IEC.
IEC 61508 SET
IEC EMC SET
Order Today!
ICC
INTERNATIONAL CODE COUNCIL
New from ICC!
Do you have the latest information to ensure your building is safe and secure? Ensure the success of your projects with these new codes from ICC.
ICC IRC- International Residential Code
ICC IBC - International Building Code
ICC IFC - International Fire Code
AWS
NEW from AWS!
AWS Standard Welding Procedure Specifications (SWPS) The New SWPS documents are now available! Order these mission critical standards today!
NEW from API!
Ensure your projects success with these two releases from the American Petroleum Institute!
API RP 13I Training and Qualification of Drilling Fluid Technologists
API RP 70 Security of Offshore Oil and Natural Gas Operations
Copyright 2003 IHS, Inc. All rights reserved.
Worldwide Offices | News & Events | Newsletters | Privacy
Business Centers | Terms & Conditions | Site Map
If you experience technical problems, e-mail globalcustomerservice@ihs.com

Appendix
SCHUSTER01

DECLARATION OF ACCURIS (IHS)

I, Shannon Schuster, declare as follows:

1. Accuris is an engineering data analysis and distribution firm that, among other missions, works with more than 400 Standards Development Organizations (SDOs) to provide access to over two million engineering standards.

2. Accuris is a successor company of Information Handling Services (IHS), founded in 1959 to provide information for aerospace engineers through microfilm databases. IHS began moving its standards online in 1995 and, in 2000, launched its online "Standards Store" through which technical standards were available for purchase.

3. IHS and its successors have served as third-party distributors for General Motors' engineering standards, licensing the standards from General Motors and distributing them through various channels, including the online Standards Store.

4. I have reviewed the attached document "GMW14400" ("Low Carbon, Heat-Treatable Boron Steel – Uncoated or Aluminized Pre-Coated"), which lists a publication date of November 2005. I have also consulted our internal database, which includes standards listings stretching back to the Standards Store launched by IHS.

5. Based on my review, I can confirm that the "GMW14400" document has been listed in our database and available to the public for purchase online since December 1, 2005. The "GMW14400" document is a true, complete, and accurate copy of the document that would have been available for purchase as of December 1, 2005.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true.

Date: 7/12/2024

Signature: DocuSigned by: Shannon Schuster FB6B1FC5510E453...

Shannon Schuster
Sr. Lead - Partnerships
Accuris

Appendix
SUEHIRO01

Certification of Accuracy

I, Frank McGee, a translator fluent in the English and Japanese languages, on behalf of Source IP, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the documents listed below in a form that best reflects the intention and meaning of the original text.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

The document are designated as:

#107636_JP-1
#107636_JP-2
#107636_JP-3



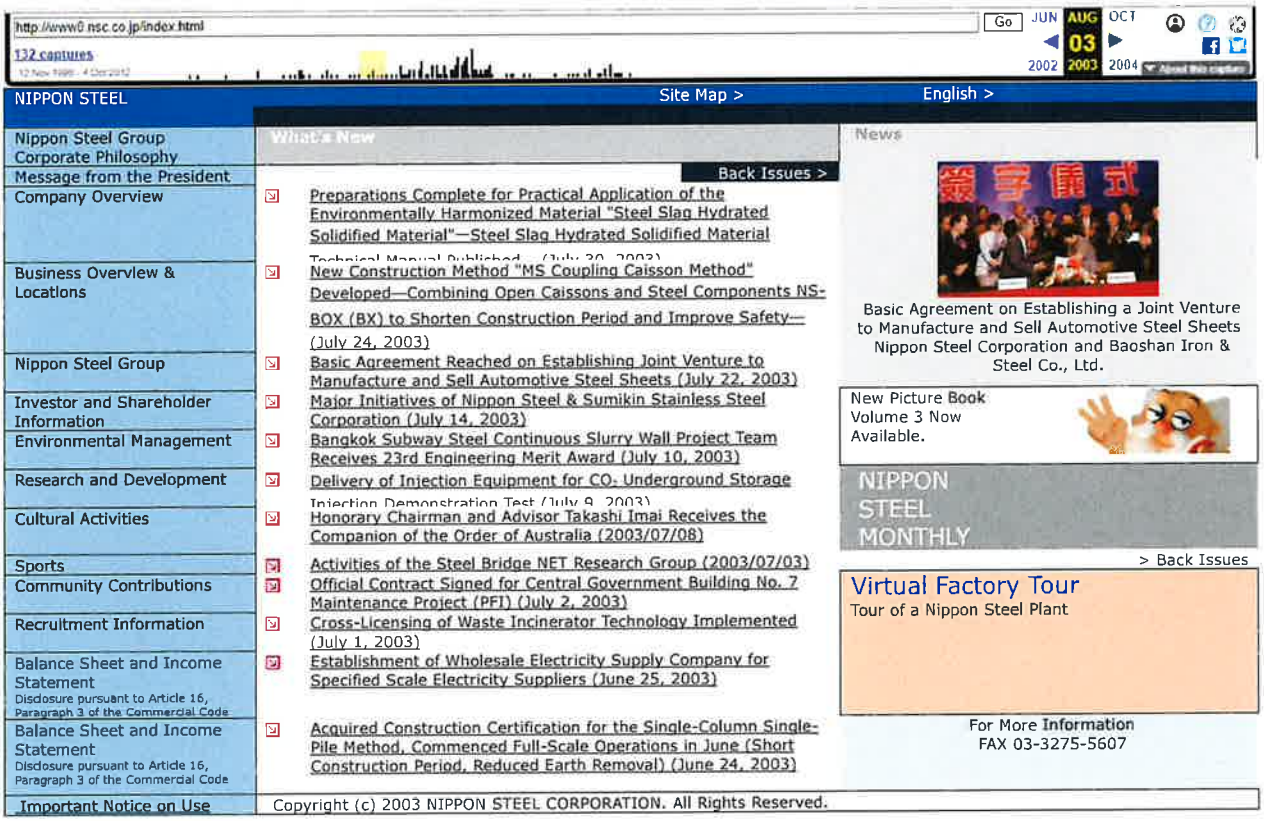
Frank McGee

February 2, 2026

Appendix
SUEHIRO02


http://www0.nsc.co.jp/index.html
Go
JUN
AUG
03
OCT
132 captures
2002
2003
2004
About this capture
新日本製鐵
NIPPON STEEL
Site Map
English
新日鉄グループ企業理念
ごあいさつ
会社概要
事業概要・事業所
新日鉄グループ
投資家・株主情報
環境経営
研究開発
文化活動
スポーツ
地域貢献活動
採用情報
貸借対照表・損益計算書
ご利用にあたっての注意
What's New
バックナンバー
環境調和型素材「鉄鋼スラグ水和固化体」の実用化推進
誓う―鉄鋼スラグ水和固化体技術マニュアルを発刊―
(2003.07.30)
新工法「MSカップリングケーソン工法」を開発～ケーソンケーソン掘削部材NS - BOX(BX)を組み合わせて
工期短縮・安全性を向上～ (2003.07.24)
自動車用鋼板を製造・販売する合弁会社設立に関する基本合意 (2003.07.22)
新日鐵住金ステンレス株式会社の主要施策について
(2003.07.14)
バンコク地下鉄掘削地中連続壁プロジェクトチーム 第23回エンジニアリング功労者賞受賞 (2003.07.10)
二酸化炭素（CO2）地中貯留圧入実証試験における圧入設備の納入について (2003.07.09)
相談役名誉会長 今井敬 オテラリー・コンパニオン勲章（オーストラリア）受章について (2003.07.08)
鋼橋NET研究会の活動状況について (2003.07.03)
中央合同庁舎第7号館整備等事業（PFI）正式契約締結
(2003.07.02)
ごみ焼却炉技術のクロスライセンス実施 (2003.07.01)
特定規模電気事業者向け電力卸供給事業会社を設立
(2003.06.25)
1柱1杭工法(サットインパイル)の建築評定を取得、6月から本格営業開始（掘工期・排土低減） (2003.06.24)
News
<自動車用鋼板を製造・販売する合弁会社設立に関する基本合意>
新日本製鐵株式会社 宝山鋼鉄株式
新・モノ語りの絵本第3巻できました。
NIPPON STEEL MONTHLY
バックナンバー
バーチャル工場見学
新日鉄の工場をご案内します
内容に関するお問い合わせ
FAX 03-3275-5607
Copyright(c)2003 NIPPON STEEL CORPORATION. All Rights Reserved.

Appendix
SUEHIRO03


http://www0.nsc.co.jp/index.html
Go
JUN
AUG
03
OCT
2002
2003
2004
132 captures
NIPPON STEEL
Site Map >
English >
Nippon Steel Group Corporate Philosophy
Message from the President
Company Overview
Business Overview & Locations
Nippon Steel Group
Investor and Shareholder Information
Environmental Management
Research and Development
Cultural Activities
Sports
Community Contributions
Recruitment Information
Balance Sheet and Income Statement
Disclosure pursuant to Article 16, Paragraph 3 of the Commercial Code
Balance Sheet and Income Statement
Disclosure pursuant to Article 16, Paragraph 3 of the Commercial Code
Important Notice on Use
What's New
Back Issues >
Preparations Complete for Practical Application of the Environmentally Harmonized Material "Steel Slag Hydrated Solidified Material"—Steel Slag Hydrated Solidified Material
New Construction Method "MS Coupling Caisson Method" Developed—Combining Open Caissons and Steel Components NS-BOX (BX) to Shorten Construction Period and Improve Safety— (July 24, 2003)
Basic Agreement Reached on Establishing Joint Venture to Manufacture and Sell Automotive Steel Sheets (July 22, 2003)
Major Initiatives of Nippon Steel & Sumikin Stainless Steel Corporation (July 14, 2003)
Bangkok Subway Steel Continuous Slurry Wall Project Team Receives 23rd Engineering Merit Award (July 10, 2003)
Delivery of Injection Equipment for CO2 Underground Storage
Honorary Chairman and Advisor Takashi Imai Receives the Companion of the Order of Australia (2003/07/08)
Activities of the Steel Bridge NET Research Group (2003/07/03)
Official Contract Signed for Central Government Building No. 7 Maintenance Project (PFI) (July 2, 2003)
Cross-Licensing of Waste Incinerator Technology Implemented (July 1, 2003)
Establishment of Wholesale Electricity Supply Company for Specified Scale Electricity Suppliers (June 25, 2003)
Acquired Construction Certification for the Single-Column Single-Pile Method, Commenced Full-Scale Operations in June (Short Construction Period, Reduced Earth Removal) (June 24, 2003)
News
Basic Agreement on Establishing a Joint Venture to Manufacture and Sell Automotive Steel Sheets Nippon Steel Corporation and Baoshan Iron & Steel Co., Ltd.
New Picture Book Volume 3 Now Available.
NIPPON STEEL MONTHLY
> Back Issues
Virtual Factory Tour
Tour of a Nippon Steel Plant
For More Information
FAX 03-3275-5607
Copyright (c) 2003 NIPPON STEEL CORPORATION. All Rights Reserved.

Appendix
SUEHIRO04

http://www0.nsc.co.jp/kenkyusho/ Go SEP OCT DEC
15 captures
31 Oct 2003 - 20 Jun 2008
2002 31 2003 2004 About this capture

CONTENTS



研究開発

当社では、製鉄事業で培った独自の高度な技術力を基軸に多分野に渡って事業展開しています。その根幹となっているのがリサーチ＆エンジニアリング一貫体制による基礎から応用・実機化までの幅広い研究開発です。製鉄事業分野では、自動車を軽量化し衝突安全性確保を実現する高張力鋼板、鉛・クロムを含まない表面処理鋼板、高効率モーター・トランス用の電磁鋼板など環境・省エネルギーに役立つ商品や各種の新しい鉄鋼製造プロセスの開発を行っています。また、エンジニアリング・新素材等の事業分野では、ビジネス拡大の基礎となる新商品開発とその基盤研究を進めています。

新日鉄技報 最新号 バックナンバー ▶

Acrobat Reader
このページをご覧になるには
AcrobatReaderが必要です。
(無料でダウンロードできます)

内容に関するお問い合わせ FAX.03-3275-5611
Copyright(c) 2001 NIPPON STEEL CORPORATION. All Rights Reserved.

Appendix
SUEHIRO05



Contents

Steel Research Center
Cutting Edge Technology Research Center
About Technical Development at Nippon Steel
Environmental/ Processing Research and Development Center

Research and Development

Our company leverages the unique, advanced technological capabilities cultivated in our iron and steel business as a foundation for expanding operations across multiple fields. At its core lies a broad research and development spectrum—ranging from basic research to applied research and actual commercialization—driven by a research and engineering-driven system. In the steel manufacturing sector, we are developing products that contribute to environmental protection and energy conservation, such as high-tensile steel sheets that reduce vehicle weight while ensuring collision safety, surface-treated steel sheets free of lead and chromium, and electromagnetic steel sheets for high-efficiency motors and transformers. We are also advancing various new steel manufacturing processes. In the field of engineering new materials and other business sectors, we are advancing new product development and the underlying research that forms the foundation for business expansion.

Nippon Steel Bulletin **Latest Issue** **Back Issues >**

You need Acrobat Reader to view this page. (Available for free download)

For More Information: FAX. 03-3275-5611
Copyright (c) 2001 NIPPON STEEL CORPORATION. All Rights Reserved.

Appendix
SUEHIRO06

http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s378.html
Go SEP OCT DEC
25 captures
2 Oct 2003 - 12 Sep 2007
2002 02 2003 2004
About this capture

自動車用材料特集（No.378　2003年7月）

目次

1 自動車用材料の特集号発刊に際して
2 自動車用高強度鋼板の開発
3 自動車用高強度熱延鋼板
4 自動車用980MPa冷間圧延鋼板の開発
5 ホットプレス用アルミニウムめっき鋼板の諸特性
6 衝突性能最適化のための高速変形特性評価技術
7 高強度鋼板の形状凍結性改善技術
8 スポット溶接部静的強度の支配因子とそれにもとづく溶接部強度特性の優れた高強度鋼板メニューの展開
9 テーラードブランク材の溶接と成形
10 自動車用クロメートフリー電気亜鉛めっき鋼板“ジンコートMZ”
11 亜鉛めっき鋼板の高潤滑性皮膜
12 鉛フリー燃料タンク用鋼板
13 ハイブリッド／電気自動車の駆動モータ用電磁鋼板
14 自動車排気系用ステンレス鋼の現状と今後の展望
15 自動車部品へのチタン材適用
16 クランクシャフト用Pb-free非調質鋼について
17 浸炭粗大粒防止鋼の開発
18 ハイテンスチールコードの現状

このページをご覧になるには
AcrobatReaderが必要です。
（無料でダウンロードできます）

内容に関するお問い合わせ　FAX.03-3275-5634
Copyright(c)2001 NIPPON STEEL CORPORATION. All Rights Reserved.

Appendix
SUEHIRO07

http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s378.html Go
25 captures
OCT 02 2003 DEC 2004

Automotive Materials Special Issue (No. 378 July 2003)

Table of Contents

1 On the Publication of the Automotive Materials Special Issue
2 Development of High-Strength Automotive Steel Sheets
3 Automotive High-Strength Hot-Rolled Steel Sheets
4 Development of 980 MPa Cold-Rolled Steel Sheet for Automotive Applications
5 Properties of Aluminum-Plated Steel Sheets for Hot Pressing
6 Technology for Evaluating High-Speed Deformation Characteristics for Crash Performance Optimization
7 Technology for Improving Shape Freezing of High-Strength Steel Sheets
8 Dominant Factors in Static Strength at Spot Welds and Development of High-Strength Steel Sheet Menu with Superior Weld Strength Characteristics Based on These Factors
9 Welding and Forming of Tailored Blank Materials
10 "Zincote MZ" Chromate-Free Electrogalvanized Steel Sheet for Automotive Applications
11 High-Lubricity Coatings for Galvanized Steel Sheets
12 Lead-Free Fuel Tank Steel
13 Electromagnetic Steel Sheets for Drive Motors in Hybrid Electric Vehicles
14 Current Status and Future Prospects of Stainless Steel for Automotive Exhaust Systems
15 Application of Titanium Materials in Automotive Components
16 Pb-free Non-Quenched Steel for Crankshafts
17 Development of Steel That Prevents Coarse Grain Formation During Carburization
18 Current Status of High-Tensile Steel Cords

You need Acrobat Reader to view this page. (Available for free download)

For More Information: FAX. 03-3275-5634
Copyright (c) 2001 NIPPON STEEL CORPORATION. All Rights Reserved.

Appendix
SUEHIRO08

https://web.archive.org/web/20041001000000*/http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s37805.pdf February 13, 2026

INTERNET ARCHIVE WEB TEXTS VIDEO AUDIO SOFTWARE IMAGES SIGN UP | LOG IN UPLOAD Search

ABOUT BLOG EVENTS PROJECTS HELP DONATE CONTACT JOBS VOLUNTEER

DONATE INTERNET ARCHIVE WaybackMachine Explore more than 1 trillion web pages saved over time

http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s37805.pdf

Calendar · Collections · Changes · Summary · Site Map · URLs

Saved 5 times between November 19, 2004 and April 15, 2007.

2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

JAN FEB MAR APR

MAY JUN JUL AUG

SEP OCT NOV DEC

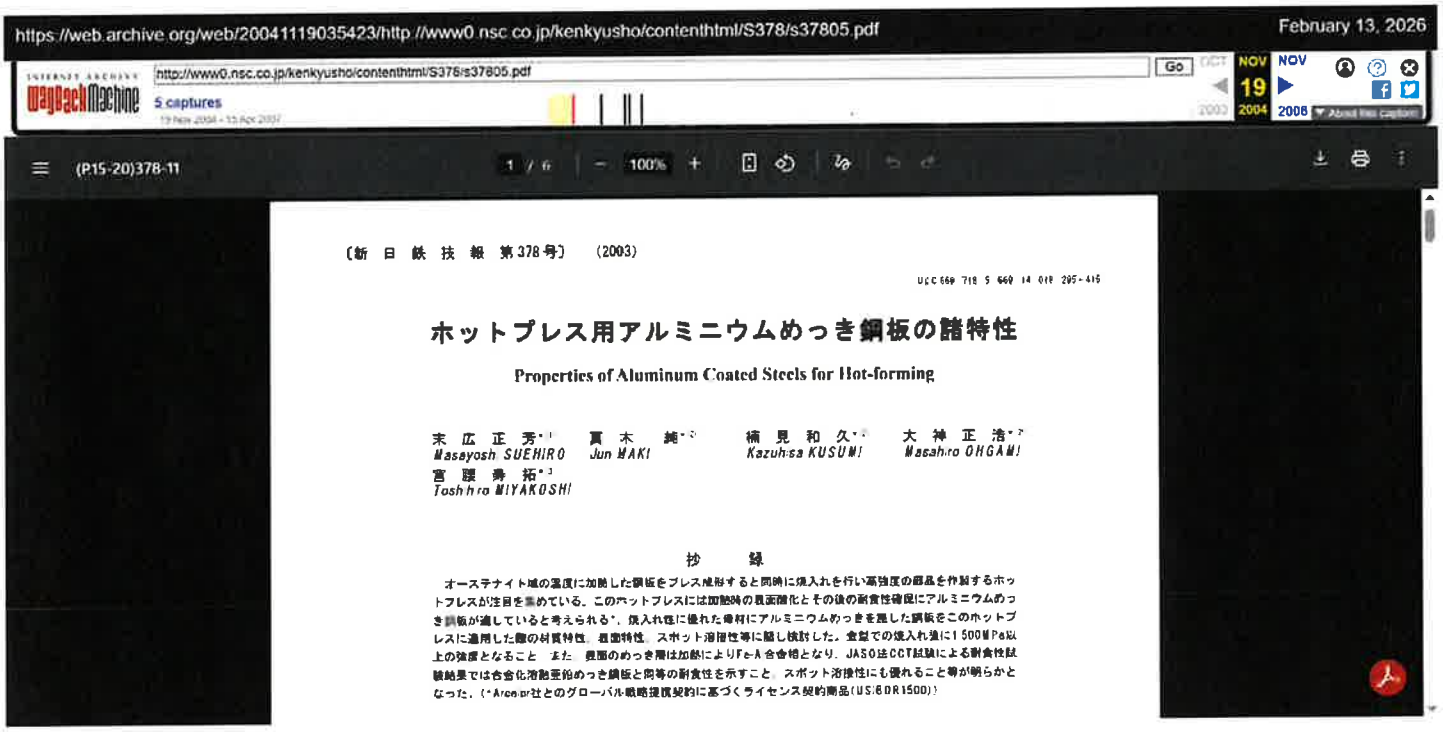
Note

This calendar view maps the number of times **http://www0.nsc.co.jp/kenkyusho/contenthtml/S378/s37805.pdf** was crawled by the Wayback Machine, *not* how many times the site was actually updated. More info in the FAQ.

FAQ | Contact Us | Terms of Service (Dec 31, 2014)

The Wayback Machine is an initiative of the Internet Archive, a 501(c)(3) non-profit, building a digital library of Internet sites and other cultural artifacts in digital form. Other projects include Open Library & archive-it.org

Your use of the Wayback Machine is subject to the Internet Archive's Terms of Use.



〔新 日 鉄 技 報 第378号〕 (2003)

UDC 669.718.5:669.14.018.295:415

ホットプレス用アルミニウムめっき鋼板の諸特性

Properties of Aluminum Coated Steels for Hot-forming

末 広 正 芳*1 Masayoshi SUEHIRO　真 木 純*2 Jun MAKI　楠 見 和 久*2 Kazuhisa KUSUMI　大 神 正 浩*2 Masahiro OHGAMI
宮 腰 寿 拓*3 Toshihiro MIYAKOSHI

抄 録

オーステナイト域の温度に加熱した鋼板をプレス成形すると同時に焼入れを行い高強度の部品を作製するホットプレスが注目を集めている。このホットプレスには加熱時の表面酸化とその後の耐食性確保にアルミニウムめっき鋼板が適していると考えられる*。焼入れ性に優れた母材にアルミニウムめっきを施した鋼板をこのホットプレスに適用した際の材質特性、表面特性、スポット溶接性等に関し検討した。金型での焼入れ後に1 500MPa以上の強度となること、また、表面のめっき層は加熱によりFe-Al合金相となり、JASO法CCT試験による耐食性試験結果では合金化溶融亜鉛めっき鋼板と同等の耐食性を示すこと、スポット溶接性にも優れること等が明らかとなった。(*Arcelor社とのグローバル戦略提携契約に基づくライセンス契約商品(USIBOR1500))

〔新 日 鉄 技 報 第378号〕 (2003)

UDC 669.718.5:669.14.018.295-415

ホットプレス用アルミニウムめっき鋼板の諸特性

Properties of Aluminum Coated Steels for Hot-forming

末広正芳*(1) Masayoshi SUEHIRO
真木 純*(2) Jun MAKI
楠見和久*(2) Kazuhisa KUSUMI
大神正浩*(2) Masahiro OHGAMI
宮腰寿拓*(3) Toshihiro MIYAKOSHI

抄 録

オーステナイト域の温度に加熱した鋼板をプレス成形すると同時に焼入れを行い高強度の部品を作製するホットプレスが注目を集めている。このホットプレスには加熱時の表面酸化とその後の耐食性確保にアルミニウムめっき鋼板が適していると考えられる*。焼入れ性に優れた母材にアルミニウムめっきを施した鋼板をこのホットプレスに適用した際の材質特性，表面特性，スポット溶接性等に関し検討した。金型での焼入れ後に1 500MPa以上の強度となること，また，表面のめっき層は加熱によりFe-Al合金相となり，JASO法CCT試験による耐食性試験結果では合金化溶融亜鉛めっき鋼板と同等の耐食性を示すこと，スポット溶接性にも優れること等が明らかとなった。(*Arcelor社とのグローバル戦略提携契約に基づくライセンス契約商品(USIBOR1500))

Abstract

Production of parts with high strength by means of hot-forming process has been receiving considerable attention lately. Application of aluminized steel with good hardenability for this process has been investigated*. Tensile strength over than 1500MPa was obtained with steel containing around 0.2mass% C. Surface coated layer changed from Al-10% Si to Fe-Al(-Si) phases through the hot-forming process. The steel with Fe-Al(-Si) surface layer showed good paintability even without phosphatized treatment. After painting, they showed good corrosion resistance in JASO-CCT as galvanized steel did. The steel showed good spot weldability due to the stable surface layer at high temperature. (*license product within the frame of global strategic alliance with Arcelor (USIBOR1500))

1. 緒 言

近年，環境問題に端を発する自動車の軽量化や衝突時の安全性向上といった観点から高強度鋼板の使用が積極的に行われている。部材によってはより高強度の鋼板を用いることで鋼板厚みをより低減でき大きな軽量化を可能とできることから，用いられる鋼板強度も440MPaや590MPa級にとどまらず780MPa級以上へと上昇している。鋼板強度が増加するにつれ一般的には成形性が劣化する。これを克服するため各種組織制御を行った高強度鋼板が開発されてきた[1]。しかしながら，鋼板強度が1 500MPa程度になると複雑な形状へのプレス成形は困難になると思われる。

1 500MPa程度の強度を持つ部材を得るため欧州ではダイクエンチ，ホットフォーム，ホットスタンプあるいはホットプレスと呼ばれる成形法が実用化されている[2]。この成形法では鋼板は900℃程度のオーステナイト域の温度に加熱され常温の金型で成形することにより焼入れ鋼板強度を高める。また，このような工法は国内においても検討されており，めっきを施していない鋼板を用い検討あるいは実用化されている[3,4]。また欧州においてはArcelor社がホットプレス特性と優れた耐食性を有するアルミニウムめっき(以下アルミめっき)製品USIBOR1500をすでに開発実用化している[2,5,6]。新日本製鐵は，Arcelor社とのグローバル戦略提携契約に基づき，USIBOR1500のライセンス契約を結び，商品の製造技術および製品特性の検討を進めてきた。本論文ではホットプレス用のアルミめっき鋼板の各種特性に関し検討した結果を報告する。

2. ホットプレス工程

ホットプレス工程は既に実用化されている。図1にその工程を簡単に示す。この製法では鋼板をオーステナイト域の温度(A_{c3}以上)ま

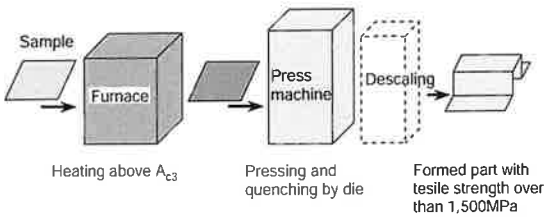


図1 ホットプレス工程の模式図

*(1) 八幡技術研究部 主幹研究員 工博(現 鉄鋼研究所 マネジャー)
北九州市戸畑区飛幡町1-1 〒804-8501 TEL:(093)872-6812
*(2) 八幡技術研究部 主任研究員
*(3) 八幡製鉄所 薄板部 マネジャー

で加熱することが必要である。例えば0.2mass%程度のC量を含有する鋼では850℃以上の温度に加熱することが必要となる。加熱後，炉から取り出された鋼板はプレス機まで搬送され常温の金型で成形し同時に焼入れが行われる。成形後鋼板全体が充分焼入れされるまで下死点で保持する。

このような成形工程をとるが，めっきを施していない鋼板を使用する場合には加熱時のスケール生成や表層脱炭を抑えるため非酸化雰囲気とする必要がある。また，非酸化雰囲気で加熱した場合でも炉からプレス機までの間は大気雰囲気となるため短時間でも表層にスケールが生成する。プレス成形品は使用時には塗装が付与されるが表層にスケールが存在すると問題となる。したがって，めっきを施していない鋼板を使用した場合にはスケールを除去するプロセスが必要となる。スケール層の除去はショットブラストや酸洗で可能であるがこれらはコスト上昇を招く。また，ショットブラストを用いた場合には形状変化を生じる懸念がある。耐熱性に優れためっき鋼板を用いるとこの工程が不要となる。

3. 素　　材

前述したようにホットプレス工程では鋼板を急速に冷却することで強度を高めるため焼入れ性に優れることが必要となる。表面に関しては耐熱性に優れためっきを施しておくことで前述した加熱炉の雰囲気制御やスケール除去のためのプロセスが不要となり，製造を容易にすることができる。以上のような条件を満足する鋼板として，表1に示すような成分系のアルミめっき鋼板があげられる。なおめっき付着量は120～160g/m²のものを用いた。この鋼板の各種特性を以下に概説する。

4. 母材特性

4.1 焼入れ前後の引張特性

本鋼板の焼入れ前後の特性を表2に示す。引張試験は1.4mmの厚みの素材からJIS5号引張試験片を作製し行った。出荷時の強度は490～590MPa級であり，金型での焼入れ後は1 500MPa以上となる。なお強度は図2に示すようにC量で調整することが可能である。図2は実験室的にC量を変化させた素材を真空溶解で溶製し焼入れ後の機械的特性を調査した結果である。これまでに知られているように焼入れ後の機械的特性はC量とともに増加することがわかる。焼入れ後の強度，つまり成形部品の強度はC量を調整することで制御可能である。なお，焼入れ時の強度に対するMn，Cr等の置換型固溶元素の影響は小さいことが知られている。これら置換型固溶元素は焼入れ性に影響するため，次章で述べる焼入れ性を確保するためには重要となる。ただし，これら元素を過剰に添加すると製品板の強度が高くなることを考慮しておく必要がある。

表1　検討に用いた鋼板の成分(mass%)

C	Mn	Cr	B
0.22	1.2	0.15	0.002

表2　焼入れ前後の引張特性

	Yield strength (MPa)	Tensile strenght (MPa)	Elongation (%)
As coated	394	615	26
As formed	1,280	1,530	8

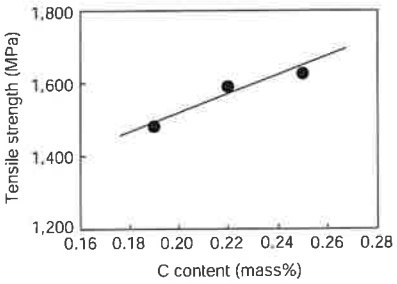


図2　C量と引張特性の関係

4.2 焼入れ性

図3にこの鋼のCCT曲線(950℃からの連続冷却曲線)を，図4に冷却速度と硬さの関係を示す。この鋼板は焼入れ性を高めるためMnやBが添加されており，加熱温度が950℃の場合約20℃/s以上の冷却速度で硬度をHV450～500の範囲とすることができる。この焼入れ速度は冷却中でのフェライト，パーライトおよびベイナイトへの変態を避ける条件で決まる。これらの変態はオーステナイト粒径が小さいと，つまり加熱温度が低いと速くなるため，焼入れに必要な冷却速度が速くなる。この点については加熱温度を900～1 000℃として検討を行ったが，この範囲ではあまり大きな差はなくどの加熱温度においても20～30℃/s程度に臨界冷却速度があった。

図3および図4および前述した他の加熱温度での実験結果からホットプレス時の鋼板の冷却速度が30℃/s以上であればどのような冷却速度をとっても十分な硬さが得られることがわかる。しかしながら，実際のプレス工程では加熱炉からプレス機への搬送とプレス開始までの間は空冷に近い冷却速度となる。

1.4mm程度の厚みの鋼板では大気雰囲気で冷却すると10～15℃/s

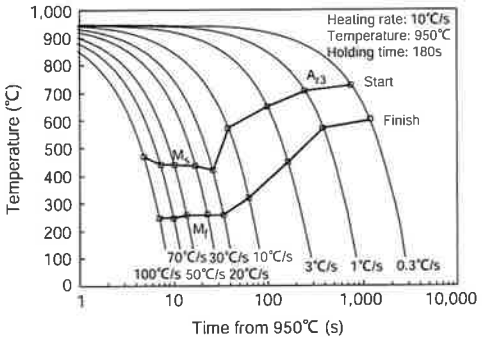


図3　CCT曲線

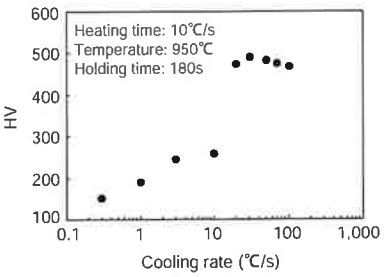


図4　硬さにおよぼす冷却速度の影響

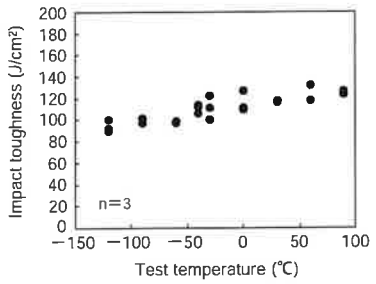


図5　シャルピー試験時の衝撃値と温度の関係

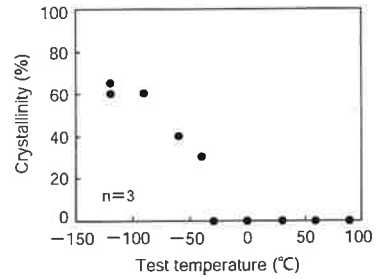


図6　シャルピー試験時の脆性破面率と温度の関係

の冷却速度となるが，この冷却速度で600℃以下まで冷却されると鋼板の強度が低下することが図3および図4からわかる。950℃から600℃までの時間は23～35秒となり素材を炉から取り出してから23秒以内に金型での冷却を開始すれば素材を焼入れることが可能となる。なお，この関係は加熱条件，冷却中の雰囲気や周りの環境により変化するため，実際のホットプレス作業環境に応じ決定する必要がある。

4.3　靭性

焼入れによりマルテンサイト相で強度を確保した場合には靭性，特に低温での靭性が劣化する懸念がある。この点に関しシャルピー衝撃試験にて検討した結果を図5および図6に示す。図5は衝撃値と温度の関係を，図6は脆性破面率を示す。この試験は4mmの熱間圧延板を水焼入れ後に2mmUノッチ2.5mmサブサイズ衝撃試験片を作製して行った。吸収エネルギーは室温から−60℃まであまり大きな変化を示さない。一方，脆性破面率は−40℃以下で増加し，−80℃では約80%となり，遷移温度(Tr_{SS0})は−60℃程度である。脆性破面率は板厚が薄くなると低減する傾向にあり，2.5mmより薄い板厚の場合には遷移温度はより低下するものと考えられる。以上の結果から，この鋼板は焼入れのままのマルテンサイト相を主体とする組織で使用されるが，通常の環境下で低温になって急激に吸収エネルギーが変化したり破壊形態が変化することはないものと推定されることがわかる。

5.　スポット溶接性

めっき付着量を120g/m²とする板厚1.2mmのアルミめっき鋼板を950℃で5分加熱し，金型で両側から挟み込むことで焼入れを行いスポット溶接用サンプルとした。表層のめっき層の変化に関しては次章で説明するが，Fe-Al合金めっきとなっている。相手材としては板厚1.8mmの440MPa級の冷間圧延薄鋼板を用いた。スポット溶接は，DR6φ型のアルミナ分散銅を電極とし，通電を17サイクル(60Hz)，加圧を400kgfとして行った。図7にナゲット径と電流密度の関係を示すがナゲット径が板厚をtとして4√t となる電流値とちりが発生する電流値の範囲は約3kA存在することがわかる。図8はせん断引張強度と電流値の関係を，図9は十字引張強度と電流値の関係を示す。図10にナゲット近傍の硬さ分布を示すが，ナゲット内および母材部は約480のビッカース硬さを持ち溶接熱影響部(HAZ)にて300程度に軟化する。このような硬さ分布を持つため，ナゲット径が充分な大きさを持つ場合破断部はこのHAZとなることが多い。

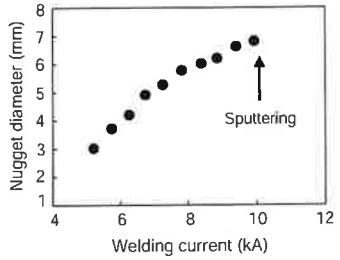


図7　スポット溶接部のナゲット径と電流値の関係

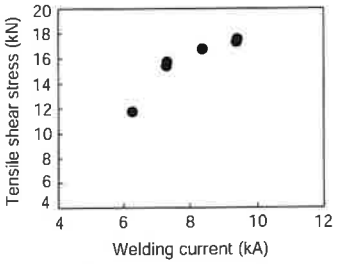


図8　スポット溶接部のせん断引張強度と電流値の関係

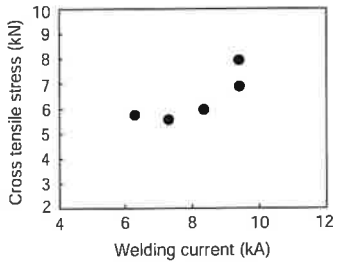


図9　スポット溶接部の十字引張強度と電流値の関係

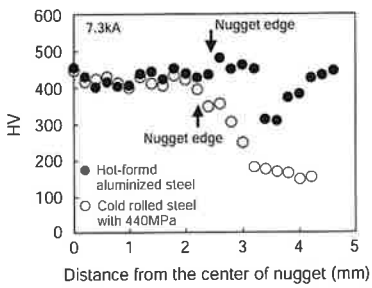


図10　ナゲット近傍の硬さ分布

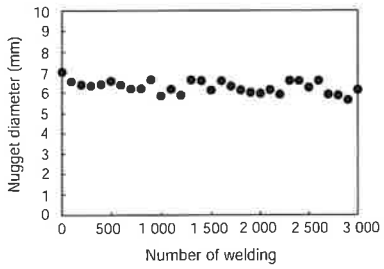


図11　連続打点によるナゲット径の変化

図11は連続打点性を評価した結果である。試験は3 000点まで行ったが，この範囲ではナゲット径の変化はあまりなく3 000点以上の連続打点も可能であると推定される。この鋼板の表層のめっき層は融点が1 000℃以上のFe-Al合金相となっているが，このことがこのような連続打点性を持つ理由と考えられる。

ここではアーク溶接性に関しては示していないが，Fe-Al合金相は沸点が2 000℃以上であり，亜鉛系のめっき鋼板で問題となるアーク溶接時のブローホールの発生は無い。

6.　めっき特性

6.1　加熱時のめっき層の合金化

本鋼板の表層めっきはSiを10％含有するアルミめっきであり，Type 1 と呼ばれているものである。このめっき層の溶融温度は約600℃であるため急速に加熱するとめっき層は一旦溶融するが，電気炉で得られる加熱速度では加熱中に融点の高いFe-Al合金層が生成し，速やかに表層まで達するため溶融物が炉材等に付着することはない。大気雰囲気中の電気炉で板厚1.6mmの素材を加熱した場合，保定温度に達するまでの時間は約２分であった。

図12に950℃で0.5分間保定した際の合金化の状況を，図13は表層のめっき層のFe，AlおよびSi濃度を板厚方向にSEM-EDSで測定した結果を示す。合金化が進行すると図に示すようなAlおよびFe濃度を持つ層状の合金相が形成される。この加熱条件下では合金相は５層からなり，Al濃度は最表層から順に約50％，30％，50％，30％，10％と変化している。４層目から母層にかけては元素濃度が連続的に変化している。

図14にThermo-calc[7]により計算したFe-Al-Si系の950℃での状態図を示す。この図に図13で示した各点の組成を重ねた。なおこの計算のFe-Al-Si系熱力学データベースはZ. Liuら[8]によるものを使用した。図14から合金層は表層からFe_2Al_5，BCC規則相，$FeAl_2$，BCC規則相，BCC不規則相と推定される。表層の合金層は保定時間が長くなるとAlが母層へと拡散していくため最表層から消滅していく。図15は保定時間を５分としたときのめっき層を示す。断面組織からは１相しか識別できなくなっているが，SEM-EDSで分析すると２相が存在していることがわかった。このときの相はBCC規則相と不規則相と考えられる。

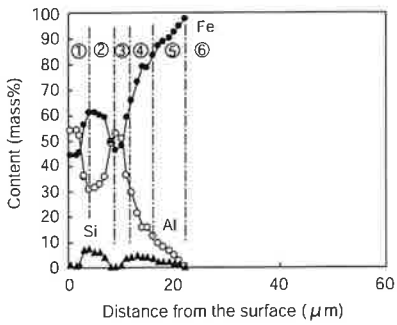


図13　図12に対応したサンプルの板厚方向のFe, Al, Si元素濃度変化

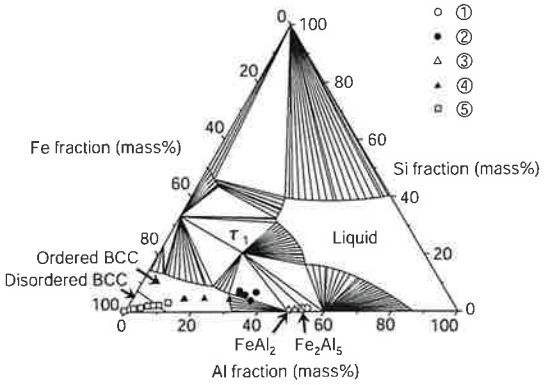


図14　Fe-Al-Si平衡状態図の950℃での等温断面図

6.2　塗装性および塗装後耐食性

鋼板は自動車への適用に際して電着塗装されて使用されるが，通常，塗装性を確保するため塗装前に化成処理が施される。化成処理は一般にりん酸亜鉛系の溶液中で行われ，表面にりん酸塩の皮膜を形成させる。この皮膜により塗装性，塗料密着性が確保されるが，Fe-Al合金相は化成処理液に浸漬してもこの化成皮膜が形成されない。これはFe-Al合金相が酸に対して非常に安定な相であるためである。しかしながら図16でわかるように加熱処理後の表面は凹凸が

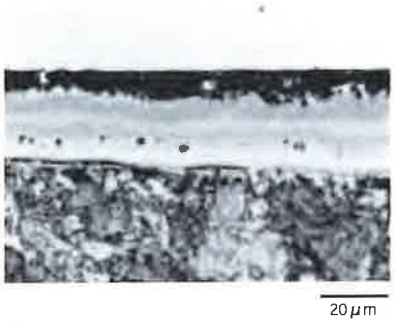


図12　950℃で30秒保定した試料のめっき層構造を示す断面光学顕微鏡写真

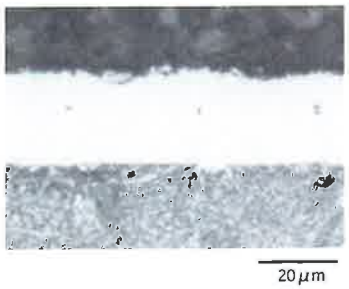


図15　950℃で５分保定後のめっき層構造を示す断面光学顕微鏡写真

ありこれによるアンカー効果で塗装性が確保される。表3は化成処理を施した試料及び施さない試料に約20μm厚みの電着塗装を行ない，塗装後の密着性を検討した結果であるが，十分な特性を確保していることがわかる。このように塗料密着性は化成処理の有無にかかわらず確保可能である。

めっき付着量を160g/m²とするアルミめっき鋼板を900℃で2分加熱することで表層をFe-Al合金めっきとした鋼板を化成処理液に浸漬し，約25μmの電着塗装後，表面の塗膜にクロス状の疵(クロスカット)を入れJASOM610に定めた複合腐食試験(CCT)を150サイクル(50日間)行った後の外観を図17に示す。JASO法CCTの試験条件を以下に示す。

塩水噴霧(5%NaCl，35℃，2h) → 乾燥(60℃，4h) → 湿潤(50℃，2h)

比較材としてめっきを施していない冷間圧延鋼板および合金化溶融亜鉛めっき鋼板(付着量片面45g/m²)を使用した。これらの材料は化成処理を施し，化成皮膜が生成していることを確認した後に試験に供した。腐食試験の途中でクロスカット部からの塗膜膨れ幅を片側最大膨れ幅として評価した結果を図18に，また150サイクル後の板厚方向への腐食深さを表面からレーザー光により1試料当たり各5点づつ測定して平均値並びに標準偏差を算出した結果を図19に示す。これらの結果から，Fe-Al合金相をめっき層とする鋼板の耐食性は剥離幅，腐食深さとも冷間圧延鋼板より優れ，合金化溶融亜鉛めっき鋼板と同等の特性を持つ事がわかる。塗装後耐食性を重視する場合にはめっき付着量を150g/m²程度とすることが望ましい。



図16　950℃で5分保定後のめっき層表層形態を示すSEM写真

表3　塗料密着性評価結果

	Surface preparation	Primary adhesion*	Secondary adhesion**
Hot-formed aluminized steel	Phosphated	100/100	100/100
Hot-formed aluminized steel	Degreased	100/100	100/100
Galvannealed steel	Phosphated	100/100	100/100
Steel	Phosphated	100/100	100/100

*Primary adhesion test: 100 grid cross-cutting by 2mm and taping after painting
**Secondary test: dipping at 40℃ water for 10 days and cross-cutting and taping

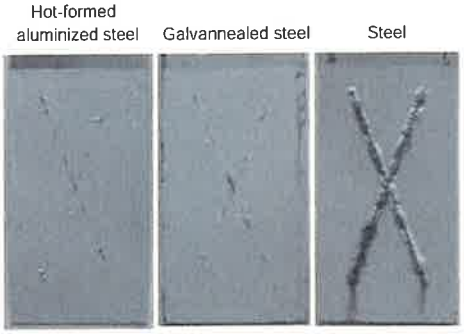


図17　JASO法CCT試験50日後の試料外観

6.3　スポット溶接部の耐食性

図20はスポット溶接時に電極と接していた部分および電極と接触していなかった部分の断面組織を示す。この図から，電極と接していた部分のめっき層はスポット溶接時に温度が上昇してもほとんど変化せずスポット溶接前と同様の厚みを有していることがわかる。そのためこの部分の塗装後耐食性は平板部と全く変わらず，図21に示すように塩水噴霧試験(SST)にて2 000時間経過後においても全く

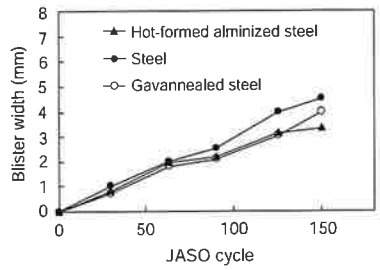


図18　JASO法CCT試験による塗膜膨れ幅の変化

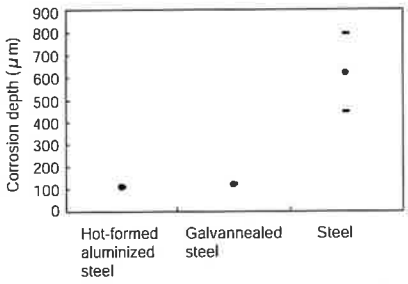


図19　JASO法CCT試験50日後の板厚方向腐食深さの変化



図20　スポット溶接後の電極直下および通常部のめっき層(腐食液：しゅう酸)

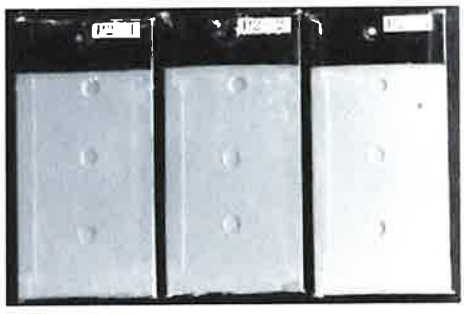


図21　スポット溶接部の塗装後耐食性のSSTによる評価，2000時間後の外観

腐食していないことがわかる。他のめっき鋼板ではスポット溶接を行った際，電極と接していた部分のめっきは溶融し電極と母材の間から押出されめっき金属が盛り上がり突起状になることがあるが，この部分は充分な塗装厚みが確保できず耐食性に問題が生じることがある。

7. 結　　言

本報告ではホットプレス用アルミめっき鋼板の母材特性および表面特性について述べた。母材特性に関しては，プレス成形時の金型焼入れで冷却速度がばらついても30℃/s以上の冷却速度が確保できれば均一な強度を有する部材が得られること，引張特性に関しては降伏強度：1 280MPa，引張強度：1 530MPa，伸び：8％が得られること，耐水素脆性にすぐれること等を述べた。スポット溶接性に関しては，表層のアルミめっきがプレス前の加熱で融点の高いFe-Al合金相となることに起因してめっき層の存在による劣化はないことや連続打点性に優れることを示した。また耐食性に関しては，Fe-Al合金相はめっきを施していない鋼板と合金化溶融亜鉛めっき鋼板の間に位置することを示した。

以上のような特徴を持つ鋼板をホットプレスに適用することで，比較的複雑な形状を持つ高強度で耐食性に優れた部材の製造が可能となる。

参考文献

1) Senuma, T.: ISIJ Int. 41, 520(2001)
2) Bano, X., Laurent, J. P.: Proc. of 39th Mechanical Working and Steel Processing Conf. Vol. XXXV, Indianapolis, 1998, p.673
3) 廣村敏樹, 内野龍一, 加藤希人, 佐藤昌彦: 自動車技術会学術講演会前刷集. 942, 1994-5, p.73
4) 例えば, アイシン高丘: 東京モーターショー, 月刊素形材. 43, (2002)
5) Cornette, D., Hourman, T., Hudin, O., Laurent, J. P., Reynaert, A.: Proc. of SAE. 2001, p.19
6) Ronin, F.: Variant-Flexible Steel Forming in Automotive Production. 2nd Europian Practice Conf. Bad Nauheim, Frankfurt, 2002
7) Sundman, B., Jansson, B., Andersson, J.-O.: CALPHAD. 9, 153(1985)
8) Zi-kui Liu, Y, Austin Chang: Metall. Mater. Trans. A. 30A, 1081(1999)

Appendix
SUEHIRO09

MARC View

LEADER 01256cas a2200337 a 4500
001 2519680
003 SIRSI
005 20151215064943.0
008 030825c20029999 fr 0 a0eng d
019 a| MARS
040 a| PSt c| PSt d| OCoLC d| UtOrBLW
050 1 4 a| TS300 b| .N566
130 0 a| Nippon steel technical report (Online)
245 1 0 a| Nippon steel technical report h| [electronic resource].
246 1 3 a| NSTR
264 1 a| Tokyo : b| Nippon Steel Corp., c| 2002-
310 a| Twice a year
336 a| text b| txt 2| rdacontent
337 a| computer b| c 2| rdamedia
338 a| unspecified b| zu 2| rdacarrier
362 0 a| No. 88 (2002)-
500 a| Title from journal home page (viewed Aug. 25, 2003).
516 a| Text (electronic journal).
538 a| Mode of access: World Wide Web.
580 a| Beginning with No. 87, 2002, issued in online format only.
650 0 a| Steel industry and trade v| Periodicals.
710 2 a| Shin Nihon Seitetsu Kabushiki Kaisha.
765 1 t| Seitetsu kenkyu.
780 0 0 t| Nippon steel technical report w| (DLC)sn85012483 w| (OCoLC)5864615
856 4 0 u| http://www0.nsc.co.jp/shinnihon_english/kenkyusho/kenkyusho_map.html
949 a| Electronic journal w| ASIS c| 1 i| 2519680-1001 l| ONLINE m| ONLINE r| Y s| Y t| ONLINE u| 8/25/2003

ASK A LIBRARIAN

PennState

Copyright ©2019 The Pennsylvania State University. All rights reserved. Except where otherwise noted, this work is subject to a Creative Commons Attribution 4.0 license. Details and exceptions.

Legal Statements | PSU Hotlines

PENN STATE UNIVERSITY LIBRARIES

Libraries Home (814) 865-4348

Libraries Intranet (Staff Only)

Accessibility Help

Website Feedback

Policies and Guidelines

Staff Directory

CONNECT WITH PENN STATE UNIVERSITY LIBRARIES

Facebook

Twitter

Instagram

Nippon steel technical report [electronic resource].

Uniform Title	Nippon steel technical report (Online)
Additional Titles	NSTR
Published	Tokyo : Nippon Steel Corp., 2002-
Additional Creators	Shin Nihon Seitetsu Kabushiki Kaisha

Access Online

www0.nsc.co.jp

Continues

Nippon steel technical report

Dates of Publication and/or Sequential Designation

No. 88 (2002)-

Subject(s)

Steel industry and trade—Periodicals

Publication Frequency

Twice a year

Note

Title from journal home page (viewed Aug. 25, 2003).

Type of File/Data

Text (electronic journal).

Technical Details

Mode of access: World Wide Web.

Complexity Note

Beginning with No. 87, 2002, issued in online format only.

ASK A LIBRARIAN

View MARC record | catkey: 2519680

PennState

Copyright ©2019 The Pennsylvania State University. All rights reserved. Except where otherwise noted, this work is subject to a Creative Commons Attribution 4.0 license. Details and exceptions.

Legal Statements | PSU Hotlines

PENN STATE UNIVERSITY LIBRARIES

Libraries Home (814) 865-4861

Libraries Intranet (Staff Only)

Accessibility Help

Website Feedback

Policies and Guidelines

Staff Directory

CONNECT WITH PENN STATE UNIVERSITY LIBRARIES

Facebook

Twitter

Instagram

Appendix
SUEHIRO10

SOURCE

Your global source
for foreign filing services

Certification of Accuracy

I, Frank McGee, a translator fluent in the English and Japanese languages, on behalf of Source IP, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

The documents are designated as:
SUEHIRO - NDL Article Record
SUEHIRO - NDL Journal Record



Frank McGee

February 10, 2026

Appendix
SUEHIRO11

```
LDR             00000cas a2200517zi 4500
001             000000079970
003             JTNDL
005             20130426142104.0
007             ta
008             911111d19912012ja fr p       |   |0jpn
015             |a 00085631 |2 jnb
022             |a 0916-7609 |l 0916-7609
040             |a JTNDL |b jpn |c JTNDL |e ncr/1987
084             |a ZP42 |2 kktb
090             |a Z17-328
24500           |6 880-01 |a 新日鉄技報 / |c 新日本製鐵株式会社技術開発本部, 技術開発企画部 編.
260             |6 880-02 |a 東京 : |b 新日本製鐵技術開発本部, 技術開発企画部, |c 1991-2012.
300             |a 冊 ; |c <30>cm.
310             |a 年2回刊
3620            |a 341号 (平成3年6月)-394号 (2012年9月)
500             |a 本タイトル等は最新号による.
500             |a 刊行頻度, 大きさの変更あり.
5102            |a 国立国会図書館雑誌記事索引 |b (通号: 341) 1991.09~
7102            |6 880-03 |a 新日本製鉄株式会社 |0 00302250
78000           |t 製鉄研究 / 新日本製鉄株式会社技術本部技術企画管理部 編. |w 000000013091 |x 0370-9566
78500           |t 新日鉄住金技報 / 新日鐵住金株式会社技術開発本部, 技術開発企画部 編. |w 024371302
866 0           |a 341号 (平成3年6月)-394号 (2012年4月)
85000           |6 245-01/$1 |a シン ニッテツ ギホウ / |c シン ニホン セイテツ カブシキ ガイシャ ギジュツ カイハツ ホンブ, ギジュツ カイハツ キカクブ ヘン.
85000           |6 245-01/(B |a Shin nittetsu giho / |c Shin nihon seitetsu kabushiki gaisha gijutsu kaihatsu honbu, Gijutsu kaihatsu kikakubu Hen.
880             |6 260-02/$1 |a トウキョウ : |b シン ニホン セイテツ ギジュツ カイハツ ホンブ, ギジュツ カイハツ キカクブ, |c 1991-2012.
880             |6 260-02/(B |a Tokyo : |b Shin nihon seitetsu gijutsu kaihatsu honbu, Gijutsu kaihatsu kikakubu, |c 1991-2012.
8802            |6 710-03/$1 |a シン ニホン セイテツ カブシキ ガイシャ |0 00302250
8802            |6 710-03/(B |a Shin Nihon Seitetsu Kabushiki Gaisha |0 00302250
```

magazine



Nippon Steel Technical Report

National Diet Library call number Z17-328

National Diet Library Bibliographic ID 000000079970

National Diet Library Persistent Identifier info:ndljp/pid/3381135

Volume and Issue List



No. 394 2012 | No. 393 2012 | (392)-(394):2012-2012 | No. 392 2012 | No. 391 2011

53 other items

Material Type	author	publisher	Publication year
magazine	Compiled by Nippon Steel Corporation, Technology Development Headquarters, Technology Development Planning Department	Nippon Steel Corporation, Technology Development Planning Department, Technology Development Headquarters	1991-2012

Material format	Publication frequency	Publication
Paper/Digital	Published twice a year	Publication discontinued

See All

Notes on Materials

Volume number etc.: No. 341 (June 1991) - No. 394 (April 2012)

Publication volume: No. 341 (June 1991) - No. 394 (September 2012)

Using the library/personal transmission service

Check the source database

National Diet Library Digital Collections

It is available for viewing through the personal transmission service for registered users (full registration) of the National Diet Library. However, if you reside outside of Japan, you cannot use the personal transmission service

Register as a user >

Log in >

Read in the library

National Diet Library: Available

Tokyo Kansai

Visit and use the facility

Request copies without visiting the library

Libraries across the country: Available

View libraries that hold this book (2 libraries in total)

Search at bookstores

Search at bookstores

Generate citations (bibliographic notes)

Output bibliographic information

Search in other databases

General notes: The title etc. is based on the latest issue.
Publication frequency and size may change

Related materials and materials before and after the title change

Previous: Steelmaking Research / Compiled by Nippon Steel Corporation, Technology Planning and Management Department, Technology Headquarters (ISSN:0370-9566)

After continuation: Nippon Steel & Sumitomo Metal Technical Report / Compiled by Nippon Steel & Sumitomo Metal Corporation, Technology Development Headquarters, Technology Development Planning Department

Library holdings across the country

Displays the holdings of libraries across the country other than the National Diet Library. List of affiliated organizations and databases >
Please contact your local library to inquire about how to use the materials, such as whether it is possible to order them from a library that has them in stock.

Set up a local library >

By prefecture All resource formats

others

CiNii Research Search Service
paper You can check the holdings status of institutions and databases that are affiliated with CiNii Research on their affiliated websites
Check availability of this book >

CiNii Research Search Service
paper You can check the holdings status of institutions and databases that are affiliated with CiNii Research on their affiliated websites
Check availability of this book >

National Diet Library collection

Please select the material you wish to use. National Diet Library call number Z17-328 Z17-328

Narrow down All Years All volumes All holding libraries

1 - 20 of 58 > 1 /3

(394):2012 Document attachment ID: 1201201514160
Kansai-kan: Stacks

(393):2012 Document attachment ID: 1201200666460
Kansai-kan: Stacks

(392)-(394):2012-2012 Document attachment ID: 1201701120897
Tokyo Main Library: Magazine Counter (New Library)

(392):2012 Document attachment ID: 1201200666440
Kansai-kan: Stacks

(391):2011 Document attachment ID: 1201103377646
Kansai-kan: Stacks

(390) 2010 Document attachment ID: 1201100061256
Kansai-kan: Stacks

(389) 2009 Document attachment ID: 1200901286399
Kansai-kan: Stacks

(388) 2008 Document attachment ID: 1200800581872
Kansai-kan: Stacks

(388)-(391):2008-2011 Document attachment ID: 1201701120868
Tokyo Main Library: Magazine Counter (New Library)

(387) 2007 Document attachment ID: 1200701586268
Kansai-kan: Stacks

(386) 2007 Document attachment ID: 1200700428091
Kansai-kan: Stacks

(385) 2006 Document attachment ID: 1200601155466
Kansai-kan: Stacks

(384) 2006 Document attachment ID: 1200600411615
Kansai-kan: Stacks

(383) 2005 Document attachment ID: 1200501742271
Kansai-kan: Stacks

(382) 2005 Document attachment ID: 1200500281723
Kansai-kan: Stacks

(382)-(387):2005-2007 Document attachment ID: 1201301646364
Tokyo Main Library: Magazine Counter (New Library)

(381) 2004 Document attachment ID: 1200404511061
Kansai-kan: Stacks

(380) 2004 Document attachment ID: 1200404060569
Kansai-kan: Stacks

(379) 2003 Document attachment ID: 1200301284618
Kansai-kan: Stacks

(378) 2003 Document attachment ID: 1200300811431
Kansai-kan: Stacks

Search at bookstores

- Japanese second-hand bookstores
- Google Book Search

Bibliographic information

You can check the details of this material and its source (keywords pointing to materials on the same subject, author names, etc.).

Generate citations (bibliographic notes) | Output bibliographic information

paper digital

Material Type	magazine
ISSN	0916-7609
ISSN-L	0916-7609
title	Nippon Steel Technical Report
Title reading	New Nittetsu Industrial Method
Authors and Editors	Compiled by Nippon Steel Corporation, Technology Development Headquarters, Technology Development Planning Department
Author heading	Nippon Steel Corporation (00302250) authority
Publication matters	Tokyo: Nippon Steel Corporation, Technology Development Planning Department, Technology Development Headquarters
Publication date etc.	1991-2012
Publication year (W3CDTF)	1991 2012

Show more

国立国会図書館サーチ
NDL SEARCH

Language: English

Means of accessing materials
Read materials online
Get a copy of the document
Reading materials in the library

National Diet Library Homepage | Inquiry | notice | Privacy Policy | Site Policy

© 2024- National Diet Library, Japan
Screen Number 104

Appendix
SUEHIRO12

```
LDR     00000cas a2200517zi 4500
001     000000079970
003     JTNDL
005     20130426142104.0
007     ta
008     911111d19912012ja fr p           |   |0jpn
015     |a 00085631  |2  jnb
022     |a 0916-7609  |1  0916-7609
040     |a JTNDL   |b jpn  |c JTNDL  |e ncr/1987
084     |a ZP42  |2 kktb
090     |a  Z17-328
24500   |6 880-01 |a Nippon Steel Journal/ |c ed. by Tech. Planning Dept., Tech. Development Div., Nippon Steel Corp.
260     |6 880-02 |a Tokyo: |b Tech. Development Div., Tech. Development Planning Dept., Nippon Steel Corp., |c 1991-2012.
300     |a vol.; |c <30>cm
310     |a twice annually
3620    |a No. 341 (June 1991) - No. 394 (Sept. 2012)
500     |a Title and other details are based on the latest issue.
500     |a Publication frequency and size subject to change.
5102    |a  National Diet Library journal citation  |b  (vol. 341) 1991.09~
7102    |6 880-03 |a 880-03 |a Nippon Steel Corp. |0 00302250
78000   |t Steel Research/Nippon Steel Corp., Technical Div., Technical Planning & Management Dept., ed. |w 000000013091 |x 0370-9566
78500   |t Nippon Steel & Sumikin Tech. Report / Edited by Tech. Planning Dept., Tech. Development Div., Nippon Steel & Sumikin, Ltd. |w 024371302
866 0   |a No. 341 (June 1991) - No. 394 (April 2012)
88000   |6 245-01/$1 |a Shin nittetsu giho / |c Shin nihon seitetsu kabushiki gaisha gijutsu kaihatsu honbu, Gijutsu kaihatsu kikakubu Hen.
88000   |6 245-01/(B |a Shin nittetsu giho / |c Shin nihon seitetsu kabushiki gaisha gijutsu kaihatsu honbu, Gijutsu kaihatsu kikakubu Hen.
880     |6 260-02/$1 |a Tokyo : |b Shin nihon seitetsu gijutsu kaihatsu honbu, Gijutsu kaihatsu kikakubu, |c 1991-2012.
880     |6 260-02/(B |a Tokyo : |b Shin nihon seitetsu gijutsu kaihatsu honbu, Gijutsu kaihatsu kikakubu, |c 1991-2012.
8802    |6 710-03/$1 |a Shin Nihon Seitetsu Kabushiki Gaisha | 0 00302250
8802    |6 710-03/(B |a Shin Nihon Seitetsu Kabushiki Gaisha | 0 00302250
```

magazine



Nippon Steel Technical Report

The cover may vary depending on the library

Nippon Steel Technical Report

National Diet Library call number Z17-328
National Diet Library Bibliographic ID 000000079970
National Diet Library Persistent Identifier info:ndljp/pid/3381135

Volume and Issue List



No. 394 2012 | No. 393 2012 | (392)-(394):2012-2012 | No. 392 2012 | No. 391 2011

53 other items

Material Type	author	publisher	Publication year
magazine	Compiled by Nippon Steel Corporation, Technology Development Headquarters, Technology Development Planning Department	Nippon Steel Corporation, Technology Development Planning Department, Technology Development Headquarters	1991-2012

Material format	Publication frequency	Publication
Paper/Digital	Published twice a year	Publication discontinued

See All

Notes on Materials

Volume number etc.: No. 341 (June 1991) - No. 394 (April 2012)

Publication volume: No. 341 (June 1991) - No. 394 (September 2012)

Using the library/personal transmission service

Check the source database

National Diet Library Digital Collections

It is available for viewing through the personal transmission service for registered users (full registration) of the National Diet Library. However, if you reside outside of Japan, you cannot use the personal transmission service.

Register as a user >

Log in >

Read in the library

National Diet Library: Available

Tokyo Kansai

Visit and use the facility

Request copies without visiting the library

Libraries across the country: Available

View libraries that hold this book (2 libraries in total)

Search at bookstores

Search at bookstores

favorite Copy URL

Generate citations (bibliographic notes)

Output bibliographic information

Search in other databases

General notes: The title etc. is based on the latest issue.
Publication frequency and size may change

Related materials and materials before and after the title change

Previous: Steelmaking Research / Compiled by Nippon Steel Corporation, Technology Planning and Management Department, Technology Headquarters (ISSN:0370-9566)

After continuation: Nippon Steel & Sumitomo Metal Technical Report / Compiled by Nippon Steel & Sumitomo Metal Corporation, Technology Development Headquarters, Technology Development Planning Department

Library holdings across the country

Displays the holdings of libraries across the country other than the National Diet Library. List of affiliated organizations and databases >
Please contact your local library to inquire about how to use the materials, such as whether it is possible to order them from a library that has them in stock. Set up a local library >

By prefecture All resource formats

others

CiNii Research Search Service
paper You can check the holdings status of institutions and databases that are affiliated with CiNii Research on their affiliated websites
Check availability of this book >

CiNii Research Search Service
paper You can check the holdings status of institutions and databases that are affiliated with CiNii Research on their affiliated websites
Check availability of this book >

National Diet Library collection

Please select the material you wish to use. National Diet Library call number Z17-328 Z17-328

Narrow down All Years All volumes All holding libraries

1 - 20 of 58 1 /3

(394):2012 Document attachment ID: 1201201514160
Kansai-kan: Stacks

(393):2012 Document attachment ID: 1201200666460
Kansai-kan: Stacks

(392)-(394):2012-2012 Document attachment ID: 1201701120897
Tokyo Main Library: Magazine Counter (New Library)

(392):2012 Document attachment ID: 1201200666440
Kansai-kan: Stacks

(391):2011 Document attachment ID: 1201103377646
Kansai-kan: Stacks

(390) 2010 Document attachment ID: 1201100061256
Kansai-kan: Stacks

(389) 2009 Document attachment ID: 1200901286399
Kansai-kan: Stacks

(388) 2008 Document attachment ID: 1200800581872
Kansai-kan: Stacks

(388)-(391):2008-2011 Document attachment ID: 1201701120868
Tokyo Main Library: Magazine Counter (New Library)

(387) 2007 Document attachment ID: 1200701586268
Kansai-kan: Stacks

(386) 2007 Document attachment ID: 1200700428091
Kansai-kan: Stacks

(385) 2006 Document attachment ID: 1200601155466
Kansai-kan: Stacks

(384) 2006 Document attachment ID: 1200600411615
Kansai-kan: Stacks

(383) 2005 Document attachment ID: 1200501742271
Kansai-kan: Stacks

(382) 2005 Document attachment ID: 1200500281723
Kansai-kan: Stacks

(382)-(387):2005-2007 Document attachment ID: 1201301646364
Tokyo Main Library: Magazine Counter (New Library)

(381) 2004 Document attachment ID: 1200404511061
Kansai-kan: Stacks

(380) 2004 Document attachment ID: 1200404060569
Kansai-kan: Stacks

(379) 2003 Document attachment ID: 1200301284618
Kansai-kan: Stacks

(378) 2003 Document attachment ID: 1200300811431
Kansai-kan: Stacks

1 2 3 >

Search at bookstores

- Japanese second-hand bookstores
- Google Book Search

Bibliographic information

You can check the details of this material and its source (keywords pointing to materials on the same subject, author names, etc.).

Generate citations (bibliographic notes) | Output bibliographic information

paper digital

Material Type	magazine
ISSN	0916-7609
ISSN-L	0916-7609
title	Nippon Steel Technical Report
Title reading	New Nittetsu Industrial Method
Authors and Editors	Compiled by Nippon Steel Corporation, Technology Development Headquarters, Technology Development Planning Department
Author heading	Nippon Steel Corporation (00302250) authority
Publication matters	Tokyo: Nippon Steel Corporation, Technology Development Planning Department, Technology Development Headquarters
Publication date etc.	1991-2012
Publication year (W3CDTF)	1991 2012

Show more

National Diet Library Search
NDL SEARCH

Language: English

Means of accessing materials
Read materials online
Get a copy of the document
Reading materials in the library

National Diet Library Homepage | Inquiry | notice | Privacy Policy | Site Policy

© 2024- National Diet Library, Japan
Screen Number 104

Appendix
SUEHIRO13

```
LDR                 naa aZ200517z  4500
001               6674061
003               JTNDL
005               20030919133029.0
008               030916||||||||ja fr p       |   |0jpn||
022               |a 0916-7609 |l 0916-7609
041               |a jpn
084               |a ZP42 |2 kktb
090               |a Z17-328
24500             |6 880-01 |a ホットプレス用アルミニウムめっき鋼板の諸特性
300               |a 15~20
363               |b 378 |i 2003
4900              |6 880-02 |a 自動車用材料特集
720               |6 880-03 |a 末広//正芳
720               |6 880-04 |a 真木//純
720               |6 880-05 |a 桶見//和久 |e 他
7730              |t 新日鉄技報 / 新日本製鐵株式会社技術開発本部, 技術開発企画部 編. |d 東京 : 新日本製鐵技術開発本部, 技術開発企画部, 1991-2012. |g (378) 2003 |w 000000079970
88000             |6 245-01/$1 |a ホットプレスヨウ アルミニウムメッキ コウハン ノ ショ トクセイ
88000             |6 245-01/(B |a Hottopuresuyo aruminiumumekki kohan no sho tokusei
8800              |6 490-02/$1 |a ジドウシャヨウ ザイリョウ トクシュウ
8800              |6 490-02/(B |a Jidoshayo zairyo tokushu
880               |6 720-03/$1 |a スエヒロ//マサヨシ
880               |6 720-03/(B |a Suehiro//Masayoshi
880               |6 720-04/$1 |a マキ//ジュン
880               |6 720-04/(B |a Maki//Jun
880               |6 720-05/$1 |a クスミ//カズヒサ
880               |6 720-05/(B |a Kusumi//Kazuhisa
```

ホットプレス用アルミニウムめっき鋼板の諸特性 (...

ホットプレス用アルミニウムめっき鋼板の諸特性 (自動車用材料特集)

国立国会図書館請求記号 Z17-328
国立国会図書館書誌ID 6674061

資料種別	著者	出版者	出版年
記事	末広 正芳ほか	東京 : 新日本製鐵技術開発本部	2003

資料形態	掲載誌名	掲載ページ
紙	新日鉄技報 / 新日本製鐵株式会社技術開発本部, 技術開発企画部 編 (378) 2003	p.15~20

すべて見る

図書館で読む

国立国会図書館：所蔵あり
東京 関西
来館して利用する

全国の図書館：所蔵あり
所蔵している図書館を見る（全1館）

お気に入り URLをコピー

引用文（参考文献注）を生成
書誌情報を出力
他のデータベースで探す

全国の図書館 国立国会図書館 書誌情報

全国の図書館の所蔵

国立国会図書館以外の全国の図書館の所蔵状況を表示します。 連携機関・データベースの一覧 >
所蔵のある図書館から取寄せることが可能かなど、資料の利用方法は、ご自身が利用されるお近くの図書館へご相談ください

地域の図書館を設定する >

都道府県順 すべての資料形態

その他

CiNii Research 検索サービス
紙 連携先のサイトで、CiNii Researchが連携している機関・データベースの所蔵状況を確認できます。

この本の所蔵を確認 >

国立国会図書館の所蔵

利用したい資料を選択してください。 国立国会図書館請求記号 Z17-328

東京本館 東京都千代田区永田町1-10-1 来館利用のご案内 >

(374)-(381) 20010300-20041000 資料送付ID: 1200800584114
東京本館：雑誌カウンター（新館） 書庫

ログインするとサービスが利用できます
ログイン 初めての方は新規利用登録へ

関西館 京都府相楽郡精華町精華台8-1-3 来館利用のご案内 >

(378) 2003 資料登録ID: 1200300811431
関西館：書庫

国立国会図書館の利用ははじめてですか？ >
閲覧や複写（コピー）、インターネットで読む方法を案内します。

書誌情報

この資料の詳細や典拠（同じ主題の資料を指すキーワード、著者名）等を確認できます。

引用文（参考文献注）を生成 書誌情報を出力

紙

資料種別	記事
タイトル	ホットプレス用アルミニウムめっき鋼板の諸特性
著者・編者	末広 正芳 真木 純 楠見 和久 他
シリーズタイトル	自動車用材料特集
著者標目	末広 正芳 真木 純 楠見 和久
タイトル（掲載誌）	新日鉄技報 / 新日本製鐵株式会社技術開発本部, 技術開発企画部 編
巻号年月日等（掲載誌）	(378) 2003
掲載号	378
掲載ページ	15～20
掲載年月日（W3CDTF）	2003

もっと見る

国立国会図書館サーチ NDL SEARCH

Language : English

資料にアクセスするための手段
インターネットで資料を読む
資料のコピーを入手する
図書館で資料を読む

国立国会図書館ホームページ | お問い合わせ お知らせ プライバシーポリシー サイトポリシー

© 2024- National Diet Library, Japan
画面番号 104

Appendix
SUEHIRO14

LDR naa a2200517z 4500
001 6674061
003 JTNDL
005 20030919133029.0
008 030916 ||||||||ja fr p | |0jpn||
022 |a 0916-7609 |1 0916-7609
041 |a jpn
084 |a ZP42 |2 kktb
090 |a Z17-328
24500 |6 880-01 |a Characteristics of aluminum-plated steel sheets for hot press
300 |a 15-30
363 |b 378 |i 2003
4900 |6 880-02 |a Special Feature on Automotive Materials
720 |6 880-03 |a Suehiro//Masayoshi
720 |6 880-04 |a Maki//Jun
720 |6 880-05 |a Kusumi//Kazuhisa |e et al.
7730 |t Nippon Steel Tech. Report / Nippon Steel Corp., Tech. Development Div., Tech. Development Planning Dept., ed.
|d Tokyo: Nippon Steel Corp., Tech. Development Div., Technical Development Planning Dept., 1991-2012.
|g (378) 2003 |w 000000079970
88000 |6 245-01/$1 |a Hottopuresuyo aruminiumumekki kohan no sho tokusei
88000 |6 245-01/(B |a Hottopuresuyo aruminiumumekki kohan no sho tokusei
8800 |6 490-02/$1 |a Jidoshayo zairyo tokushu
8800 |6 490-02/(B |a Jidoshayo zairyo tokushu
880 |6 720-03/$1 |a Suehiro//Masayoshi
880 |6 720-03/(B |a Suehiro//Masayoshi
880 |6 720-04/$1 |a Maki//Jun
880 |6 720-04/(B |a Maki//Jun
880 |6 720-05/$1 |a Kusumi//Kazuhisa
880 |6 720-05/(B |a Kusumi//Kazuhisa



Characteristics of aluminum-plated steel...

Characteristics of aluminum-plated steel sheets for hot press (Special Feature on Automotive Materials)

National Diet Library Billing
Z17-328

National Diet Library Bibliographic ID
666 40 61

Reading in the library.

National Library of Congress: Owned

Tokyo, Japan Kansai

Visit and use

Libraries across the country: owned by

View the library (all one library)

Favourites Copy the URL

Generate citations (reference note)

Output bibliographic information

Search in other databases.

Document type	Authors	Publisher	Year of publication
Articles	Masayoshi Suehiro and others	Tokyo : New Japan Steel Technology Development Division	2003

Document form	Publication name	Posting page
Paper	Nippon Steel Technical Report / Technology Development Division, Technology Development Planning Department, Nippon Steel Corporation (378) 2003	p.15 to 20

See all

Libraries across the country. National Diet Library Bibliographic information

Library of the whole country.

Displays the holdings of libraries nationwide other than the National Diet Library.

List of partner organizations and databases >

Please contact your local library for how to use the materials, such as whether it is possible to receive it from the library where you own it.

Set up a local library. >

By Prefecture All Doc. Types

Others

CiNii Research Search Service

Paper

You can check the holding status of the organization and database that CiNii Research is cooperating with on the linked site.

Confirm the holding of this book >

Collection of the National Diet Library

Please select the materials you want to use. National Diet Library Billing Z17-328

Tokyo Main Building

1-19-1 Nagatacho, Chiyoda-ku, Tokyo Information on visiting the museum >

(374)-(381) 20010300-20041000 ID: 1200800584114

Tokyo Main Building: Magazine Counter (New Building) Library

⚠In use (Scheduled return date: March 3, 2026)

You can use the service when you log in

Log in

For the first time, go to a new use registration

Kansaikan

8-1-3 Seikadai, Seikadai, Seika-cho, Soraku-gun, Kyoto Prefecture

Information on visiting the museum >

(378) 2003 ID: 1200300811431

Kansai-kan: Library

Is this your first time using the National Library?
We will guide you through how to browse, copy (copy), and read on the Internet.

Bibliographic information

You can check the details and the source of this document (keywords referring to the material of the same subject, author name, etc.).

Generate citations (reference note)

Output bibliographic information

Paper

Document type	Articles
Title	Characteristics of aluminum-plated steel sheets for hot press
Author/Editor	Masayoshi Suehiro Jun Maki Kazuhisa Kusumi, etc.
Series Title	Automotive Materials
Author's Targets	Masayoshi Suehiro Jun Maki Kazuhisa Kussumi
Title (published magazine)	Nippon Steel Technical Report / Technology Development Division, Technology Development Planning Department, Nippon Steel Corporation
Volume Title Date, etc. (published magazine)	(378) 2003
Issued	378
Posting page	15 to 20.
Date of publication (W3CDTF)	2003

View more

National Diet Library Search
NDL SEARCH

How to access the materials

Read the materials on the Internet

Get a copy of the material

Read the materials in the library

National Diet Library website Contact Us News Privacy Policy Site Policy

© 2024- National Diet Library, Japan.

Screen number 104

Appendix
SUEHIRO15

Certification of Accuracy

I, Frank McGee, a translator fluent in the English and Japanese languages, on behalf of Source IP, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

The document is designated as: Certificate



Frank McGee

February 13, 2026

Appendix
SUEHIRO16

（証明番号）
国図利 2512175-3-7 号

国立国会図書館所蔵図書館資料に関する証明書

以下のとおり相違ないことを証明する。

図書館資料名及び請求記号	新日鉄技報 Z17-328
出版年・巻号等	平成 15 年 7 月 31 日 第 378 号
受入年月日	平成 15 年 8 月 13 日
掲載記事	ホットプレス用アルミニウムめっき鋼板の諸特性 Properties of Aluminum Coated Steels for Hot-forming
ページ	表紙、目次、15～20 ページ、奥付

令和8年 2 月 10 日

国立国会図書館利用者サービス部長

大場　利康

ISSN 0916-7609

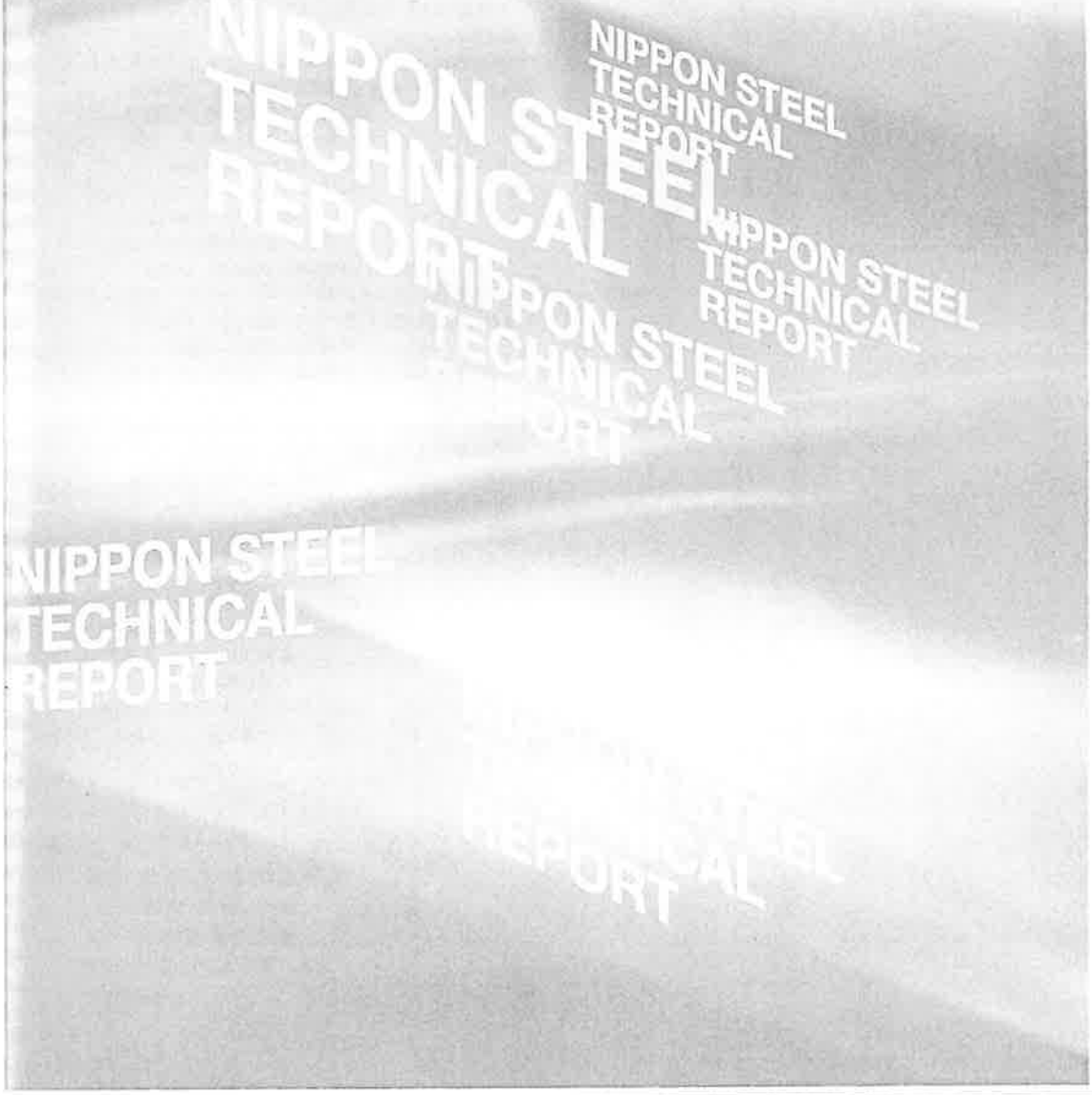
新日鉄技報

Z17-328
(378)
2003
1200300811430
国立国会
15.08.13
図書館

No.378 2003

特集●自動車用材料

http://www0.nsc.co.jp/kenkyusho/index.html



新日鉄技報

第378号　　平成15年（2003）7月

—目　　次—

自動車用材料特集

（巻頭言）

1. 自動車用材料の特集号発刊に際して ・・・

Shinnittetsu Giho

No. 378 July 2003

— Contents —

Special Issue on Materials for Automotive Use
(Preface)
1 Remarks on Special Issue on Materials for Automotive Use
K. YAMAZAKI
(Technical Report)
2 Development of High Strength Steels for Automobiles
M. TAKAHASHI
7 High Strength Hot-rolled Steel Sheets for Autmobiles
M. TAKAHASHI, O. KAWANO, T. HAYASHIDA, R. OKAMOTO, H. TANIGUCHI
12 Developments of Ultra High-strength Cold-rolled Steel Sheets for Automotive Use
T. NONAKA, K. GOTO, H. TANIGUCHI, K. YAMAZAKI
15 Properties of Aluminum Coated Steels for Hot-forming
M. SUEHIRO, J. MAKI, K. KUSUMI, M. OHGAMI, T. MIYAKOSHI
21 Material Characterization at High Strain Rates for an Optimization of Car Body Structure at Crash Events
A. UENISHI, H. YOSHIDA, Y. KURIYAMA, M. TAKAHASHI
25 Shape Control Techniques for High Strength Steel in Sheet Metal Forming
T. YOSHIDA, T. KATAYAMA, K. HASHIMOTO, Y. KURIYAMA
30 Factors to Determine Static Strengths of Spot-weld for High-strength Steel Sheets and Developments of High-strength Steel Sheets with Strong and Stable Welding Characteristics
Y. SAKUMA, H. OIKAWA
35 Welding Methods and Forming Characteristics of Tailored Blanks (TBs)
Y. MIYAZAKI, K. HASHIMOTO, Y. KURIYAMA, J. KOBAYASHI
40 Chromate-free Electrogalvanized Steel Sheets for Automobile Use "ZINKOTE MZ"
K. ISHIZUKA, K.HAYASHI, K. NISHIMURA, H. SHINDO, M. KUROSAKI
43 Lubricant Film for Zinc Coated Steel Sheets
T. OCHIAI, S. SUZUKI, A. MIYASAKA, M. FUKUI, M. HIRATA, K. ITOH
46 Pb-free Coated Steel Sheet for Fuel Tanks
M. KUROSAKI, K. MATSUMURA, T. IZAKI, J. MAKI, M. FUDA, A. MIYASAKA, S. SUZUKI
51 Electrical Steel Sheet for Traction Motor of Hybrid/Electric Vehicles
M. YABUMOTO, C. KAIDO, T. WAKISAKA, T. KUBOTA, N. SUZUKI
55 Present and Future Trends of Stainless Steel for Automotive Exhaust System
Y. INOUE, M. KIKUCHI
62 Application of Titanium and Its Alloys for Automobile Parts
H. FUJII, K. TAKAHASHI, Y. YAMASHITA
68 Development of Lead Free Micro Alloyed Steel for Crank Shafts
M. HASHIMURA, H. HIRATA, H. KANISAWA, K. NAITO
72 Development of Anti-coarsening Extra-fine Steel for Carburizing
M. KUBOTA, T. OCHI
77 State of the Art for High Tensile Strength Steel Cord
H. TASHIRO, T. TARUI

Published by
Technical Development Planning Div.
Technical Development Bureau
Nippon Steel Corporation
6-3, Otemachi 2-chome, Chiyoda-ku, Tokyo 100-8071, Japan

日 鉄 技 報 第378号] (2003)

UDC 669.718.5:669.14.018.295-415

ホットプレス用アルミニウムめっき鋼板の諸特性

Properties of Aluminum Coated Steels for Hot-forming

末広正芳*(1) 真木 純*(2) 楠見和久*(2) 大神正浩*(2)
Masayoshi SUEHIRO *Jun MAKI* *Kazuhisa KUSUMI* *Masahiro OHGAMI*
宮腰寿拓*(3)
Toshihiro MIYAKOSHI

抄 録

オーステナイト域の温度に加熱した鋼板をプレス成形すると同時に焼入れを行い高強度の部品を作製するホットプレスが注目を集めている。このホットプレスには加熱時の表面酸化とその後の耐食性確保にアルミニウムめっき鋼板が適していると考えられる*。焼入れ性に優れた母材にアルミニウムめっきを施した鋼板をこのホットプレスに適用した際の材質特性，表面特性，スポット溶接性等に関し検討した。金型での焼入れ後に1 500MPa以上の強度となること，また，表面のめっき層は加熱によりFe-Al合金相となり，JASO法CCT試験による耐食性試験結果では合金化溶融亜鉛めっき鋼板と同等の耐食性を示すこと，スポット溶接性にも優れること等が明らかとなった。(*Arcelor社とのグローバル戦略提携契約に基づくライセンス契約商品(USIBOR1500))

Abstract

Production of parts with high strength by means of hot-forming process has been receiving considerable attention lately. Application of aluminized steel with good hardenability for this process has been investigated*. Tensile strength over than 1500MPa was obtained with steel containing around 0.2mass% C. Surface coated layer changed from Al-10% Si to Fe-Al(-Si) phases through the hot-forming process. The steel with Fe-Al(-Si) surface layer showed good paintability even without phosphatized treatment. After painting, they showed good corrosion resistance in JASO-CCT as galvanized steel did. The steel showed good spot weldability due to the stable surface layer at high temperature. (*license product within the frame of global strategic alliance with Arcelor (USIBOR1500))

緒 言

年，環境問題に端を発する自動車の軽量化や衝突時の安全性向いった観点から高強度鋼板の使用が積極的に行われている。部よってはより高強度の鋼板を用いることで鋼板厚みをより低減大きな軽量化を可能とできることから，用いられる鋼板強度もIPaや590MPa級にとどまらず780MPa級以上へと上昇している。強度が増加するにつれ一般的には成形性が劣化する。これを克るため各種組織制御を行った高強度鋼板が開発されてきた[1]。しながら，鋼板強度が1 500MPa程度になると複雑な形状へのプ成形は困難になると思われる。

500MPa程度の強度を持つ部材を得るため欧州ではダイクエンホットフォーム，ホットスタンプあるいはホットプレスと呼ば成形法が実用化されている[2]。この成形法では鋼板は900℃程度ーステナイト域の温度に加熱され常温の金型で成形することに焼入れ鋼板強度を高める。また，このような工法は国内におい検討されており，めっきを施していない鋼板を用い検討あるい用化されている[3,4]。また欧州においてはArcelor社がホットプレ性と優れた耐食性を有するアルミニウムめっき(以下アルミめっき)製品USIBOR1500をすでに開発実用化している[2,5,6]。新日本製鐵は，Arcelor社とのグローバル戦略提携契約に基づき，USIBOR1500のライセンス契約を結び，商品の製造技術および製品特性の検討を進めてきた。本論文ではホットプレス用のアルミめっき鋼板の各種特性に関し検討した結果を報告する。

2. ホットプレス工程

ホットプレス工程は既に実用化されている。図1にその工程を簡単に示す。この製法では鋼板をオーステナイト域の温度(A_{c3}以上)ま

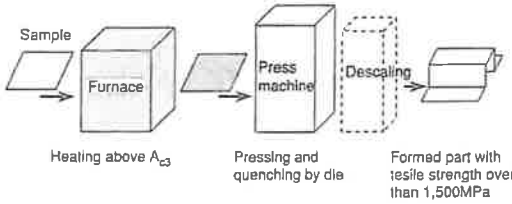


図1 ホットプレス工程の模式図

八幡技術研究部 主幹研究員 工博(現 鉄鋼研究所 マネジャー)
北九州市戸畑区飛畑町1-1 〒804-8501 TEL:(093)872-6812

*(2) 八幡技術研究部 主任研究員
*(1) 八幡製鉄所 厚板部 マネジャー

熱することが必要である。例えば0.2mass%程度のC量を含有するでは850℃以上の温度に加熱することが必要となる。加熱後，ら取り出された鋼板はプレス機まで搬送され常温の金型で成形時に焼入れが行われる。成形後鋼板全体が完分焼入れされるまで死点で保持する。

このような成形工程をとるが，めっきを施していない鋼板を使用る場合には加熱時のスケール生成や脱層脱炭を抑えるため非酸化気とする必要がある。また，非酸化雰囲気で加熱した場合でもいちプレス機までの間は大気雰囲気となるため短時間でも表層にールが生成する。プレス成形品は使用時には疲労が付与される層にスケールが存在すると問題となる。したがって，めっきをていない鋼板を使用した場合にはスケールを除去するプロセス要となる。スケール層の除去はショットブラストや酸洗で可能らるがこれらはコスト上昇を招く。また，ショットブラストを用た場合には形状変化を生じる恐れがある。耐熱性に優れためっき反を用いるとこの工程が不要となる。

素　　材

前述したようにホットプレス工程では鋼板を急速に冷却すること度を高めるため焼入れ性に優れることが必要となる。表面に関では耐熱性に優れためっきを施しておくことで前述した加熱炉の雰気制御やスケール除去のためのプロセスが不要となり，製造を易にすることができる。以上のような条件を満足する鋼板とし表1に示すような成分系のアルミめっき鋼板があげられる。なめっき付着量は120～160g/m²のものを用いた。この鋼板の各種特を以下に概説する。

母材特性

4.1　焼入れ前後の引張特性

本鋼板の焼入れ前後の特性を表2に示す。引張試験は1.4mmの厚の素材からJIS5号引張試験片を作製し行った。出荷時の強度は490～590MPa級であり，金型での焼入れ後は1 500MPa以上となる。な強度は図2に示すようにC量で調整することが可能である。図2実験室的にC量を変化させた素材を真空溶解で溶製し焼入れ後の械的特性を調査した結果である。これまでに知られているように入れ後の機械的特性はC量とともに増加することがわかる。焼入伏の強度，つまり成形製品の強度はC量を調整することで制御可である。なお，焼入れ時の強度に対するMn，Cr等の置換型固溶元素の影響は小さいことが知られている。これら置換型固溶元素は入れ性に影響するため，次章で述べる焼入れ性を確保するために重要となる。ただし，これら元素を過剰に添加すると製品板の強が高くなることを考慮しておく必要がある。

表1　検討に用いた鋼板の成分(mass%)

C	Mn	Cr	B
0.22	1.2	0.15	0.002

表2　焼入れ前後の引張特性

	Yield strength (MPa)	Tensile strenghu (MPa)	Elongation (%)
As coated	394	615	26
As formed	1,260	1,530	8

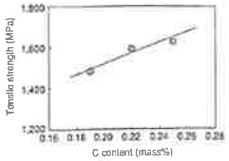


図2　C量と引張特性の関係

4.2　焼入れ性

図3にこの鋼のCCT曲線(950℃からの連続冷却曲線)を，図4に冷却速度と硬さの関係を示す。この鋼板に焼入れ性を高めるためMnやBが添加されており，加熱温度が950℃の場合約20℃/s以上の冷却速度で硬度をHV450～500の範囲とすることができる。この焼入れ速度は冷却中でのフェライト，パーライトおよびベイナイトへの変態を避ける条件で決まる。これらの変態はオーステナイト粒径が小さいと，つまり加熱温度が低いと速くなるため，焼入れに必要な冷却速度が速くなる。この点については加熱温度を900～1 000℃として検討を行ったが，この範囲ではあまり大きな差はなくどの加熱温度においても20～30℃/s程度に臨界冷却速度があった。

図3および図4および前述した他の加熱温度での実験結果からホットプレス時の鋼板の冷却速度が30℃/s以上であればどのような冷却速度をとっても十分な硬さが得られることがわかる。しかしながら，実際のプレス工程では加熱炉からプレス機への搬送とプレス開始までの間は空冷に近い冷却速度となる。

1.4mm程度の厚みの鋼板では大気雰囲気で冷却すると10～15℃/s

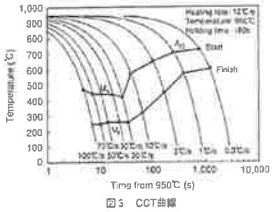


図3　CCT曲線

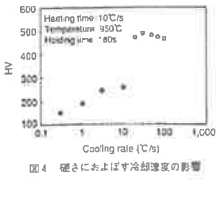


図4　硬さにおよぼす冷却速度の影響

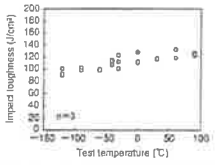


図5　シャルピー試験時の衝撃値と温度の関係

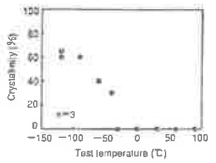


図6　シャルピー試験時の脆性破面率と温度の関係

の冷却速度となるが，この冷却速度で600℃以下まで冷却されると鋼板の強度が低下することが図3および図4からわかる。950℃から600℃までの時間は23～35秒となり素材を炉から取り出してから23秒以内に金型での冷却を開始すれば素材を投入れることが可能となる。なお，この関係は加熱条件，冷却中の雰囲気や周りの環境により変化するため，実際のホットプレス作業環境に応じ決定する必要がある。

4.3　靭性

焼入れによりマルテンサイト相で強度を確保した場合には靭性，特に低温での靭性が劣化する懸念がある。この点に関しシャルピー衝撃試験にて検討した結果を図5および図6に示す。図5は衝撃値と温度の関係を，図6は脆性破面率を示す。この試験は4mmの熱間圧延板を焼入れ後に2mmUノッチ2.5mmサブサイズ衝撃試験片を作製して行った。吸収エネルギーは室温から−60℃までまわり大きな変化を示さない。一方，脆性破面率は−40℃以下で増加し，−60℃では約80%となり，遷移温度($T_{E_{50}}$)は−60℃程度である。脆性破面率は板厚が薄くなると低減する傾向にあり，2.5mmより薄い板厚の場合には遷移温度はより低下するものと考えられる。以上の結果から，この鋼板は焼入れのままのマルテンサイト相を主体とする組織で使用されるが，通常の環境下で低温になって急激に吸収エネルギーが変化したり破壊形態が変化することはないものと推定されることがわかる。

5.　スポット溶接性

めっき付着量を120g/m²とする板厚1.2mmのアルミめっき鋼板を950℃で5分加熱し，金型で所望から挟み込むことで焼入れを行いスポット溶接用サンプルとした。表層のめっき層の変化に関しては次章で説明するが，Fe-Al合金のめっきとなっている，相手材としては板厚1.8mmの440MPa級の冷間圧延薄鋼板を用いた。スポット溶接は，DR6ｆ型のアルミナ分散銅を電極とし，通電を17サイクル(60Hz)，加圧を400kgfとして行った。図7にナゲット径と電流密度の関係を示すがナゲット径が板厚を：として4√t となる電流値とちりが発生する電流値の範囲は約3kA存在することがわかる。図8はせん断引張強度と電流値の関係を，図9は十字引張強度と電流値の関係を示す。図10にナゲット近傍の硬さ分布を示すが，ナゲット内および母材部は約480のビッカース硬さを持ち溶接熱影響部(HAZ)にて300程度に軟化する。このような硬さ分布を持つため，ナゲット径が充分な大きさを持つ場合破断部はこのHAZとなることが多い。

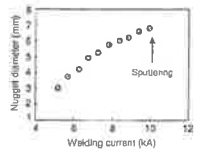


図7　スポット溶接部のナゲット径と電流値の関係

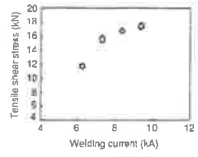


図8　スポット溶接部のせん断引張強度と電流値の関係

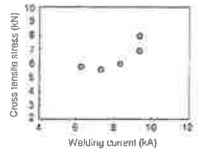


図9　スポット溶接部の十字引張強度と電流値の関係

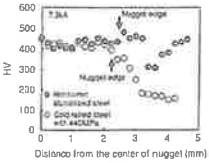


図10　ナゲット近傍の硬さ分布

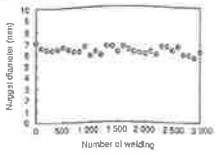


図11 連続打点によるナゲット径の変化

図11は連続打点性を評価した結果である。試験は3 000点まで行ったが，この範囲ではナゲット径の変化はあまりなく3 000点以上の連続打点も可能であると推定される。この鋼板の表層のめっき層は融点が1 000℃以上のFe-Al合金相となっているが，このことがこのような連続打点性を持つ理由と考えられる。

ここではアーク溶接性に関しては示していないが，Fe-Al合金相は沸点が2 000℃以上であり，亜鉛系のめっき鋼板で問題となるアーク溶接時のブローホールの発生は無い。

6. めっき特性

6.1 加熱時のめっき層の合金化

本鋼板の表層めっきはSiを10％含有するアルミめっきであり，Type 1と呼ばれているものである。このめっき層の溶融温度は約600℃であるため急速に加熱するとめっき層は一旦溶融するが，電気炉で得られる加熱速度では加熱中に融点の高いFe-Al合金層が生成し，逆やかに表層まで達するため溶融物が炉材等に付着することはない。大気雰囲気中の電気炉で板厚1.6mmの素材を加熱した場合，保定温度に達するまでの時間は約2分であった。

図12に950℃で0.5分間保定した際の合金化の状況を，図13は表層のめっき層のFe，AlおよびSi濃度を板厚方向にSEM-EDSで測定した結果を示す。合金化が進行すると図に示すようなAlおよびFe濃度を持つ層状の合金相が形成される。この加熱条件下では合金相は5層からなり，Al濃度は最表層から順に約50％，30％，50％，30％，10％と変化している。4層目から母層にかけては元素濃度が連続的に変化している。

図14にThermo-calc[11]により計算したFe-Al-Si系の950℃での状態図を示す。この図に図13で示した各点の組成を重ねた。なおこの計算のFe-Al-Si系熱力学データベースはZ. Liu ら[11]によるものを使用した。図14から合金層は表層からFe_2Al_5，BCC規則相，$FeAl_3$，BCC規則相，BCC不規則相と推定される。表層の合金層は保定時間が長くなるとAlが母層へと拡散していくため最表層から消滅していく。図15は保定時間を5分としたときのめっき層を示す。断面組織からは1相しか識別できなくなっているが，SEM-EDSで分析すると2相が存在していることがわかった。このときの相はBCC規則相と不規則相と考えられる。



図12 950℃で30秒保定した試料のめっき層構造を示す断面光学顕微鏡写真

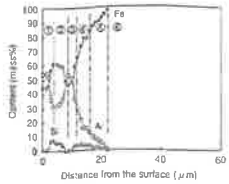


図13 図12に対応したサンプルの板厚方向のFe, Al, Si元素濃度変化

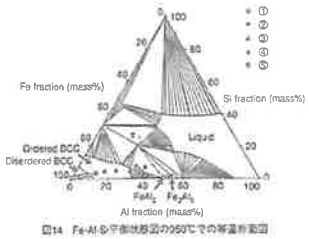


図14 Fe-Al-Si平衡状態図の950℃での等温断面図

6.2 塗装性および塗装後耐食性

鋼板は自動車への適用に際して電着塗装されて使用されるが，通常，塗装性を確保するため塗装前に化成処理が施される。化成処理は一般にりん酸亜鉛系の溶液中で行われ，表面にりん酸塩の皮膜を形成させる。この皮膜により塗装性，塗料密着性が確保されるが，Fe-Al合金相は化成処理液に浸漬してもこの化成皮膜が形成されない。これはFe-Al合金相が鉄に対して非常に安定な相であるためである。しかしながら図16でわかるように加熱処理後の表面は凹凸がありこれによるアンカー効果で塗装性が確保される。表3は化成処理を施した試料及び施さない試料に約30μm厚みの電着塗装を行ない，塗装後の密着性を検討した結果であるが，十分な特性を確保していることがわかる。このように塗料密着性は化成処理の有無にかかわらず確保可能である。

図15 950℃で5分保定後のめっき層構造を示す断面光学顕微鏡写真

めっき付着量を160g/m²とするアルミめっき鋼板を900℃で2分加熱することで表層をFe-Al合金めっきとした鋼板を化成処理液に浸漬し，約25μmの電着塗膜後，表面の塗膜にクロス状の疵(クロスカット)を入れJASOM610に定めた複合腐食試験(CCT)を150サイクル(50日間)行った後の外観を図17に示す。JASO法CCTの試験条件を以下に示す。

塩水噴霧(5%NaCl，35℃，2h) → 乾燥(60℃，4h) → 湿潤(50℃，2h)

比較材としてめっきを施していない冷間圧延鋼板および合金化溶融亜鉛めっき鋼板(付着量片面45g/m²)を使用した。これらの材料は化成処理を施し，化成皮膜が生成していることを確認した後に試験に供した。腐食試験の途中でクロスカット部からの塗膜剥れ幅を片側最大剥れ幅として評価した結果を図18に，また150サイクル後の板厚方向への腐食深さを表層からレーザー光により1試料当たり各5カ所ずつ測定して平均値並びに標準偏差を算出した結果を図19に示す。これらの結果から，Fe-Al合金相をめっき層とする鋼板の耐食性は剥離幅，腐食深さとも溶融亜鉛めっき鋼板より優れ，合金化溶融亜鉛めっき鋼板と同等の特性を持つ事がわかる。塗装後耐食性を重視する場合にはめっき付着量を150g/m²程度とすることが望ましい。

表3 塗料密着性評価結果

	Surface preparation	Primary adhesion*	Secondary adhesion**
Hot-formed aluminized steel	Phosphated	100/100	100/100
Hot-formed aluminized steel	Degreased	100/100	100/100
Galvannealed steel	Phosphated	100/100	100/100
Steel	Phosphated	100/100	100/100

*Primary adhesion test: 100 grid cross-cutting by 2mm and taping after painting
**Secondary test: dipping at 40℃ water for 10 days and cross cutting and taping



図16 950℃で5分保定後のめっき層表層形態を示すSEM写真

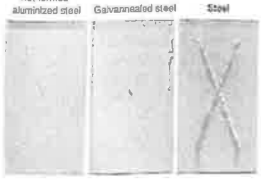


図17 JASO法CCT試験50日後の試料外観

6.3 スポット溶接部の耐食性

図20はスポット溶接時に電極と接していた部分および電極と接触していなかった部分の断面組織を示す。この図から，電極と接していた部分のめっき層はスポット溶接時に温度が上昇してもほとんど変化せずスポット溶接前と同様の厚みを有していることがわかる。そのためこの部分の塗装後耐食性は平板部と全く変わらず，図21に示すように塩水噴霧試験(SST)にて2 000時間経過においても全く

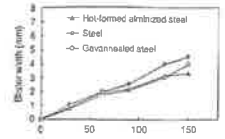


図18 JASO法CCT試験による塗膜剥れ幅の変化

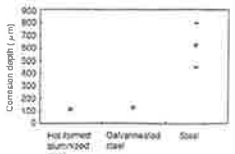


図19 JASO法CCT試験50日後の板厚方向腐食深さの変化



図20 スポット溶接後の電極直下および通常部のめっき層(腐食液：しゅう酸)

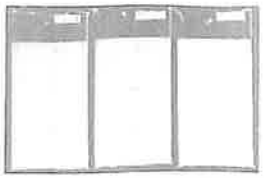


図21 スポット溶接部の塗装後耐食性のSSTによる評価，2000時間後の外観

腐食していないことがわかる。他のめっき鋼板ではスポット溶接を行った際，電極と接していた部分のめっきは溶融し電極と母材の間から押出されめっき金属が盛り上がり突起状になることがあるが，この部分は充分な塗装厚みが確保できず耐食性に問題が生じることがある。

7. 結　　言

本報告ではホットプレス用アルミめっき鋼板の母材特性および表面特性について述べた。母材特性に関しては，プレス成形時の金型焼入れで冷却速度がばらついても30℃/s以上の冷却速度が確保できれば均一な強度を有する部材が得られること，引張特性に関しては降伏強度：1 280MPa，引張強度：1 530MPa，伸び：8%が得られること，耐水素脆性にすぐれること等を述べた。スポット溶接性に関しては，表層のアルミめっきがプレス前の加熱で融点の高いFe-Al合金相となることに起因してめっき層の存在による劣化はないことや連続打点性に優れることを示した。また耐食性に関しては，Fe-Al合金相はめっきを施していない鋼板と合金化溶融亜鉛めっき鋼板の間に位置することを示した。

以上のような特徴を持つ鋼板をホットプレスに適用することで，比較的複雑な形状を持つ高強度で耐食性に優れた部材の製造が可能となる。

参考文献

1) Senuma, T.: ISIJ Int. 41, 520(2001)
2) Bano, X., Laurent, J. P.: Proc. of 39th Mechanical Working and Steel Processing Conf. Vol. XXXV, Indianapolis, 1998, p.673
3) 廣村敏樹, 内野龍一, 加藤希人, 佐藤昌彦：自動車技術会学術講演会前刷集. 942, 1994-5, p.73
4) 例えば, アイシン高丘：東京モーターショー. 月刊素形材. 43, (2002)
5) Comene, D., Hourman, T., Hudin, O., Laurent, J. P., Reynaert, A.: Proc. of SAE 2001, p.19
6) Ronin, F.: Variant-Flexible Steel Forming in Automotive Production. 2nd Europian Practice Conf. Bad Nauheim, Frankfurt, 2002
7) Sundman, B., Jansson, B., Andersson, J.-O.: CALPHAD. 9, 153(1985)
8) Zi-kui Liu, Y. Austin Chang: Metall. Mater. Trans. A. 30A, 1081(1999)



Appendix
SUEHIRO17

(Certificate Number)
National Library of Japan Certificate No. 2512175-3-7

[Seal of the Director of the User Services Department at the National Diet Library]

Certificate for Library Document Held by the National Diet Library

I hereby certify that the following information is accurate.

Library Material Title and Call Number	Nippon Steel Technical Report Z17-328
Publication Year/Volume/Issue	July 31, 2003 No. 378
Date Received	August 13, 2003
Published Article	Properties of Aluminum Coated Steels for Hot-Forming Properties of Aluminum Coated Steels for Hot-Forming
Pages	Cover, Table of Contents, Pages 15-20, Copyright Page

February 10, 2026

Toshiyasu OBA
Director, User Services Department,
National Diet Library

[Seal of the Director of the User Services Department at the National Diet Library]

Appendix
SUEHIRO18

```
leader  01430nas-a2200409---4500
001     99110978966557024
005     20230321200429.0
008     740618u1972uuuuja-fr-p-o-----0---a0eng--
016     7#$a012427181 $2Uk
016     7#$a2141063-X $2DE-600
035     ##$a(CKB)110978966557024
035     ##$a(CONSER)---73640872-
035     ##$a(DE-599)ZDB2141063-X
037     ##$b6-3, Otemachi 2-chome, Chiyoda-ku, 100
041     1#$aeng $hjpn
042     ##$apcc $ansdp
043     ##$aa-ja---
050     00$aTS300 $b.N566
082     0#$a672/.05
210     ##$aNIPPON STEEL TECH REP
210     ##$aNIPPON STEEL TECHNICAL REPORT
210     0#$aNippon steel tech. rep., Overs.
222     #0$aNippon steel technical report. Overseas
245     00$aNippon steel technical report. $pOverseas.
260     ##$a[Tokyo] $bNippon Steel Corp.
300     ##$a1 online resource
336     ##$atext $btxt $2rdacontent
337     ##$acomputer $bc $2rdamedia
362     0#$ano. 1- 1972-
580     ##$a"A complete or abridged translation of articles that appeared in ... 'Seitetsu kenkyu.'"
650     #0$aSteel industry and trade $vPeriodicals.
650     #7$aSteel industry and trade. $2fast $0(OCoLC)fst01132646
655     #7$aPeriodicals. $2fast $0(OCoLC)fst01411641
710     2#$aShin Nihon Seitetsu Kabushiki Kaisha.
776     08$iPrint version: $tNippon steel technical report. $x0300-306X $w(DLC)   73640872 $w(OCoLC)1784867
906     ##$aJOURNAL
920     ##$aexl_impl conversion
```

JOURNAL

Nippon steel technical report. Overseas.

Shin Nihon Seitetsu Kabushiki Kaisha.

1972

Available at Arthur Lakes Library Journals Collection (Floors 1 & 1M) (X)

Available Online

TOP
CITE OR SHARE
VIEW ONLINE
GET IT
SEARCH INSIDE
VIRTUAL BROWSE

Cite or Share

EMAIL CITATION PERMALINK ENDNOTE EXPORT RIS EASYBIB QR

View Online

Full text availability

Free E- Journals

Available from 1993 volume: 56 until 2013 volume: 140.

Get It

Please sign in to check if there are any request options. Sign In

BACK TO LOCATIONS

LOCATION AND ITEM INFORMATION

Arthur Lakes Library

Available , Journals Collection (Floors 1 & 1M) ; X

Summary holdings:

no.21 (1983:June)-no.79 (1999:Jan.)

no.80 (1999)-no.86 (2002)(Bound)

View less

LOCATE

Item in place (0 requests)

Not loanable

Search inside

Search for articles within this journal

Article title or keyword

Virtual Browse


Journal of solar energy engineering.


Journal of biomechanical engineering.


Rock products (Chicago, Ill. : 1917)


Journal of applied mechanics


Chemical Society reviews.

1980 1977 c1963 (New York, N.Y. : 1959) c1972

c1959

Related Links

Ask a Librarian ›
Suggest a Purchase ›
Can't Find It ›
Report a Problem ›
Display Source Record ›

Details

Title	Nippon steel technical report. Overseas.
Author/Creator	Shin Nihon Seitetsu Kabushiki Kaisha. ›
Subject	Steel industry and trade ›
Genre	Periodicals
Related titles	Available in other form: Print version: Nippon steel technical report. ›
Publisher	Tokyo Nippon Steel Corp. no. 1- 1972-
Creation Date	1972
Format	1 online resource
Language	English
Source	Library Catalog
Alma Record ID	997226947202341
Identifier	ISSN : 0300-306X