

MULTNOMAH COUNTY LIBRARY
COLLECTION SHRINKAGE—A
BASELINE REPORT

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A REPORT FOR THE MULTNOMAH COUNTY LIBRARY

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MULTNOMAH COUNTY LIBRARY COLLECTION SHRINKAGE—A BASELINE REPORT

Executive Summary

In July 2005, the library administration contacted staff from the Multnomah County Budget Office Evaluation, a unit external to the Library's internal management system, to request independent assistance estimating the amount of missing materials at the library, known in the private sector as '*shrinkage*'. While much of shrinkage can be due to theft, it is impossible to distinguish between this and misplaced or inaccurate material accounting. Results reported herein should be considered a baseline assessment and not an annualized rate.

There are three general ways to categories how shrinkage occurs to the library collection: materials are borrowed by patrons and unreturned; items which cannot be located are subsequently placed on missing status; and materials missing in the inventory, where the catalog identifies them as being on the shelf, are not located after repeated searches. Each of these three ways was assessed and reported separately due to the nature of their tracking. Shrinkage was measured for all branches and outreach services and for most material types, with the exception of non-circulating reference materials, paperbacks, CD-ROMS, maps, and the special collections. This analysis reflected 1.67 million of the 2.06 million item multi-branch collection (87% of the entire collection).

Both unreturned and missing status items were queried in the library's Millennium data system. Unreturned items over four years accounted for approximately 5.6% of the current collection, and were the single largest source of shrinkage. Missing status items accounted for approximately 2.9% of the collection.

The materials missing in inventory had to be sampled and manually checked and rechecked by library staff to determine if they were indeed gone from the collection. A stratified random sample of library collection's available for check-out was selected and inventoried to provide a snapshot estimate of the additional missing items. Only 56% of materials were available at the time of sampling, with the remaining materials checked-out to library patrons. Results found that 3.1% (+/- 0.2%) of the library's collection believed to be on the shelf were missing in inventory.

These system-wide shrinkage calculations mask the amount shrinkage by specific material types, specifically those of multi-media materials. Results showed that CDs, DVDs, and videotapes consistently had the greatest amount of shrinkage in the collection. Young adult materials showed elevated shrinkage levels among printed materials. A preliminary analysis of security steps taken by the library to safeguard DVDs and CDs showed promising reductions in shrinkage of these materials.

Examining the collection missing in inventory by branch found a range of 1.0% loss at Albina to 9.4% of the Rockwood branch (excluding unreturned and missing status items). North Portland and Holgate branches also showed elevated levels of loss of 5.3% and 4.9%, respectively.

Unfortunately, comparable shrinkage data from other jurisdictions, the private sector, previous research and audits were difficult to obtain. Those located were reported herein, however they were not wholly comparable to Multnomah County's results. Recommendations, common library shrinkage reduction strategies, and research limitations areas are discussed.

BACKGROUND

Library administrators initiated this project after *The Oregonian* published several stories related to theft of materials at the Multnomah County library in June of 2005. The County's library system is comprised of 16 geographically dispersed branches, a central location, and community outreach services that manage a more than two million item collection (Appendix G).¹ The Multnomah County library system has the highest circulation of any library system in the United States, with approximately 19.5 million items circulated (Public Library Association, 2006).

The library administration was committed to responding to the issue and determining the best approaches to quantifying and reducing shrinkage of the library's collection. Inventory shrinkage is a private sector term defined as the loss attributable to a combination of shoplifting, employee theft, administrative errors, and vendor fraud (Hollinger & Langton, 2005).

The administration's goals were to consider the various security options and costs, but they were unable to perform the necessary cost-benefit analysis because they had incomplete data regarding the size and scope of the collection's shrinkage. In July 2005, the library administration contacted staff from the Multnomah County Budget Office Evaluation, a unit external to the Library's internal management structure, to request independent estimates of materials loss at the library.²

The library administrators had several objectives for this research:

1. Estimate shrinkage by material type (fiction, non-fiction, DVDs, CDs, etc.),
 - a. Examine attributes in multi-media shrinkage in greater detail,
2. Estimate the overall shrinkage at the County library system,
3. Estimate shrinkage by branch location, and
4. Obtain the data necessary for cost-benefit analyses of various shrinkage prevention strategies.

There are generally three categories that account for collections shrinkage: *unreturned*, *missing status*, and *missing in inventory* (Figure 1). Items that are "unreturned" were lost in circulation by patrons checking them out and failing to return them. In this case, overdue fines and lost charges are levied against the patron's account, and if they grow too large, the account is turned over to a collections agency. According to the library administration, an average of 65% of charges are successfully collected by the collections

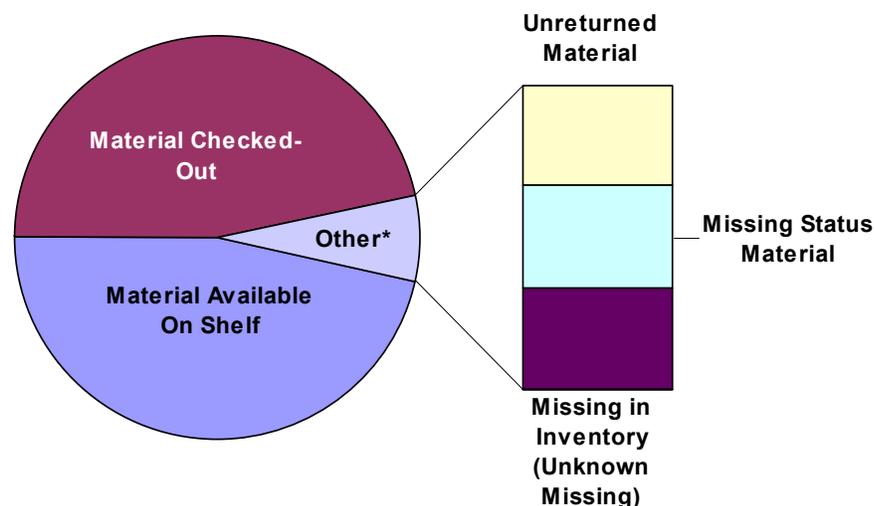
¹ Multnomah County Library collections holdings for FY2005-06 was 2.1 million items.

² Research activities by the Budget Office Evaluation staff did not begin until early 2006, due to the library migration from the DYNIX data system to the Millennium data system, and to conflicting work schedules.

agency. The data is captured and reported cumulatively over the last four years in the Millennium data system.

Next are items that cannot be located, typically after a request is made by a patron. Staff would attempt to locate the requested material and when they were unsuccessful the item is listed as “missing status” materials. Sometimes these are found at a later date. Items on missing status are tracked by the library’s data system and typically purged from the system annually. However, due to the migration to the new data system the last purge was performed in the spring of 2005.

Finally, there are items that according to the catalog should be on the shelf, but which cannot be found in an inventory. These items are currently not known to be “missing in inventory”, for had they been previously identified they would have been placed into missing status. To calculate these requires an inventory of materials. The results of an inventory search represent a snapshot in time for an inventory that in some cases may be nearly 20 years or more.



*Materials retired due to age or damage, and those sent to the Title Wave bookstore are not counted.

Figure 1. Conceptual Library Collection and Shrinkage Categories (proportions illustrative only)

Each of these factors are accounted for somewhat differently and therefore caution should be used when assessing shrinkage various rates. Two of the three factors are cumulative counts over in some cases several years, while the sample inventory is a snapshot of the collection at a specific time. Because of the different methodologies of these factors, it is inappropriate to simply add them together as an annualized rate.

Defining the issues. On the surface, the concept of measuring shrinkage or loss rates at public libraries appears fairly straightforward. Unfortunately, there are several reasons why this was not the case, mostly due to the fact that there are no approved standards in

defining, measuring, calculating, and reporting shrinkage. Because of this, comparing the Multnomah County library system results to others proves difficult.

A review of recent American Library Association publications on performance measurement and evaluation, found no reference to measuring library material loss or theft (Durrance & Fisher, 2005; Rubin, 2006). This was unusual given the vast amounts of data that libraries submit as part of the Public Library Association's annual performance measures. A search of municipal performance measurement texts found little or no reference to the concept of reporting shrinkage or loss (Ammons, 2001; Tighe & Strachota, 1995).

An examination through the National Association of Local Government Auditors' (NALGA) database of performance audits from various jurisdictions yielded no relevant or comparable examples of material shrinkage measurement (cities of Philadelphia, PA.; San Jose, CA.; & Baton Rouge, LA.; see References).³ This included a 2004 performance audit conducted by the Multnomah County Auditor's Office.

McCree (2000), who has to date provided the most comprehensive and recent review of the issues, notes that the difficulty with evaluating shrinkage at libraries lies in what the author termed "a problem of definitions." When calculating shrinkage, how you define and measure will dramatically influence the results. For example, when calculating does one include known sources (i.e., unreturned materials by patrons) as well as unknown sources? What about materials that have since been identified as lost and subsequently purged from the data system? Should materials that are mutilated—often to avoid detection of enhanced security systems—be included in the count (Mast, 1983)? Besides traditional materials, should all library losses be considered (e.g., computers, artwork, patron's personal items, other library property, etc.)?

Determining theft is even more difficult to assess. While shrinkage may be highly related to theft, it is also due mis-shelved materials and errors in inventory accounting (Burnett, 1990; Hollinger & Langton, 2005). From a measurement point of view, there is no standard accepted definition of what constitutes theft, or how to identify and measure it. For example, if a patron unintentionally removes a book from the library without checking it out (e.g., in a stack of self-checkout materials, one is missed) is that considered theft? On the flip side, if someone intentionally takes an item but is caught at the door, can library staff clearly conclude it as attempted theft or simply a mistake?

Other difficulties lie in the fact that there is no accepted standard methodology for determining library shrinkage. Several options exist, each with their own advantages and disadvantages (typically cost versus accuracy). Complete inventories, partial inventories, random samples of entire or selected sections, stratified random samples, and spot-checks of 'high-loss' materials have all been performed and in some cases compared (Foster, 1996; Greenwood & McKean, 1985; Griffith, 1978; McCree, 2000; Pinzclik, 1985).

³ Philadelphia and San Jose did perform limited item checks, but these were not related to the entire collection, and focused more upon the processes and controls for adding new materials to the collection versus collection loss.

The most accurate would be a full inventory of the entire system performed at regular intervals. Unfortunately, for a system like Multnomah County with its two million item collection—of which half is in use and not on the shelf—a full inventory would prove time consuming, expensive, and highly disruptive to patrons. On the opposite side, spot-checking ‘high-loss’ materials can lead to inaccurate conclusions of loss due to the less than rigorous sampling nature—it would be easy to miss true ‘high-loss’ areas if all areas were not considered equally. A comparison of a full inventory snapshot versus seven other sampling methods, identified little variance between sampling and a full inventory when a proper sampling methodology is followed (Foster, 1996).

It is important to note that inventory methods and their calculations also depend upon the frequency of inventories, which are surprisingly uncommon. Burrows and Cooper’s research of libraries in the United Kingdom nearly fifteen years ago found that the frequency of library inventories varied from annually to infrequently, to often never (1992). Little difference was found more recently with American libraries.

A survey of American urban library administrators by the Urban Libraries Council found that 61% of respondents did not conduct inventories of their collection as part of their loss prevention measures (Urban Libraries Council, 2005). Only 10% did full inventories with another 12% randomly sampling their entire collections. Only 20% said they performed the inventory on an annual basis. Based on the logistics of a larger library system, it’s likely that libraries that perform either full or entire system samples are smaller than the system at Multnomah County. The last inventory of the Multnomah County library system was back in the mid- to late 1980’s.⁴

Finally, there is no accepted standard formula or measure for calculating inventory shrinkage or calculating a loss rate. Some determine an annual loss rate only for new items since loss has been found to be highest for the newest materials (3M Canada, online; Burrows & Cooper, 1992; McCree, 2000). Others reported the entire collection as system-loss snapshot in time (Foster, 1996; Greenwood & McKean, 1985). This would report loss of any materials regardless of age of materials, which includes items which may have unknowingly been lost years or even decades ago. Other less common calculations include Burrows and Cooper’s (1992) loss as it relates to circulation (books per thousand loans); Lincoln and Lincoln’s (1986) international comparison of book theft index per population and per patron population; and Griffith’s annual loss rate by Dewey decimal number (1978).

Given these and other issues related to the cost of performing the work it was not surprising to find very little published quality comparative data available. According to

⁴ Veteran Multnomah County library staff recalled a library sampling inventory that was performed in the mid to late 1980’s to determine loss rate, however a hard copy of the report was never located. Staff were unable to remember specific details to the report, only that it was at one time done and its results lead to the implementation of a previous theft detection system. According to staff, a subsequent inventory, performed a year after that security system was installed, showed no change in the loss rate. The system was removed in the early 1990’s because the gates and ropes caused traffic and access problems in the library buildings.

the American Library Association, there is no established ‘standard’ rate of loss due in part to the varying methods listed above. Most of the published measures of loss, regardless of definition or various methodological concerns, centered around small library systems, academic or other specialized libraries, or libraries from other counties (Burrows & Cooper, 1992) .

METHODS

Definition. Due to the three general ways items can go missing, each were examined and reported separately. *Unreturned* items that were never returned by patrons are tracked by the library in the Millennium data system. These were queried and reported separately. *Missing status* items previously identified are also tracked in the Millennium data system and were reported separately. Items that were supposed to be on the shelf and available for checkout were statistically sampled and inventoried to determine a percentage of the collection missing in inventory, another factor in shrinkage.

Sampling for missing inventory. Based on McCree’s work, items that were missing in inventory were defined as available cataloged items which were not currently on loan or in transit, but which could not be found after repeated attempts (2000). Therefore, only inventory currently not known to be missing was estimated through sampling. Although it is highly probable that those materials not found, either in missing status or through sampling, were stolen, it is impossible to say for certain.

Due to the size and nature of material flow, the inventory consisted of a stratified random sample selected by material types.⁵ Lost materials were calculated as a snapshot percentage of all sampled library system materials. To reduce likelihood that items were missed due to patron use or mis-shelving, the process was repeated for missing items after a month (Burnett, 1990).

Inventory Process. On February 25, 2006, after the library closed for the evening, the library’s Millennium data system was queried for all materials currently available for check-out in the library system. Data were separated by material types (e.g., fiction, non-fiction, CDs, DVDs, etc.). The data excluded the following material types: special collections, non-circulating reference materials, CD-ROM, maps, paperbacks, and other miscellaneous materials, which accounted for approximately 13% of the library’s collection.⁶ Items that were not currently available (e.g., checked-out, unreturned, missing status, retired to Title Wave Used Bookstore, or damaged/ out of circulation) were not included in the sampling methodology. The total number of available materials was 939,419. Based on the database count ending FY05-06 (i.e., July 2006) the total population was estimated to be 1,668,903 items. Approximately 56% of library materials

⁵ Stratification on material type and branch would dramatically increase the amount of work of library staff, and was therefore not selected.

⁶ There were several reasons why the administration chose to exclude these categories. Such as, small proportion of the total collection, greater efficiency for staff and researchers time, difficulty in isolating and retrieving a list from the new data system, and because these categories were more difficult items to locate.

were available for check-out.⁷ Appendix A lists the FY05-06 collection by type and location.

The available collection data was processed into stratified random samples based on material types. Samples were designed to give a margin of error of +/-3% at a 95% confidence interval under a conservative response distribution of 50% for each material type. The material types included: fiction, juvenile easy, non-fiction, juvenile fiction, foreign language, young adult, large print, juvenile non-fiction, audiotape, music scores, CD, DVD, and videotape. To ensure that the samples were random, they were statistically tested against the available population of material by category on both age of material and the frequency of branch location. The 13 stratified samples had a final total sample size of 13,164 items.

Lists were then compiled by location and sent to the branches for inventory the next morning before the library opened. Staff from the branches searched the shelves to locate the exact item based on its unique barcode. If it was located it was coded '*found.*' If the material was not found, it was then checked against the data system to see if it had been checked out, otherwise circulated, or removed from the system (e.g., retired or repaired title).

To identify materials that may have been misplaced, a similar process was repeated a month later. All materials not initially located were searched against the data system for activity. If no activity was identified, the shelf was checked a second time. If any of these checks yielded a positive match, the item was coded '*found.*' If not, the item was coded '*missing.*' Figure 2 depicts the shrinkage and inventory process from total material population and sample selection, to identification of missing in inventory items.

Shared collection. Shared collections refers to materials that can automatically change their “home” location in the library’s Millennium data system when they are checked out at one branch location and returned to another. Items that do not “share” must be shipped back to their home location when they are returned to a branch that is not their home before they can circulate again. Sharing high-circulation items such as CDs, DVDs, and videotapes, cuts down on the number of items that must be shipped around the system and puts them into circulation faster after they are returned. Due to issues with the way Millennium handles shared materials, the shared collections home location became problematic for inventory purposes, particularly with high circulating multi-media materials. When searching for one of these items, it was possible that it was at a location that was different from what was reported in Millennium. Therefore, CDs, DVDs, and videotapes were checked a third time via Millennium for patron activity four months after the second inventory search. If any of these checks yielded a positive match, the multi-media item was coded '*found.*' If not, all other items were ultimately coded '*missing in inventory.*'

⁷ The Holgate branch’s non-fiction collection was inadvertently excluded from the data submitted for sampling. The non-fiction collection was 9,325 items. If these items were included the collection size would have been approximately 1,678,228.

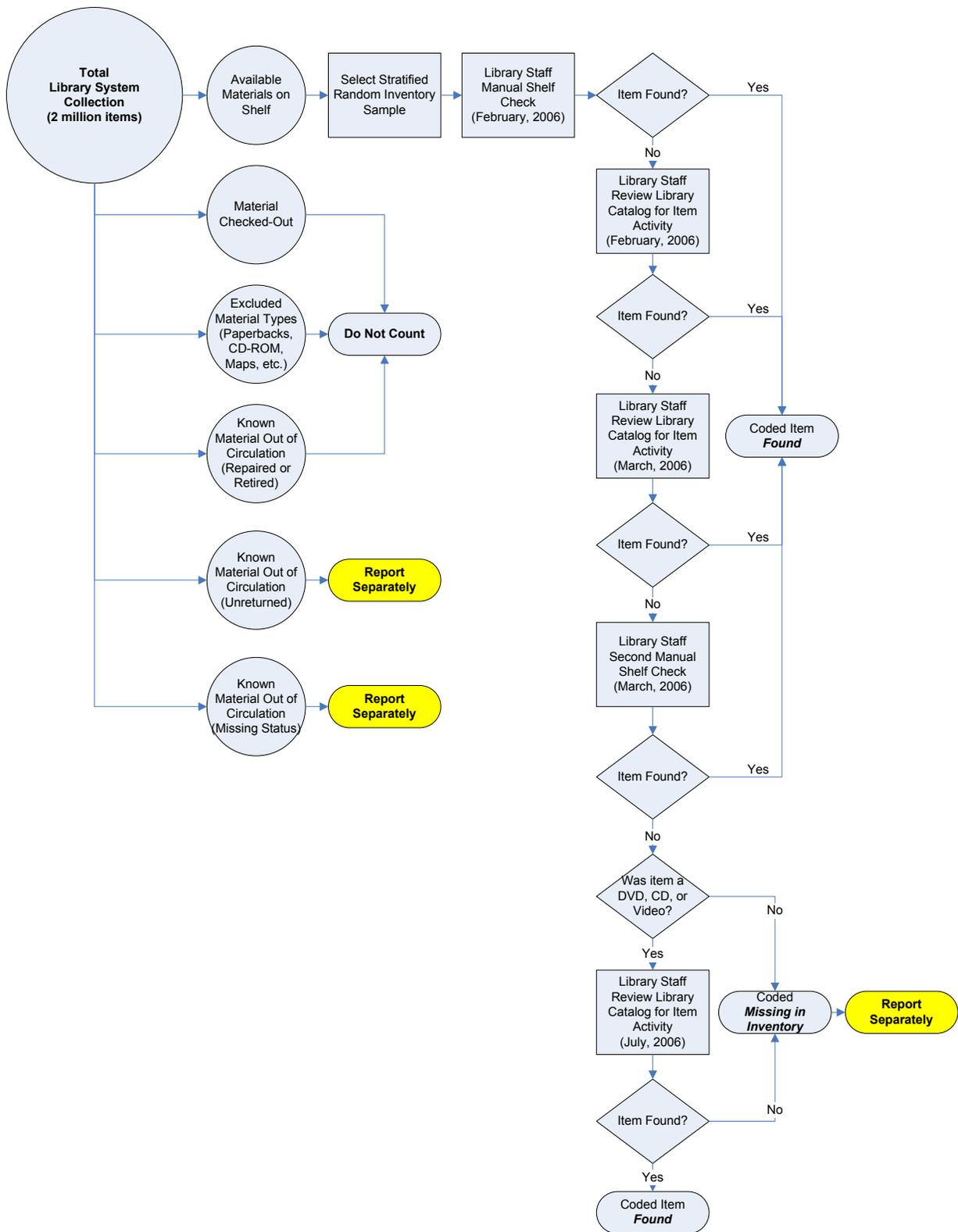


Figure 2. Shrinkage Assessment Process

RESULTS

Unreturned. There were a total of 102,675 unreturned items that were checked-out and lost in circulation by patrons over a four year period.⁸ Table 1 shows the number of items unreturned by material type at the end of FY05-06. Unreturned items cumulatively accounted for approximately 5.6% of the collection. Non-fiction accounted for nearly a third of all unreturned items.

Table 1. Unreturned Materials by Type (cumulative four year total)

Material Type	Total Library Collection (FY05-06)**	Unreturned by Patrons (FY05-06)	Library Collection (FY05-06) Plus Unreturned	Percent of Collection Unreturned
Audiotape	37,195	1,480	38,675	3.8%
CD (music+ book)	131,765	14,028	145,793	9.6%
DVD	69,208	8,614	77,822	11.1%
Fiction	218,907	11,758	230,665	5.1%
Foreign	46,475	1,570	48,045	3.3%
Juvenile Non-Fiction	140,849	5,167	146,016	3.5%
Juvenile Easy	147,872	7,506	155,378	4.8%
Juvenile Fiction	64,686	3,432	68,118	5.0%
Large Print	26,294	433	26,727	1.6%
Music Scores	39,929	593	40,522	1.5%
Non-fiction	648,182	31,525	679,707	4.6%
Videotape	47,001	8,289	55,290	15.0%
Young Adult	50,540	4,818	55,358	8.7%
Total*	1,668,903	99,213	1,768,116	5.6%

*Excludes 3,462 items from other categories.

** Library Collection total does not include unreturned items.

The percentage of the collection unreturned by patrons varied widely by material type, with multi-media collections suffering most. Fifteen percent of the videotape collections was currently unreturned by patrons, and higher than average levels were also noted in DVDs (11%) and CDs (10%) of the collection. Young adult books had the highest unreturned amounts for printed materials (9%).

Missing status. According to the Millennium data system there were 48,422 items in missing status at the close of FY05-06.⁹ This included items that were reportedly returned by a patron, but that never materialized in the system (a.k.a., claims returned). Table 2 shows the number of missing status items by material type. The library has a process to do subsequent searches for items in missing status, to determine whether they can later be found. That process had not yet taken place at the time the data for this report was collected, so it is not known how many of these items might be found with additional

⁸ Excludes 3,462 items in special collections, CD-ROM, maps, paperbacks, and other miscellaneous materials. In addition, there were 10,068 items that were coded as ‘errors’ in the data system migration, which were not included in these results. The number of items represented a four year cumulative total.

⁹ Excludes 1,137 items in special collections, CD-ROM, maps, paperbacks, and other miscellaneous materials. Missing status represent a cumulative total from April 2005 until June 2006.

searches. Missing status items accounted for approximately 2.9% of the collection over a 14-month period. Non-fiction and CDs each accounted for about 25% of missing status items.

Table 2. Missing Status Items by Material Type

Material Type	Total Library Collection (FY05-06)	Missing Status (FY05-06)	Percent of Collection on Missing Status
Audiotape	37,195	849	2.3%
CD (music+ book)	131,765	12,346	9.4%
DVD	69,208	3,260	4.7%
Fiction	218,907	6,278	2.9%
Foreign	46,475	587	1.3%
Juvenile Non-Fiction	140,849	1,948	1.4%
Juvenile Easy	147,872	1,589	1.1%
Juvenile Fiction	64,686	966	1.5%
Large Print	26,294	274	1.0%
Music Scores	39,929	370	0.9%
Non-fiction	648,182	12,455	1.9%
Videotape	47,001	4,851	10.3%
Young Adult	50,540	2,649	5.2%
Total*	1,668,903	48,422	2.9%

*Excludes 1,137 items from other categories.

As with unreturned materials, the percentage of the collection on missing status varied widely by material type, again with multi-media collection suffering most. About 10% of the videotape collections was currently listed on missing status with higher levels also in CDs (9%). Elevated levels, albeit lower than others, were also noted in the DVD collection. Young adult books had the highest missing status amounts for printed materials (5%).

Missing in inventory sampling. The 13,164 item stratified random sample included materials from the 16 branches, a central location, and community outreach services at varying proportions (see Appendix B). Of those, a total of 12,287 items were found (93.3% of the sample). There were 877 missing in inventory items in the sample of available materials (6.6%). Most items were located on their initial search (95.4%), with 3.7% found on the subsequent search. A third search added just 0.8%.¹⁰ Music scores, DVD, and CDs showed a slightly greater than average likelihood of being found on the second search versus other material types. Additional items would have likely been found in a full third follow-up search, but the amount would likely have been immaterial.

After the searches were completed and the data were returned for analysis it was discovered that the Holgate branch was missing all data related to its non-fiction

¹⁰ The third search was for DVD, CD, and videotape materials due to tracking issues with the shared collections.

collection.¹¹ Follow-up determined that the Millennium data for Holgate’s non-fiction collection were never received for sampling. Overall, non-fiction materials account for the largest single material type in the library’s collection (~35%). While this will have modest impact on the system calculations, it must be noted that the estimates of the Holgate branch will only reflect materials other than the non-fiction collection.

Calculating missing in inventory by material type. Missing in inventory sampling does not directly equate to missing materials or total missing collection (Appendix C). Therefore, the results are reported in several sections to illustrate calculations to collection lost (see Tables 3 – 6). Table 3 displays the total collection, available material and sample sizes for each of the material strata. The amount of materials available to check out was 56% of the collection, but varied widely by material type with 85% of music scores available for patrons and only 4% of the DVD collection available. Multi-media materials overall had the lowest availability rates (less than half), while printed materials were typically more than half.

Table 3. Library Collection, Available Materials, and Sample, by Material Type

Material Type	Total Library Collection (FY05-06)	Material Available for Check-Out	Percent Available for Check-Out	Random Sample of Available Material
Audiotape	37,195	19,055	51%	1,011
CD (music+books)	131,765	40,288	31%	1,040
DVD	69,208	2,472	4%	746
Fiction	218,907	132,427	60%	1,059
Foreign	46,475	35,286	76%	1,036
Juvenile Easy	147,872	72,785	49%	1,052
Juvenile Fiction	64,686	38,879	60%	1,039
Juvenile Non-fiction	140,849	91,826	65%	1,055
Large Print	26,294	18,085	69%	1,008
Music scores	39,929	33,920	85%	1,035
Non-fiction*	648,182	413,842	64%	1,065
Videotape	47,001	13,994	30%	992
Young Adult	50,540	26,560	53%	1,026
Unweighted Total	1,668,903	939,419	56%	13,164

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

Anecdotal discussions and research suggested that the percentage of materials missing in inventory would vary by the type of material (e.g., printed materials versus multi-media materials). Table 4 displays the results of the search and the estimated materials missing in inventory by type. It is important to note that the missing in inventory estimates reflect the *available* items by material type and not the entire collection.

¹¹ Holgate’s non-fiction was estimated at 9,325 items. Juvenile non-fiction—a separate material type—was accounted for in the Holgate sample.

Table 4. Missing in Inventory Point Estimates

Material Type	Random Sample of Available Material	Sample Found	Sample Missing in Inventory	Missing in Inventory Point Estimate	Missing in Inventory Lower Bound	Missing in Inventory Upper Bound
Audiotape	1,011	954	57	5.6%	4.4%	7.2%
CD (music+books)	1,040	867	173	16.6%	14.5%	19.0%
DVD	746	671	75	10.1%	8.1%	12.4%
Fiction	1,059	1,004	55	5.2%	4.0%	6.7%
Foreign	1,036	965	71	6.9%	5.5%	8.6%
Juvenile Easy	1,052	1,008	44	4.2%	3.1%	5.6%
Juvenile Fiction	1,039	998	41	3.9%	2.9%	5.3%
Juvenile Non-fiction	1,055	1,017	38	3.6%	2.6%	4.9%
Large Print	1,008	986	22	2.2%	1.5%	3.3%
Music scores	1,035	996	39	3.8%	2.8%	5.1%
Non-fiction	1,065	1,010	55	5.2%	4.0%	6.7%
Videotape	992	860	132	13.3%	11.3%	15.6%
Young Adult	1,026	951	75	7.3%	5.9%	9.1%
Unweighted Total	13,164	12,287	877			

Based on the known availability of materials at the time of the sample, the number of missing materials by type can be estimated using the point estimates provided. Table 5 displays the estimated number of materials missing in inventory by material type and provides for the weighted system total estimate.¹² The system-wide missing in inventory estimate was 5.5%. As stated above, this estimate reflects the missing inventory of *available* items by material type, not the percent of the entire collection missing.

Table 5. Missing in Inventory Count Estimates

Material Type	Material Available for Check-Out	Missing in Inventory Point Estimate	Missing in Inventory Lower Bound	Missing in Inventory Upper Bound	Missing Available Material Point Estimate	Missing Available Material Lower Bound	Missing Available Material Upper Bound
Audiotape	19,055	5.6%	4.4%	7.2%	1,074	835	1,378
CD (music+books)	40,288	16.6%	14.5%	19.0%	6,702	5,838	7,663
DVD	2,472	10.1%	8.1%	12.4%	249	200	307
Fiction	132,427	5.2%	4.0%	6.7%	6,878	5,310	8,873
Foreign	35,286	6.9%	5.5%	8.6%	2,418	1,930	3,020
Juvenile Easy	72,785	4.2%	3.1%	5.6%	3,044	2,278	4,054
Juvenile Fiction	38,879	3.9%	2.9%	5.3%	1,534	1,135	2,064
Juvenile Non-fiction	91,826	3.6%	2.6%	4.9%	3,307	2,424	4,509
Large Print	18,085	2.2%	1.5%	3.3%	395	262	593
Music scores	33,920	3.8%	2.8%	5.1%	1,278	940	1,733
Non-fiction	413,842	5.2%	4.0%	6.7%	21,372	16,512	27,562
Videotape	13,994	13.3%	11.3%	15.6%	1,862	1,586	2,177
Young Adult	26,560	7.3%	5.9%	9.1%	1,942	1,559	2,409
Weighted Total*	939,419	5.5%	5.2%	5.9%	51,950	48,380	55,708

*Shaded values denote weighted system total.

¹² Because the stratified sampling methodology led to disproportionate sample sizes in each material category, the entire system estimate had to be weighted to calculate proper point estimates.

The number of missing in inventory materials was estimated at 51,950 items (between 48,380 and 55,708 items), and ranged from 395 large print items to 21,372 non-fiction items. The volume of missing in inventory items generally reflected the size material type collection.

Based on the missing in inventory estimates calculated above, the percentage of the total collections missing in inventory and the percentage of the total collections missing by material type can be estimated. This percentage is based upon the collection counts that occurred at the end of FY2005-2006 in July 2006, and may have changed slightly from the time the sample was inventoried. Table 6 shows that the estimated 51,950 items missing in inventory represents 3.1% of the nearly 1.67 million item collection (between 2.9% and 3.3%).

Table 6. Collection Missing in Inventory by Material Type

Material Type	Total Library Collection (FY05-06)	Missing Available Material Point Estimate	Missing Available Material Lower Bound	Missing Available Material Upper Bound	Collection Missing in Inventory	Collection Missing in Inventory Lower Bound	Collection Missing in Inventory Upper Bound
Audiotape	37,195	1,074	835	1,378	2.9%	2.2%	3.7%
CD (music+books)	131,765	6,702	5,838	7,663	5.1%	4.4%	5.8%
DVD	69,208	249	200	307	0.4%	0.3%	0.4%
Fiction	218,907	6,878	5,310	8,873	3.1%	2.4%	4.1%
Foreign	46,475	2,418	1,930	3,020	5.2%	4.2%	6.5%
Juvenile Easy	147,872	3,044	2,278	4,054	2.1%	1.5%	2.7%
Juvenile Fiction	64,686	1,534	1,135	2,064	2.4%	1.8%	3.2%
Juvenile Non-fiction	140,849	3,307	2,424	4,509	2.3%	1.7%	3.2%
Large Print	26,294	395	262	593	1.5%	1.0%	2.3%
Music scores	39,929	1,278	940	1,733	3.2%	2.4%	4.3%
Non-fiction*	648,182	21,372	16,512	27,562	3.3%	2.5%	4.3%
Videotape	47,001	1,862	1,586	2,177	4.0%	3.4%	4.6%
Young Adult	50,540	1,942	1,559	2,409	3.8%	3.1%	4.8%
Weighted Total**	1,668,903	51,950	48,380	55,708	3.1%	2.9%	3.3%

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

**Shaded values denote weighted system total.

Materials. Anecdote and research suggest that newer materials are more likely to go missing. Based on the date the materials were added to the collection, an analysis of the age of the available material sample was performed to compare those missing to those found. These results do not necessarily reflect the collection as a whole, since this only reflects available material at the time of the sample (i.e., it does not include missing status materials or unreturned items).

Table 7. Material Type (Sample) by Year Added to Collection

Material Type	Year Added to Collection (Available Sample)																			Total
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Audiotape	3	2	2	1		3	6	6	15	28	48	152	98	180	239	64	78	85	1	1,011
CD (music+books)	3	2	4	3	2	3	11	19	23	7	16	17	49	131	87	137	287	213	26	1,040
DVD													3	8	42	112	228	279	74	746
Fiction	59	11	5	8	20	10	13	12	21	24	43	58	63	110	127	176	179	105	15	1,059
Foreign	12	5	3		9	21	23	12	19	29	23	49	105	125	87	167	205	136	6	1,036
Juvenile Easy	1	4	8	1	4	3	5	14	14	20	56	99	98	140	131	166	173	104	11	1,052
Juvenile Fiction	59	5	9	4	5	7	14	26	9	21	44	69	68	152	152	156	133	91	15	1,039
Juvenile Non-fiction	16	2	6	5	7	10	6	18	26	37	65	69	85	139	138	167	140	93	26	1,055
Large Print	20		2	6	8	5	15	13	26	28	58	89	98	110	118	139	136	126	11	1,008
Music scores	485	14	36	23	29	78	35	12	28	35	24	48	21	38	23	58	35	13		1,035
Non-fiction*	165	15	26	10	15	34	30	23	29	29	53	65	76	114	94	101	106	72	8	1,065
Videotape	1	2	1		10	7	8	11	27	22	72	129	135	280	115	127	36	8	1	992
Young Adult								4	4	10	10	17	29	54	109	181	307	272	29	1,026
Total	824	62	102	61	109	181	166	170	241	290	512	861	928	1581	1462	1751	2043	1597	223	13,164
Percent of Sample	6%	0%	1%	0%	1%	1%	1%	1%	2%	2%	4%	7%	7%	12%	11%	13%	16%	12%	2%	100%

*The Holgate branch non-fiction collection was inadvertently excluded (~8,900 items).

The weighted system sample of available materials was initially tested, and results found that missing in inventory items were significantly newer than found items. The average age for missing in inventory items was 67 months (5.6 years old) while the average age for found items was 73.6 months (6.1 years).¹³

Comparing the age of missing and found items by individual material type identified inconsistent patterns. First, of the 13 different material types, only available CDs, DVDs, and Juvenile Easy materials had a significant differences in the age of missing or found items. CDs followed the general pattern noted above; those that were missing in inventory averaged 32.6 months old versus those found at 38.7 months old.

The pattern for both available DVDs and Juvenile Easy materials was reversed. DVDs that were missing in inventory averaged 25.6 months old versus those found that were 15.6 months old. Juvenile Easy materials that were missing in inventory averaged 63.2 months old versus those found at 49.6 months old. Again, since age data for the entire collection was not collected, it is not possible to know where these results reflect the entire collection.

Material missing in inventory by branches. Missing in inventory estimates for each branch collection were calculated, including Central, and Library Outreach Services (see Appendix D). Note that these did not include shrinkage due to unreturned items or missing status items. While branches have most material types, the material type composition of each branch are not evenly distributed. For example, Central has a majority of music scores, while Library Outreach Services has a large proportion of large print materials and no juvenile materials. The data were weighted to reflect the disproportionate branch collection size and material type distributions.

Missing in inventory by branches does not directly equate to missing materials or the entire missing collections (Appendix D). Therefore, the results are reported in several sections to illustrate calculations to the collections missing in inventory (see Tables 8 – 11). Table 8 displays collection sizes, available material and availability by branch locations. Availability ranged from 30% at Belmont to 70% at the Central Library.

¹³ F(1, 13163) = 7.959, p = .005.

Table 8. Branch Collection, and Available Materials

Branch Location	Total Library Collection (FY05-06)	Material Available for Check-Out	Percent Available for Check-Out
Albina	43,108	15,779	37%
Belmont	65,274	19,399	30%
Capitol Hill	46,225	22,087	48%
Central	592,305	412,256	70%
Fairview-Columbia	31,495	15,807	50%
Gregory Heights	48,664	26,598	55%
Gresham	127,769	70,767	55%
Hillsdale	90,217	42,964	48%
Holgate*	37,836	17,600	47%
Hollywood	117,403	43,274	37%
Library Outreach Services	20,206	13,175	65%
Midland	160,853	94,874	59%
North Portland	57,016	27,374	48%
Northwest	35,820	20,715	58%
Rockwood	41,818	24,100	58%
Sellwood	45,537	20,127	44%
St. Johns	38,950	22,395	57%
Woodstock	68,407	30,126	44%
Unweighted Total**	1,668,903	939,417	56%

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

** Note that 2 items were missing location identifier.

Based on the known availability of materials by location at the time of the sample, the percent and number of materials missing in inventory by branch can be estimated (Table 9). Due to small sample size, weighted estimates could not be accurately calculated for the Fairview-Columbia branch. As stated above, these estimates reflect the missing inventory of *available* items by branch type, and not their respective total collection.

Table 9. Weighted Branch Point Estimates

Branch Location	Random Sample of Available Material	Sample Material Found	Sample Missing in Inventory	Missing in Inventory Point Estimate	Missing in Inventory Lower Bound	Missing in Inventory Upper Bound
Albina	220	214	6	2.7%	1.3%	5.8%
Belmont	272	250	22	8.1%	5.4%	11.9%
Capitol Hill	310	300	10	3.2%	1.8%	5.8%
Central	5,777	5,473	304	5.3%	4.7%	5.9%
Fairview-Columbia	221	Sample size too small to accurately calculate estimates.				
Gregory Heights	372	358	14	3.8%	2.3%	6.2%
Gresham	992	932	60	6.1%	4.7%	7.7%
Hillsdale	602	572	30	5.0%	3.5%	7.0%
Holgate	247	220	27	10.9%	7.6%	15.4%
Hollywood	606	555	51	8.4%	6.5%	10.9%
Library Outreach Services	184	179	5	2.7%	1.2%	6.2%
Midland	1,329	1,279	50	3.8%	2.9%	4.9%
North Portland	384	341	43	11.2%	8.4%	14.7%
Northwest	289	273	16	5.5%	3.4%	8.8%
Rockwood	338	280	58	17.2%	13.5%	21.5%
Sellwood	281	270	11	3.9%	2.2%	6.9%
St. Johns	314	302	12	3.8%	2.2%	6.6%
Woodstock	422	392	30	7.1%	5.0%	10.0%
Weighted Total*	13,164	12,415	749	5.7%	5.3%	6.1%

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

*Shading denotes weighted system totals.

Table 10 displays the counts of material missing in inventory for each branch location. Branch point-estimate counts ranged from 356 at the Library Outreach Services to 21,190 at Central. Collections by branch show a missing in inventory range from 2.7% at both Albina and the Library Outreach Services to 16.3% at the Rockwood location. Again, the volume of missing inventory generally reflected the size of the material type collection.

Table 10. Lost Material Count Estimates by Branch

Branch Location	Material Available for Check-Out	Missing in Inventory Point Estimate	Missing in Inventory Lower Bound	Missing in Inventory Upper Bound	Missing Available Material Point Estimate	Missing Available Material Lower Bound	Missing Available Material Upper Bound
Albina	15,779	2.7%	1.3%	5.8%	431	199	918
Belmont	19,399	7.4%	4.8%	11.1%	1,426	933	2,149
Capitol Hill	22,087	2.9%	1.5%	5.4%	641	338	1,197
Central	412,256	5.1%	4.6%	5.7%	21,190	18,964	23,663
Fairview-Columbia	15,807	Sample size too small to accurately calculate estimates.					
Gregory Heights	26,598	3.8%	2.3%	6.2%	997	598	1,649
Gresham	70,767	5.9%	4.6%	7.5%	4,140	3,220	5,300
Hillsdale	42,964	4.8%	3.4%	6.8%	2,071	1,448	2,934
Holgate*	17,600	10.5%	7.3%	15.0%	1,853	1,283	2,636
Hollywood	43,274	8.4%	6.5%	10.9%	3,644	2,796	4,717
Library Outreach Services	13,175	2.7%	1.2%	6.2%	356	153	813
Midland	94,874	3.8%	2.9%	4.9%	3,567	2,713	4,668
North Portland	27,374	10.9%	8.2%	14.5%	2,995	2,242	3,956
Northwest	20,715	4.8%	2.9%	7.9%	1,001	601	1,645
Rockwood	24,100	16.3%	12.7%	20.6%	3,921	3,066	4,960
Sellwood	20,127	3.9%	2.2%	6.9%	787	443	1,383
St. Johns	22,395	3.8%	2.2%	6.6%	855	493	1,469
Woodstock	30,126	7.1%	5.0%	10.0%	2,142	1,512	3,004
Weighted Total**	939,417	5.5%	5.2%	5.9%	51,950	48,380	55,708

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

**Shading denotes weighted system totals.

Based on estimated branch missing inventory above, the percentage of the total branch collections missing can be estimated for each branch. These estimates do not include unreturned items by patron or missing status items, only missing in inventory items based on sampling. Collections by branch show a range of a missing inventory from 1.0% at Albina to 9.4% at the Rockwood location (see Table 11).

Table 11. Branch Collection Missing in Inventory

Branch Location	Total Library Collection (FY05-06)	Missing Available Material Point Estimate	Missing Available Material Lower Bound	Missing Available Material Upper Bound	Collection Missing in Inventory	Collection Missing in Inventory Lower Bound	Collection Missing in Inventory Upper Bound
Albina	43,108	431	199	918	1.0%	0.5%	2.1%
Belmont	65,274	1,426	933	2,149	2.2%	1.4%	3.3%
Capitol Hill	46,225	641	338	1,197	1.4%	0.7%	2.6%
Central	592,305	21,190	18,964	23,663	3.6%	3.2%	4.0%
Fairview-Columbia	31,495	Sample size too small to accurately calculate estimates.					
Gregory Heights	48,664	997	598	1,649	2.0%	1.2%	3.4%
Gresham	127,769	4,140	3,220	5,300	3.2%	2.5%	4.1%
Hillsdale	90,217	2,071	1,448	2,934	2.3%	1.6%	3.3%
Holgate*	37,836	1,853	1,283	2,636	4.9%	3.4%	7.0%
Hollywood	117,403	3,644	2,796	4,717	3.1%	2.4%	4.0%
Library Outreach Services	20,206	356	153	813	1.8%	0.8%	4.0%
Midland	160,853	3,567	2,713	4,668	2.2%	1.7%	2.9%
North Portland	57,016	2,995	2,242	3,956	5.3%	3.9%	6.9%
Northwest	35,820	1,001	601	1,645	2.8%	1.7%	4.6%
Rockwood	41,818	3,921	3,066	4,960	9.4%	7.3%	11.9%
Sellwood	45,537	787	443	1,383	1.7%	1.0%	3.0%
St. Johns	38,950	855	493	1,469	2.2%	1.3%	3.8%
Woodstock	68,407	2,142	1,512	3,004	3.1%	2.2%	4.4%
Weighted Total**	1,668,903	51,950	48,380	55,708	3.1%	2.9%	3.3%

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

**Shading denotes weighted system totals.

In addition to Rockwood, North Portland and Holgate both showed elevated collections missing inventory. However, Holgate's estimate is likely inflated due to the exclusion of its non-fiction collection during sampling. Based on the overall non-fiction missing, had Holgate's total collection been sampled, the branch collection missing would likely have been lower than 4.9%. These differences assume there to be no difference in patron reporting of missing materials and staff placing them into missing status, and/or in the level of material management and organization at various branches.

Changes in DVD and CD processes. After the *Oregonian* ran its stories, the library administration had DVDs moved from the collection floor to a secure location accessible to staff only. CDs were moved to more visible locations in each branch, where staff could monitor them more closely. These changes in security were completed by July 30, 2005. While changes were performed outside the scope of this study, administrators wanted to know if either of these efforts had any impact to the loss of these materials.

Data from the sampling methodology was used in an attempt to shed some light on the subject. All available DVDs that were added to the library's collection before the security change date were coded *Security* = 0 and those added after the change were coded *Security* = 1. A logistic regression model was used to determine if the security changes

indicated any difference in the likelihood that the available item would be found during the inventory.

Results of both the DVD and CD logistic regressions were promising; the change in security was significantly predictive in whether an item was located during inventory. Controlling for age of the material and all other things being equal, the likelihood of an available DVD being found was 17-times greater *after* the materials were moved out of reach of patrons.¹⁴

Controlling for age of the material and all other things being equal, the likelihood of an available CD being found was 2-times greater *after* the materials were moved to a more visible location.¹⁵

A note of caution. While the results of the DVD and CD changes appear promising, it should be cautioned that the effects could be merely an artifact of the available materials at the time of the sample, due to changes from increased media exposure, better organization of materials, or some other unknown variable or combination thereof. Additionally, the data suggest that DVD and CD shrinkage were more likely due to patrons checking them out and never returning them (~12% each) versus other forms of shrinkage. Unless the available materials are returned to their original locations and re-measured, it would be difficult to know whether for certain the effects were related to the security process changes at the library.

DISCUSSION

The result of the analysis of the 1.67 million of the library's 2.07 million item collection showed varying levels of shrinkage from a variety of sources. Patron's unreturned materials represent the single greatest source of shrinkage at 5.6% of the collection. Missing status materials accounted for 2.9%, and 3.1% were due to materials that were missing in the inventory based on sampling (+/-0.2%). Because of the different methods used to calculate the shrinkage, it is inappropriate to simply add up the shrinkage numbers for a single amount. Nonetheless, it is easy to see that a substantial percentage of the total collection is simply not available for patrons to use due to shrinkage.¹⁶

These system wide shrinkage calculations mask the amount shrinkage by specific material types, specifically those of multi-media materials. Table 12 shows that CDs, DVDs, and videotapes consistently had the greatest amount of shrinkage. Young adult materials showed elevated shrinkage levels among printed materials. This means that a

¹⁴ Initial constant log likelihood = 486.779. Block 1 model log likelihood = 433.847, $\chi^2(2) = 52.932$, $p < .001$; Age in Months $B = -0.032$ (Wald (1) = 10.004, $p = .002$), $\text{Exp}(B) = 0.969$; Security (1), $B = 2.832$ (Wald (1) = 7.557, $p = .006$), $\text{Exp}(B) = 16.984$. The classification table showed no significant improvement over constant-only model (89.9% correct).

¹⁵ Initial constant log likelihood = 936.094. Block 1 model log likelihood = 926.853, $\chi^2(2) = 9.241$, $p = 0.010$; Age in Months $B = 0.008$ (Wald (1) = 6.609, $p = .010$), $\text{Exp}(B) = 1.008$; Security (1), $B = 0.651$ (Wald (1) = 1.917, $p = .045$), $\text{Exp}(B) = 1.419$. The classification table showed no significant improvement over constant-only model (83.4% correct).

¹⁶ Not all lost items are replaced—replacement depends on many factors such as the number of copies available, circulation rates, and age of materials.

substantial amount of these materials are never available for use because they are unreturned, stolen, misplaced, or inaccurately cataloged.

Table 12. Summary Shrinkage by Type (Unreturned, Missing Status, and Missing in Inventory)

Material Type	Total Library Collection (FY05-06)	Percent of Collection Unreturned	Percent of Collection on Missing Status	Collection Missing in Inventory*
Audiotape	37,195	3.8%	2.3%	2.9%
CD (music+books)	131,765	9.6%	9.4%	5.1%
DVD	69,208	11.1%	4.7%	0.4%
Fiction	218,907	5.1%	2.9%	3.1%
Foreign	46,475	3.3%	1.3%	5.2%
Juvenile Easy	147,872	3.5%	1.4%	2.1%
Juvenile Fiction	64,686	4.8%	1.1%	2.4%
Juvenile Non-fiction	140,849	5.0%	1.5%	2.3%
Large Print	26,294	1.6%	1.0%	1.5%
Music scores	39,929	1.5%	0.9%	3.2%
Non-fiction*	648,182	4.6%	1.9%	3.3%
Videotape	47,001	15.0%	10.3%	4.0%
Young Adult	50,540	8.7%	5.2%	3.8%
Total	1,668,903	5.6%	2.9%	3.1%

*Shaded cell denotes weighted total (+/-0.2%)

These system wide shrinkage calculations also mask the amount shrinkage by specific location (Appendix G). The sample inventory results showed variation in inventory missing at branch collections that ranged from 1.0% at Albina to 9.4% at Rockwood. North Portland also showed a larger than average collection loss at 5.3%.

The initial review of the security changes that the library incorporated appeared to be promising. The results of removing DVDs from the library floor appeared positive with a 17-times greater likelihood of locating the material after the changes. Additionally, simply moving the CDs to a more visible location also appeared to have some beneficial effects. Again, these are not final results, but instead indicators as to the efficacy of the changes in security processes for available materials. Future research should revisit this issue.

Comparables. It is difficult to determine the context in which these measures of shrinkage compare. As was stated earlier there is a general lack of standards in defining, measuring, calculating, and reporting shrinkage making useful comparisons difficult. Appendix E lists several studies, their methods, definitions, library environment, and their results. The few snapshot calculations showed various measures of loss ranging from 5.3% to 8%, and higher for multi-media items. However, the methods used were not consistent with those used in this report, and most excluded shrinkage due to unreturned materials.

In an attempt to find more comparable information, searches of the internet, of library list-serves, of peer comparison libraries, and of the private industry were performed.

Successful ‘hits’ were followed-up with either email or telephone calls requesting any reports that may have been produced. The issue of library theft was quite common, not surprising however, was the lack of any quality published comparable data.

The internet searches and list-serves revealed several common themes. Security devices to reduce theft, various steps in combating theft, and theft related to small specialized or academic libraries were the most common. Little recent empirical data was offered on the internet. Anecdotal reports from list-serves often offered a ‘rule of thumb’ loss of 10%, however it is unclear exactly how this is defined (e.g., a system snapshot or new materials annually) or which materials are considered (e.g., printed materials versus multi-media). Most threads anecdotally suggested comparatively low loss for printed material and substantially higher loss rates for multi-media materials (i.e., videotapes, CDs, DVD, etc.). No useful reports were made available.

Several peer jurisdictions identified by the Multnomah County Auditor’s report and the library administration were contacted regarding comparable inventories and shrinkage.¹⁷ While most were able to provide recent Public Library Data Service (PLDS) data, none were able to provide comparable shrinkage data as a portion of their total collection (snapshot) or annualized loss rate of materials (either new or existing).

One jurisdiction of reasonable comparability in circulation speaking on the condition of anonymity, reported the results of their 2005 multi-media collection inventory. A snapshot counting only materials that were available for checkout and not already known to be missing, the DVD collection had an estimated loss of 30%, CD (music only) had a 25% loss and videotapes 14% (Appendix E). Their methodology would be largely consistent with this report’s lost item sampling results.

Finally, contact was made with several local and national retailers for books, CDs, and DVDs. This included correspondence with Powell’s Bookstore, Barnes and Noble, Borders Books, Everyday Music, Music Millennium, Hollywood Video and Blockbuster Video. Each of these retailers were contacted on several occasions, however none would discuss their inventory shrinkage, even informally.

An examination of the most recent National Retail Security Surveys (NRSS) found no booksellers reporting their annual shrinkage rates for 2003 (Hollinger & Langton, 2005). The reported annual shrinkage for music and video retailers was 1.76%. However, this estimate was based on a sample size of only three retailers, and authors suggest it is possible that only those retailers with the greatest investment in loss prevention reported their findings (pg. 5).¹⁸

¹⁷ Charlotte & Mecklenburg County, NC., Dayton & Montgomery County, OH., Denver, CO., Seattle, WA., Hennepin, MN. and King County, WA.

¹⁸ The NRSS survey has suffered from a substantial decrease in response rates over time. The information reported by the NRSS appears to best represent apparel and department store segments.

RECOMMENDATIONS

Based on the results from this work, there are several areas that should be prioritized first in reducing the loss of materials. These include targeting the sources of shrinkage, specific material types, and specific locations.

First, the majority of the shrinkage was due to patrons checking-out materials but never returning them. A review of the library's lending policies should be considered and combined with further analysis of the unreturned items. The analysis should determine if these incidents are single-item events or multiple-item events. For example, did a patron check-out one DVD and not return it, or did they check out 20?

Next, specific material types appear to be more vulnerable than others. For example, multi-media materials and young adult books had the highest shrinkage. Specially, CDs, DVDs, and videotapes should be reviewed for enhanced security. The same promising security changes that were incorporated with DVDs and CDs, might also be effective with videotapes. Young adult printed materials and non-fiction—just due to the sheer size of shrinkage—should also be reviewed for enhanced security.

Finally, the Rockwood, North Portland, and Holgate branch locations had higher than average missing in inventory shrinkage. An assessment of the physical branch layout should be performed to determine if changes in the environment can reduce the likelihood of loss. The Central location should also be assessed given the sheer volume of shrinkage identified.

Common strategies. There is no lack of suggestions on how to combat loss at public libraries in the literature. An analysis of these suggestions found they could be categorized into planning, monitoring and communicating inventory, training, process adjustments, and environmental modifications. Appendix F lists common strategies and the source of the recommended strategy.¹⁹

While many of these strategies may be effective in reducing shrinkage, it should be noted that little empirical evidence was offered to show the efficacy, or cost-effectiveness these strategies. For example, the use of electronic gates has promised dramatic reductions in theft from 50% to 80% (3M Canada, online; Hanson, 1989), however with the exception of the companies that supply these products, there has been little independent empirical evidence to support these claims (McCree, 2000).²⁰

Some strategies are inexpensive and easy to implement, while others may be either cost-prohibited, or in direct conflict with the operating philosophy of some libraries. For instance, locking-up all materials will likely reduce shrinkage dramatically, however it

¹⁹ The American Library Association and the Association of College and Research Libraries provide additional guidelines regarding thefts in libraries online (see References).

²⁰ This is not to say that they are not effective at all. The Urban Libraries Council (2005) found that 68% of libraries were using some form of electronic gates. However, only 61% of those surveyed rated the systems as somewhat or very effective in deterring theft, and all still suggested that theft was still a common occurrence. Additionally, some evidence suggests that installation of these systems may reduce theft, but may also have the unintended consequence of increased material mutilation (Mast, 1983).

also reduces patron access to browse the collections. Additionally, the cost of many of the strategies listed may require additional staff and associated costs (e.g., security, monitoring CCTV, bag collection and inspection). A thorough cost-benefit analysis would be needed to determine if these actions would cost the library system more than would be saved.²¹

LIMITATIONS

The basis of this analysis assumes the data in the new Millennium data system was correct at the time of sampling. Previous research has found that errors in the cataloging system or processes can account for inflated shrinkage estimates (Burnett, 1990). Given the fact that the data reported were based on a new data system that was recently migrated suggests that this possibility is reasonable. Future samples would help determine if these findings are consistent over time.

Additionally, the shrinkage calculated in this report assumes that all missing and unreturned materials are gone forever. Items do get returned by patrons either willingly or through collections. Some items considered to be missing may be simply mis-shelved, and no one will likely find them if looking. These too may turn up later, suggesting that overall findings may be somewhat over-stated.

The analysis included 87% of the total library collection. The analysis did not include several material types such as the special collection, non-circulating reference materials, maps, CD-ROMS, and paperbacks. Taking the entire collections into consideration would likely increase the total shrinkage counts.

Estimates of the effectiveness of the changes in security protocol are only preliminary examinations, promising at best. Because items were not returned to their original location and re-tested, it is impossible to attribute the impact to the changes in material locations. This should be followed in future research.

The loss herein makes no assertion about whether it was due to theft or for some other reason (e.g., miscataloged, mis-shelved, poor accounting, etc.). Additionally, the research doesn't consider the possibility that shrinkage may also be attributed to unauthorized borrowing from staff (Hollinger & Langton, 2005; McCree, 2000).

Finally, this research should be considered a baseline report of the collection's cumulative shrinkage from a variety of sources. The limited data collected herein were unable to determine the annual shrinkage rates, which would be helpful in on-going management, internal performance measurement, and strategy assessment. Future research should assess annualized shrinkage for the collection.

²¹ A cost-benefit analysis was beyond the scope of this research.

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EVALUATION

This research demonstrates accountability and good government. Appropriate evaluation of program implementation, measurement of results, and determination of cost-benefits are critical to maximizing public resources and making data-driven policy decisions. To assure quality, this project was performed in accordance with the American Evaluation Association's *Guiding Principles for Evaluators*.²²

It took the Budget Office Evaluation staff approximately 96 hours to complete this research. Based on the Budget Office's FY06-07 program offer (#72018A), the fully loaded cost-per-hour averaged \$70.50.²³ The evaluation component of this project, excluding library staff time, cost Multnomah County approximately \$6,768.

²² *Guiding Principles for Evaluators*. (2004). American Evaluation Association.
<http://www.eval.org/Publications/GuidingPrinciplesPrintable.asp>

²³ These cost estimate includes all applicable administration and support costs.

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Appendix A. Selected Material Type by Branch Collection (FY05-06)

Branch	Material Type													Total
	Audiotape	CD (music+ books)	DVD	Fiction	Foreign	Juvenile Easy	Juvenile Fiction	Juvenile Non-fiction	Large Print	Music scores	Non-fiction*	Video tape	Young Adult	
Albina	1,402	7,139	4,240	3,983	751	4,936	5,186	1,871	388	94	8,582	2,123	2,413	43,108
Belmont	1,875	8,862	6,295	7,897	620	7,189	7,793	2,938	517	134	15,729	2,843	2,582	65,274
Capitol Hill	1,778	4,583	2,639	5,753	1,365	6,100	6,183	2,756	583	94	9,525	1,833	3,033	46,225
Central	5,696	29,046	9,164	64,751	9,907	19,320	15,079	11,225	3,014	37,614	374,361	7,124	6,004	592,305
Fairview- Columbia	718	2,209	1,772	3,894	1066	3,532	3,790	1,535	413	81	9,838	966	1,681	31,495
Gregory Heights	1,295	3,879	3,009	5,942	3,123	6,847	5,957	2,153	581	105	11,368	2,079	2,326	48,664
Gresham	3,293	9,160	4,544	18,916	4,397	14,620	16,850	5,335	1,921	265	40,773	3,827	3,868	127,769
Hillsdale	2,603	8,205	3,819	17,554	1,763	8,841	10,139	4,259	1,215	228	25,933	2,303	3,355	90,217
Holgate*	1,425	5,220	3,292	4,772	2,948	6,357	5,736	2,773	532	81	1,834	1,834	2,866	37,836
Hollywood	3,048	11,848	6,108	16,803	2,059	11,093	17,253	6,998	1,331	252	31,990	4,814	3,806	117,403
Library Outreach Services	1,478	266	521	5,206	1	66	11	9,714			2,353	590		20,206
Midland	4,202	10,454	5,950	28,030	7,437	14,864	18,885	8,707	2,767	360	49,394	4,885	4,918	160,853
North Portland	1,387	6,788	3,803	5,926	2,720	7,746	6,528	2,346	490	127	13,222	3,167	2,766	57,016
Northwest	837	4,714	2,677	4,085	503	4,043	3,826	2,007	480	73	9,737	1,286	1,552	35,820
Rockwood	1,337	3,470	2,442	5,117	2,900	5,925	4,580	2,215	454	80	9,086	1,956	2,256	41,818
St. Johns	1,392	4,360	2,888	5,692	2,876	5,999	5,995	2,210	568	98	9,691	1,583	2,185	45,537
Sellwood	1,452	4,883	2,645	4,808	395	4,860	4,832	1,912	473	88	9,229	1,460	1,913	38,950
Woodstock	1,977	6,679	3,400	9,778	1,644	8,511	9,260	3,435	853	155	17,371	2,328	3,016	68,407
Total	37,195	131,765	69,208	218,907	46,475	140,849	147,872	64,686	26,294	39,929	648,182	47,001	50,540	1,668,903

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 item collection).

Appendix B. Stratified Random Sample by Branch Location

Branch	Material Type													Total
	Audiotape	CD (music+ books)	DVD	Fiction	Foreign	Juvenile Easy	Juvenile Fiction	Juvenile Non- fiction	Large Print	Music scores	Non- fiction*	Videotape	Young Adult	
Albina	38	40	33	17	9	28	18	37	11		7	47	52	337
Belmont	27	33	22	28	7	26	31	47	8	1	14	28	35	307
Capitol Hill	46	35	64	19	43	57	36	42	12	1	7	52	78	492
Central	171	275	42	386	246	142	233	154	137	1,004	697	134	127	3,748
Fairview-Columbia	15	18	25	18	23	19	22	29	11		11	24	35	250
Gregory Heights	42	35	41	26	67	57	38	63	19	1	20	52	32	493
Gresham	94	85	102	93	86	110	87	113	88	1	63	91	96	1,109
Hillsdale	67	80	48	73	43	61	59	69	35	2	32	56	69	694
Holgate*	39	33	32	15	70	36	30	58	17	1		40	58	429
Hollywood	59	51	37	64	32	78	109	73	55	4	25	83	52	722
Library Outreach Services	49	1	12	28					368		7	11		476
Midland	115	85	41	127	178	178	147	107	107	9	84	88	88	1,354
North Portland	52	45	36	22	54	48	38	59	22	1	17	71	58	523
Northwest	22	22	34	29	16	32	45	36	30	4	9	41	47	367
Rockwood	56	55	56	31	63	40	36	36	20	2	17	54	53	519
Zellwood	30	41	47	28	7	31	35	42	20		13	32	54	380
St. Johns	40	48	33	22	57	49	37	35	25	1	16	46	34	443
Woodstock	49	58	41	33	35	60	38	55	23	3	26	42	58	521
Total	1,011	1,040	746	1,059	1,036	1,052	1,039	1,055	1,008	1,035	1,065	992	1,026	13,164

*The Holgate branch non-fiction collection was inadvertently excluded (~8,900 item collection).

Appendix C. Missing in Inventory Results by Material Type and for the Library System

Material Type	Total Library Collection (FY05-06)	Material Available for Check-Out	Percent Available for Check-Out	Random Sample of Available Material	Sample Material Found	Sample Missing in Inventory	Missing in Inventory Point Estimate	Missing in Inventory Lower Bound	Missing in Inventory Upper Bound	Missing Available Material Point Estimate	Missing Available Material Lower Bound	Missing Available Material Upper Bound	Collection Missing in Inventory	Collection Missing in Inventory Lower Bound	Collection Missing in Inventory Upper Bound
Audiotape	37,195	19,055	51%	1,011	954	57	5.6%	4.4%	7.2%	1,074	835	1,378	2.9%	2.2%	3.7%
CD (music+books)	131,765	40,288	31%	1,040	867	173	16.6%	14.5%	19.0%	6,702	5,838	7,663	5.1%	4.4%	5.8%
DVD	69,208	2,472	4%	746	671	75	10.1%	8.1%	12.4%	249	200	307	0.4%	0.3%	0.4%
Fiction	218,907	132,427	60%	1,059	1,004	55	5.2%	4.0%	6.7%	6,878	5,310	8,873	3.1%	2.4%	4.1%
Foreign	46,475	35,286	76%	1,036	965	71	6.9%	5.5%	8.6%	2,418	1,930	3,020	5.2%	4.2%	6.5%
Juvenile Easy	147,872	72,785	49%	1,052	1,008	44	4.2%	3.1%	5.6%	3,044	2,278	4,054	2.1%	1.5%	2.7%
Juvenile Fiction	64,686	38,879	60%	1,039	998	41	3.9%	2.9%	5.3%	1,534	1,135	2,064	2.4%	1.8%	3.2%
Juvenile Non-fiction	140,849	91,826	65%	1,055	1,017	38	3.6%	2.6%	4.9%	3,307	2,424	4,509	2.3%	1.7%	3.2%
Large Print	26,294	18,085	69%	1,008	986	22	2.2%	1.5%	3.3%	395	262	593	1.5%	1.0%	2.3%
Music scores	39,929	33,920	85%	1,035	996	39	3.8%	2.8%	5.1%	1,278	940	1,733	3.2%	2.4%	4.3%
Non-fiction**	648,182	413,842	64%	1,065	1,010	55	5.2%	4.0%	6.7%	21,372	16,512	27,562	3.3%	2.5%	4.3%
Videotape	47,001	13,994	30%	992	860	132	13.3%	11.3%	15.6%	1,862	1,586	2,177	4.0%	3.4%	4.6%
Young Adult	50,540	26,560	53%	1,026	951	75	7.3%	5.9%	9.1%	1,942	1,559	2,409	3.8%	3.1%	4.8%
Unweighted Total	1,668,903	939,419	56%	13,164	12,287	877									
Weighted Total*	1,668,903	939,419	56%	13,164	12,436	728	5.5%	5.2%	5.9%	51,950	48,380	55,708	3.1%	2.9%	3.3%

*Shading denotes weighted system total.

**The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

Appendix D. Missing in Inventory Results by Branch Collection and for the Library System

Branch Location	Total Library Collection (FY05-06)	Material Available for Check-Out	Percent Available for Check-Out	Random Sample of Available Material	Sample Material Found	Sample Missing in Inventory	Missing in Inventory Point Estimate	Missing in Inventory Lower Bound	Missing in Inventory Upper Bound	Missing Available Material Point Estimate	Missing Available Material Lower Bound	Missing Available Material Upper Bound	Collection Missing in Inventory	Collection Missing in Inventory Lower Bound	Collection Missing in Inventory Upper Bound
Albina	43,108	15,779	37%	220	214	6	2.7%	1.3%	5.8%	431	199	918	1.0%	0.5%	2.1%
Belmont	65,274	19,399	30%	272	252	20	7.4%	4.8%	11.1%	1,426	933	2,149	2.2%	1.4%	3.3%
Capitol Hill	46,225	22,087	48%	310	301	9	2.9%	1.5%	5.4%	641	338	1,197	1.4%	0.7%	2.6%
Central	592,305	412,256	70%	5,777	5,480	297	5.1%	4.6%	5.7%	21,190	18,964	23,663	3.6%	3.2%	4.0%
Fairview-Columbia	31,495	15,807	50%	221	Sample size too small to accurately calculate estimates.										
Gregory Heights	48,664	26,598	55%	373	359	14	3.8%	2.3%	6.2%	997	598	1,649	2.0%	1.2%	3.4%
Gresham	127,769	70,767	55%	991	933	58	5.9%	4.6%	7.5%	4,140	3,220	5,300	3.2%	2.5%	4.1%
Hillsdale	90,217	42,964	48%	602	573	29	4.8%	3.4%	6.8%	2,071	1,448	2,934	2.3%	1.6%	3.3%
Holgate*	37,836	17,600	47%	247	221	26	10.5%	7.3%	15.0%	1,853	1,283	2,636	4.9%	3.4%	7.0%
Hollywood	117,403	43,274	37%	606	555	51	8.4%	6.5%	10.9%	3,644	2,796	4,717	3.1%	2.4%	4.0%
Library Outreach Services	20,206	13,175	65%	185	180	5	2.7%	1.2%	6.2%	356	153	813	1.8%	0.8%	4.0%
Midland	160,853	94,874	59%	1,330	1,280	50	3.8%	2.9%	4.9%	3,567	2,713	4,668	2.2%	1.7%	2.9%
North Portland	57,016	27,374	48%	384	342	42	10.9%	8.2%	14.5%	2,995	2,242	3,956	5.3%	3.9%	6.9%
Northwest	35,820	20,715	58%	290	276	14	4.8%	2.9%	7.9%	1,001	601	1,645	2.8%	1.7%	4.6%
Rockwood	41,818	24,100	58%	338	283	55	16.3%	12.7%	20.6%	3,921	3,066	4,960	9.4%	7.3%	11.9%
Sellwood	45,537	20,127	44%	281	270	11	3.9%	2.2%	6.9%	787	443	1,383	1.7%	1.0%	3.0%
St. Johns	38,950	22,395	57%	314	302	12	3.8%	2.2%	6.6%	855	493	1,469	2.2%	1.3%	3.8%
Woodstock	68,407	30,126	44%	422	392	30	7.1%	5.0%	10.0%	2,142	1,512	3,004	3.1%	2.2%	4.4%
Weighted Total**	1,668,903	939,417	56%	13,164	12,436	728	5.5%	5.2%	5.9%	51,950	48,380	55,708	3.1%	2.9%	3.3%

*The Holgate branch non-fiction collection was inadvertently excluded (9,325 items).

**Shading denotes weighted system totals.

Appendix E. Other Published Loss Study Results by Method, Definition, and Collection Environment

Study	Method	Definition	Size/Location/Type	Results
Burnett (1990)	Random sample of non-circulated books	Excludes checked-out materials; only non-circulated books over last year; Fiction collection only	Long Beach, CA./ public	8% system snapshot; 2% to 3% annually
Burrows & Cooper (1992)	Full inventory (285 branches)	Includes patron-lost checked-out materials; excludes multimedia	Various/England, Wales, N. Ireland, Scotland/ public, academic, & specialty libraries	5.3% system-loss (public libraries); Loss rate of new books at one year was 5.1% (all library types)
Griffith (1978)	" <i>Random Sections Inventory</i> " variant on a random stratified methodology	Books only (no multimedia)	Iowa/ high school library	Depending on material's Dewey decimal (subject matter) 1.1% to 6.5% annually
McCree (2000)	Stratified Random Samples (12 branches)	Total adult collection; excluded checked-out materials	Various (totaled 691,000 collection)/ London, England/ Public	New book loss 5% to 48% by subject matter w/in 6 months; non-fiction books 13.4% and fiction 14.4%
White (online)	Full inventory	Total collection; excluded checked-out materials	66,000 items/ NE USA college library	1.6% annually; Multi-media materials ranged 5% to 42% annually
Anonymous (2005)	Random sample of multi-media collection	DVD, CD music, & videotape available for checkout excluding those items already known to be missing	Western USA/ public library system	DVD collection had an estimated loss of 30%, CD (music only) had a 25% loss & videotapes 14%

Appendix F. Common Library Loss Reduction Strategies

Type of Response	Specific Strategy	Source
Plan	Develop a security policy and guidelines for staff, security personnel, and patrons	Brown & Platkus, online; Burnett, 1990; Burrows & Cooper, 1992; McCree, 2000; Mosley, Caggiano, & Charles, 1996
Plan	Strategic planning of new locations with loss in mind	Curry, Flodin, & Matheson, 2000; McCree, 2000
Monitor Inventory & Communicate	Recognize and monitor loss in the collection regularly and follow-up; regularly update staff	Brown & Platkus, online; Burnett, 1990; Burrows & Cooper, 1992; Cuddy & Marchok, 2003; Curry, Flodin, & Matheson, 2000; McCree, 2000; Mosley, Caggiano, & Charles, 1996
Monitor Inventory & Communicate	Post warning posters telling patron to report theft and costs	Burnett, 1990; Burrows & Cooper, 1992; Cuddy & Marchok, 2003; Mosley, Caggiano, & Charles, 1996
Train Staff	Training of staff on recognizing and responding to thefts and methods	American Library Association, 2003; Burnett, 1990; McCree, 2000
Train Staff	Appoint a security manager	American Library Association, 2003; Brown & Platkus, online
Train Staff	Reduce opportunities for theft through increased staff interaction	Burrows & Cooper, 1992
Adjust Process	Closed access (rooms) to valuable or high-loss materials	American Library Association, 2003; Curry, Flodin, & Matheson, 2000; McCree, 2000; Mosley, Caggiano, & Charles, 1996
Adjust Process	Use locked cases for valuable or high-loss materials	McCree, 2000; Mosley, Caggiano, & Charles, 1996
Adjust Process	Collect patron bag and coats upon entering the library/ inspect bag upon exit	Burnett, 1990; Burrows & Cooper, 1992
Adjust Process	On-going shelf reading to find misfiled books should occur	American Library Association, 2003; Burnett, 1990
Adjust Process	All new materials codes should be double checked before adding to collection	Burnett, 1990
Adjust Process	Make sure all materials are clearly marked as library property	American Library Association, 2003; Mosley, Caggiano, & Charles, 1996
Adjust Process	Monitor emergency exits regularly	Burnett, 1990
Modify Environment	Redesign physical layouts that control the flow of patrons and materials	Greenwood & McKean, 1985; McCree, 2000
Modify Environment	Utilize security tagging systems and electronic gates/ test regularly	3M Canada, online; Brown & Platkus, online; Burnett, 1990; Burrows & Cooper, 1992; Hansen, 1989; McCree, 2000
Modify Environment	Add uniformed and plain clothed security staff at locations	Burrows & Cooper, 1992; McCree, 2000
Modify Environment	Install close-circuit televisions (CCTV) and staff to monitor	American Library Association, 2003; Burrows & Cooper, 1992; McCree, 2000
Modify Environment	Install security mirrors in hard to see areas of library	Dennis, 2001
Modify Environment	New material loading docks should be secure	Burnett, 1990
Modify Environment	Public photocopy machines should be accessible/working and have an available change machine	Burnett, 1990; Mosley, Caggiano, & Charles, 1996
Modify Environment	Install a police panic button	McCree, 2000

Multnomah County Library

Central Library and 16 neighborhood libraries

