

**Public Library Use and Economic Hard Times:
Analysis of Recent Data**

A Report Prepared for
The American Library Association

by

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To explore the proposition of whether or not library use increases during an economic downturn, monthly circulation data were requested (in mid-February 2002) from the 25 largest U.S. public libraries, all serving populations of 1,000,000 persons or more.¹ The reference period for analysis was January 1997 through December 2001, a span of 60 months encompassing the recent economic downturn, which began in March 2001.² Statistics on total circulation for the full reference period (60 months) were provided by 18 of the 25 libraries.

As the initial step, the average circulation for each month (using the arithmetic mean) was computed for the 18 libraries — yielding 60 monthly averages. These values are presented in Table 1, Column (1) “Actual Circulation (average)”, and are plotted graphically in Figure 1. It is evident from these numbers that from March 2001 onward (the period of economic downturn), average monthly circulation was larger than in the same month during any of the previous years. For example, the March 2001 average (677,247) exceeds that of March 2000 (641,871) by 35,376, or 5.5%. Average circulation in July 2001 (685,247) exceeded that of July 2000 (610,132) by 75,115, or 12.3%. The same pattern is evident for each month of 2001, when compared to the value for the same month in the previous years.

Formal statistical methods yield more insightful analysis of these numbers. In Figure 1, trend was measured by fitting a least-squares regression line to 48 monthly averages occurring in the years prior to 2001.³ The line describes the annual trend which occurred in the four-year period before the recession year — and by extrapolation into 2001, gives the best prediction of monthly circulation averages that would have occurred, had the trend continued. The values given by the trend line⁴ — for the 48 months to which the line was fitted, and the 12 months (Year 2001) to which it was extrapolated — are presented in Table 1, Column (2) “Trend Value”. By comparing trend and actual circulation averages in each month of the series (the numerical and percent differences are presented in Columns (3) and (4)), it is evident that circulation in the year 2001 was substantially higher than would have been predicted on the basis of the four previous years.

Variation of data values in time series is a resultant of four types of change or movement. These consist of:

1. Secular trend, or the growth (or decline) occurring in the data over a long period of time — e.g., changes in annual library circulation caused by growth (or decline) of service area population.

¹ According to data published in the 2001 Public Library Data Service annual Statistical Report. The 25 “largest” libraries were chosen according size of service area population.

² Determined by the National Bureau of Economic Research, Cambridge, MA.
See: “The Business-Cycle Peak of March 2001,” NBER, November 25, 2001.

³ A straight line was found to best describe the trend of the data, in comparison to various non-linear alternatives that included logarithmic, exponential, and second and third degree (polynomial) curves.

⁴ By substituting X values 1, 2, 3,...60 (month of series) in the linear regression equation $Y = 69.353X + 578,701$.

2. Seasonal variation, or the more or less regular movement within each 12-month period. This movement occurs year after year and caused by the changing seasons.
3. Cyclical movement, e.g., the swing from prosperity through economic downturn and back again (examined in this report). Cycles in this category may vary in length, periodicity, and intensity.
4. Residual, accidental, or random variations, plus disturbances such as fads, disasters, strikes, and other non-recurring factors.

These components function concurrently, so that to observe cyclical movement, the data in time series need to be adjusted for effects of trend and seasonal variation. In order to measure the amount of variation in monthly circulation that is attributable to economic turndown (a cyclical movement), changes caused by trend and seasonal variation need to be removed from the series.

To remove trend, each monthly circulation average can be expressed as a percentage of its corresponding trend value -- i.e., by computing the ratio (actual/trend). The resulting ratios are shown in Table 2, Column (3).

To estimate seasonal variation, these ratios (actual/trend) were averaged for each month (Jan, Feb, ...Dec), over the 4-year period prior to 2001. The resulting average ratios show the typical relation of each month to trend -- yielding indices of seasonal variation shown in Table 2, Column (4)). The respective seasonal indices were then subtracted from the (actual/trend) ratios for each month. This eliminates seasonal variation from the series, leaving only combined cyclical and residual (random) fluctuations. These numbers are presented in Table 2, Column (5) "Cyclical Variation", and plotted graphically in Figure 2.

Examining the tabled and graphed numbers for cyclical movement, random variation is dominant in the four-year period before 2001 -- indicated by occurrence of nearly equal numbers of positive and negative values over the 48-month series. A different pattern is evident in 2001, however, in which all the percent values are positive. In each month of the year (after adjustment for trend and seasonal variation) average circulation is higher than in the same month during any of the previous years. The cyclical movement above trend is highest during the (NBER-designated) period of recession-- beginning at 8.3% in March, rising to 13.0% in August and 11.3% in October (following the events of 9/11), and declining to 9.0% for the remainder of the year.

These numbers suggest a relationship between public library use and the economic cycle, but do not themselves specify the immediate causes.

— E.L. —

**TABLE 1 -- AVERAGE CIRCULATION BY MONTH (JANUARY 1997 TO DECEMBER 2001)
AND VALUE PREDICTED BY 48-MONTH LINE OF TREND
(computed on data reported by 18 of the 25 largest public libraries)**

Month	(1)	(2)	(3)	(4)	
	Actual Circulation (average)	Trend Value (line of trend)*	Numerical Difference (1) - (2)	Percent Difference (1) / (2)	
1997	Jan	604,937	578,770	26,167	4.52
	Feb	568,160	578,840	-10,679	-1.84
	Mar	604,623	578,909	25,714	4.44
	Apr	599,621	578,978	20,642	3.57
	May	552,780	579,048	-26,268	-4.54
	June	577,827	579,117	-1,290	-0.22
	July	635,671	579,187	56,485	9.75
	Aug	523,466	579,256	-55,790	-9.63
	Sep	561,612	579,325	-17,713	-3.06
	Oct	609,049	579,395	29,654	5.12
	Nov	548,313	579,464	-31,151	-5.38
	Dec	497,923	579,533	-81,611	-14.08
1998	Jan	602,829	579,603	23,227	4.01
	Feb	574,349	579,672	-5,323	-0.92
	Mar	624,671	579,741	44,930	7.75
	Apr	585,163	579,811	5,352	0.92
	May	541,345	579,880	-38,535	-6.65
	June	591,362	579,949	11,413	1.97
	July	611,582	580,019	31,563	5.44
	Aug	556,203	580,088	-23,885	-4.12
	Sep	561,778	580,157	-18,379	-3.17
	Oct	618,586	580,227	38,359	6.61
	Nov	570,238	580,296	-10,058	-1.73
	Dec	507,831	580,366	-72,535	-12.50
1999	Jan	586,182	580,435	5,747	0.99
	Feb	576,890	580,504	-3,614	-0.62
	Mar	635,706	580,574	55,132	9.50
	Apr	575,033	580,643	-5,610	-0.97
	May	545,168	580,712	-35,544	-6.12
	June	613,504	580,782	32,722	5.63
	July	619,666	580,851	38,815	6.68
	Aug	574,958	580,920	-5,963	-1.03
	Sep	558,590	580,990	-22,399	-3.86
	Oct	607,965	581,059	26,906	4.63
	Nov	583,608	581,128	2,479	0.43
	Dec	495,958	581,198	-85,240	-14.67
2000	Jan	589,718	581,267	8,450	1.45
	Feb	602,278	581,336	20,942	3.60
	Mar	641,871	581,406	60,465	10.40
	Apr	579,911	581,475	-1,564	-0.27
	May	569,077	581,545	-12,468	-2.14
	June	606,109	581,614	24,495	4.21
	July	610,132	581,683	28,448	4.89
	Aug	601,053	581,753	19,301	3.32
	Sep	572,138	581,822	-9,684	-1.66
	Oct	610,469	581,891	28,577	4.91
	Nov	575,189	581,961	-6,772	-1.16
	Dec	498,118	582,030	-83,912	-14.42
2001	Jan	631,056	582,099	48,956	8.41
	Feb	601,942	582,169	19,773	3.40
	Mar	677,247	582,238	95,009	16.32
	Apr	619,289	582,307	36,982	6.35
	May	605,543	582,377	23,167	3.98
	June	651,574	582,446	69,128	11.87
	July	685,247	582,515	102,732	17.64
	Aug	641,875	582,585	59,290	10.18
	Sep	603,299	582,654	20,645	3.54
	Oct	679,284	582,724	96,561	16.57
	Nov	624,674	582,793	41,881	7.19
	Dec	553,462	582,862	-29,401	-5.04

* Least squares line fitted from Jan 1997 through Dec 2000.

**FIGURE 1 -- AVERAGE CIRCULATION BY MONTH (JANUARY 1997 TO DECEMBER 2001)
AND VALUE PREDICTED BY 48-MONTH LINE OF TREND**

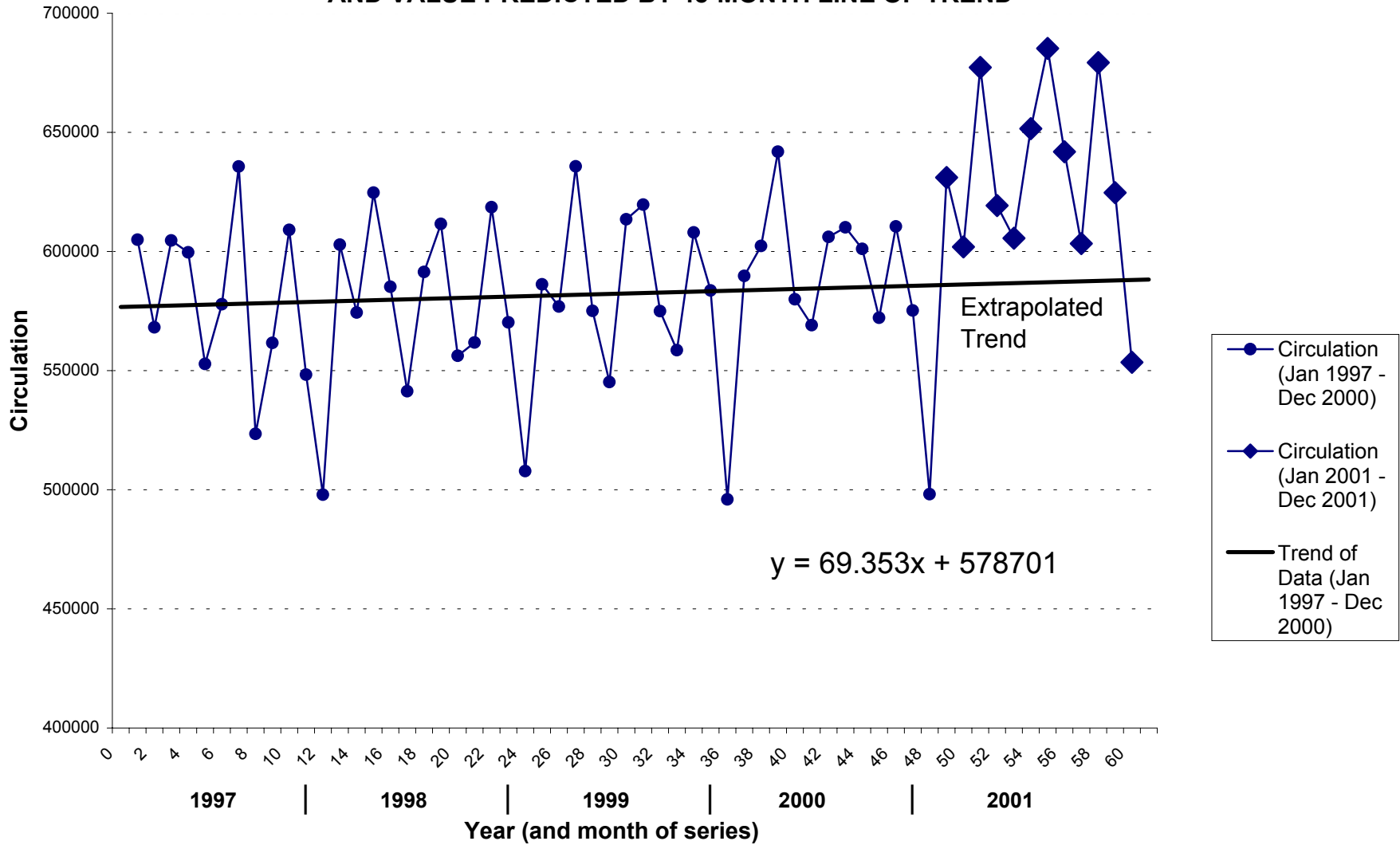


TABLE 2 -- ADJUSTMENT FOR TREND AND SEASONAL VARIATION

(The resulting series (column (5)) represents the cyclical and residual fluctuations occurring in the series.)

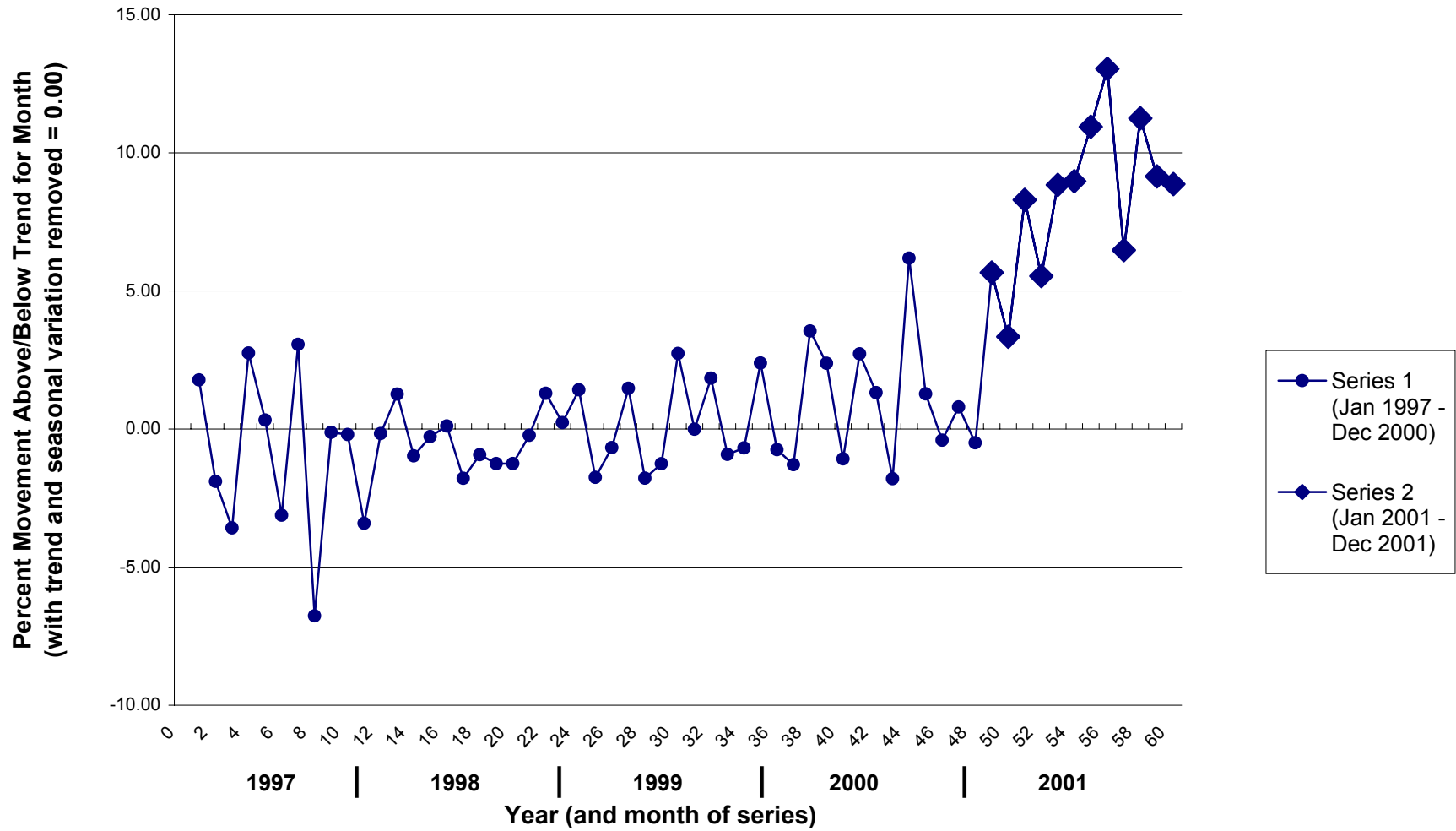
	(1)	(2)	(3)	(4)	(5)	
Month	Actual Circulation (average)	Trend Value (line of trend) *	Ratio (1) / (2) **	Index of Seasonal Variation ***	Cyclical Fluctuation [(3) - (4)]*100	
1997	Jan	604,937	578,770	1.045	1.027	1.78
	Feb	568,160	578,840	0.982	1.001	-1.90
	Mar	604,623	578,909	1.044	1.080	-3.58
	Apr	599,621	578,978	1.036	1.008	2.75
	May	552,780	579,048	0.955	0.951	0.33
	June	577,827	579,117	0.998	1.029	-3.12
	July	635,671	579,187	1.098	1.067	3.06
	Aug	523,466	579,256	0.904	0.971	-6.77
	Sep	561,612	579,325	0.969	0.971	-0.12
	Oct	609,049	579,395	1.051	1.053	-0.20
	Nov	548,313	579,464	0.946	0.980	-3.41
	Dec	497,923	579,533	0.859	0.861	-0.17
1998	Jan	602,829	579,603	1.040	1.027	1.26
	Feb	574,349	579,672	0.991	1.001	-0.97
	Mar	624,671	579,741	1.077	1.080	-0.27
	Apr	585,163	579,811	1.009	1.008	0.11
	May	541,345	579,880	0.934	0.951	-1.78
	June	591,362	579,949	1.020	1.029	-0.93
	July	611,582	580,019	1.054	1.067	-1.25
	Aug	556,203	580,088	0.959	0.971	-1.25
	Sep	561,778	580,157	0.968	0.971	-0.23
	Oct	618,586	580,227	1.066	1.053	1.29
	Nov	570,238	580,296	0.983	0.980	0.23
	Dec	507,831	580,366	0.875	0.861	1.42
1999	Jan	586,182	580,435	1.010	1.027	-1.75
	Feb	576,890	580,504	0.994	1.001	-0.68
	Mar	635,706	580,574	1.095	1.080	1.47
	Apr	575,033	580,643	0.990	1.008	-1.78
	May	545,168	580,712	0.939	0.951	-1.26
	June	613,504	580,782	1.056	1.029	2.74
	July	619,666	580,851	1.067	1.067	-0.01
	Aug	574,958	580,920	0.990	0.971	1.84
	Sep	558,590	580,990	0.961	0.971	-0.92
	Oct	607,965	581,059	1.046	1.053	-0.69
	Nov	583,608	581,128	1.004	0.980	2.39
	Dec	495,958	581,198	0.853	0.861	-0.75
2000	Jan	589,718	581,267	1.015	1.027	-1.29
	Feb	602,278	581,336	1.036	1.001	3.55
	Mar	641,871	581,406	1.104	1.080	2.38
	Apr	579,911	581,475	0.997	1.008	-1.08
	May	569,077	581,545	0.979	0.951	2.72
	June	606,109	581,614	1.042	1.029	1.31
	July	610,132	581,683	1.049	1.067	-1.80
	Aug	601,053	581,753	1.033	0.971	6.18
	Sep	572,138	581,822	0.983	0.971	1.27
	Oct	610,469	581,891	1.049	1.053	-0.41
	Nov	575,189	581,961	0.988	0.980	0.80
	Dec	498,118	582,030	0.856	0.861	-0.50
2001	Jan	631,056	582,099	1.084	1.027	5.67
	Feb	601,942	582,169	1.034	1.001	3.34
	Mar	677,247	582,238	1.163	1.080	8.30
	Apr	619,289	582,307	1.064	1.008	5.54
	May	605,543	582,377	1.040	0.951	8.84
	June	651,574	582,446	1.119	1.029	8.97
	July	685,247	582,515	1.176	1.067	10.94
	Aug	641,875	582,585	1.102	0.971	13.04
	Sep	603,299	582,654	1.035	0.971	6.48
	Oct	679,284	582,724	1.166	1.053	11.25
	Nov	624,674	582,793	1.072	0.980	9.15
	Dec	553,462	582,862	0.950	0.861	8.87

* Least squares line fitted from Jan 1997 through Dec 2000.

** These values represent the original data expressed in percentage form with trend removed.

*** Average of the column (3) values for each month (Jan, Feb, ... Dec) for the years 1997-2000.

**FIGURE 2 -- CYCLICAL (AND RESIDUAL) VARIATION IN CIRCULATION BY MONTH
(JANUARY 1997 THRU DECEMBER 2001)**
(I.e., the original series adjusted for trend and seasonal variation.)



Appendix: 18 libraries providing circulation data used in analysis

1. Brooklyn Public Library
2. Broward County Libraries Division
3. Dallas Public Library
4. Harris County Public Library
5. Hawaii State Public Library System
6. Houston Public Library
7. King County Library System
8. County of Los Angeles Public Library
9. Miami Dade Public Library System
10. Philadelphia, Free Library of
11. Phoenix Public Library
12. Pittsburgh, Carnegie Library of
13. Queens Borough Public Library
14. Sacramento Public Library
15. San Antonio Public Library
16. San Bernardino Public Library
17. San Diego Public Library
18. Tampa Hillsborough County Public Library