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CONNECTICUT TEACHERS'
RETIREMENT SYSTEM

Actuarial Modeling Report
as of June 30, 1984

April, 1985

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SECTION I

INTRODUCTION

In establishing a funding program for a pension plan, two primary issues should be considered:

- What are the projected contributions under alternative funding programs?

- What is the projected funded status of the plan under alternative funding programs?

With regard to projected contributions, two questions should be asked:

- What will be the long-term trend of annual contributions?

- What will be the year-to-year variability in contributions?

In order to evaluate the projected funded status, two questions need to be asked:

- What is the long-term funding goal of the plan?

- What is the time framework for achieving that goal?

To give the Board and others responsible for the Plan some guidance on these questions, 30-year projections were developed comparing the expected results under the current funding law, and under the proposed revision in the funding law.

Approach

The essence of the approach was to update assets and participant data year-by-year on the assumption that the experience of the System will be exactly as assumed in the June 30, 1984 actuarial valuation. Based on this updated data, year-by-year valuations are run to determine contributions and funded status for each year in the future.

The major additional assumption needed for these projections that was not included in the June 30, 1984 valuation regards new members. For the projections it was assumed that each active teacher who leaves active status will be replaced by a new teacher. Thus, the number of active teachers is assumed to stay constant at 38,418.

Two projections were made initially, differing only in the funding law used in determining contributions:

- The current law calls for a 1985-1986 contribution equal to 55% of the sum of the normal cost plus a 40-year level dollar amortization of the unfunded actuarial liability. This grades up to 100% of the sum for 1994-1995. Subsequent contribution would be normal cost plus level dollar amortization payments over the 40-year period ending June 30, 2034.

- The proposed law calls for a 1985-1986 contribution equal to 70% of the sum of the normal cost plus a 40-year level percent of payroll amortization of the unfunded actuarial liability. This would grade up to 100% of the sum for 1991-1992. Subsequent contributions would be normal cost plus level percent of payroll amortization payments over the 40-year period ending June 30, 2031.

Two additional projections were then made, identical to the proposed law projections, except that the assumed investment experience of the System was based on studies done by the Treasurer to determine the most likely rate of return for:

- the asset allocation of the System's assets scheduled to be achieved by June 30, 1989; and

- an alternative allocation that had a higher allocation of common stocks, and therefore a higher expected rate of return.

The purpose of these projections is to show how investment experience different than assumed in calculating contributions will affect future contributions.

The approach followed is described in more detail in Appendix A.

SECTION II

PROJECTED CONTRIBUTIONS OF THE SYSTEM

This section of the report gives tables showing the projected contributions based on the current and proposed laws, both as a percent of payroll of members and as dollar amounts.
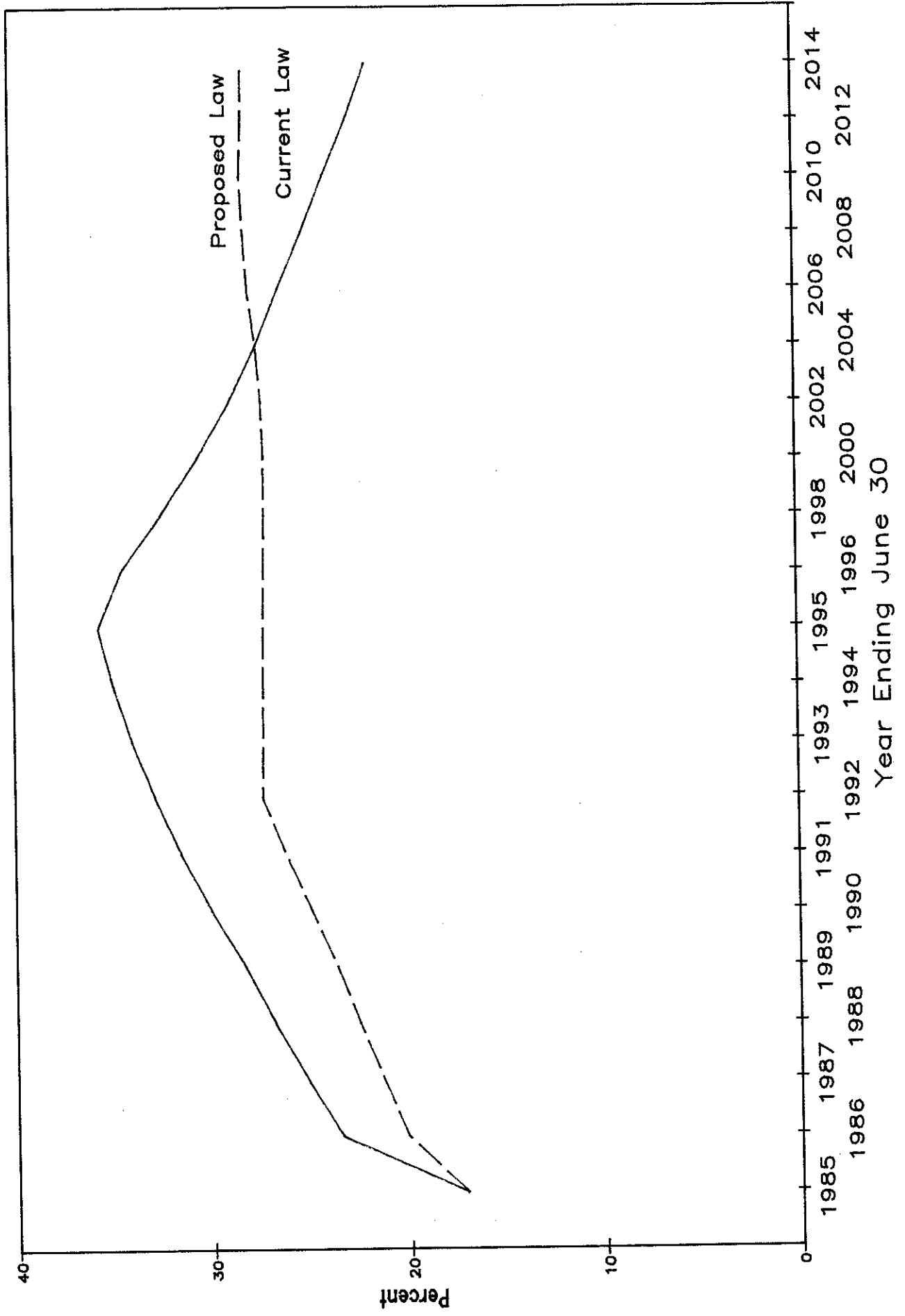
It is assumed that the best available measure of the State's ongoing ability to fund the System is whether the contributions increase at the same rate that the total payroll increases. It is assumed that if the contributions as a percent of payroll do not increase, then the annual increase in dollars in the contribution should not create special problems in preparing the State's budget. Conversely, it is assumed that if the contribution as a percent of payroll does significantly increase year-by-year, that the annual increases in dollars in the contribution will create special problems in preparing the State's budget.

Thus, it is assumed that the series of projected contributions under the proposed law will be significantly easier to budget for than the current law, because it quits increasing as a percent of payroll three years earlier.

Regarding the long-term trend of contributions, the tables show that under the proposed law, contributions would be significantly lower for 18 years, becoming significantly higher after that. At the end of the 40-year amortization period, both contributions would drop to normal cost only, which would be 11.5% of payroll.

Regarding the possible year-to-year variability of contributions, see Section IV of the report.

State Contributions as a Percent of Payroll

State Contributions in Dollars

Proposed Law

Current Law

Contributions in Millions

1100
1000
900
800
700
600
500
400
300
200
100

1985 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014

Year Ending June 30
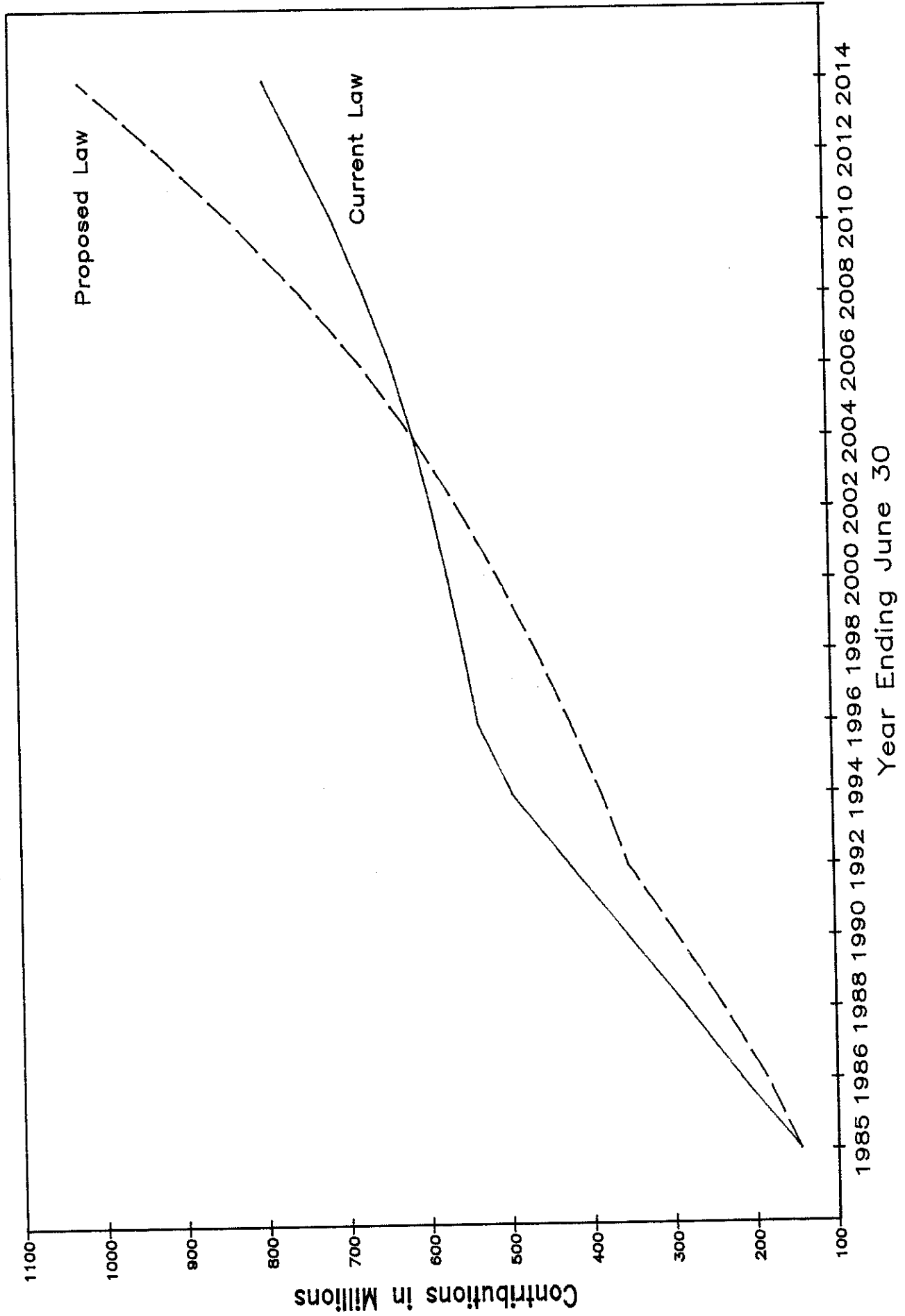
SECTION III

PROJECTED FUNDED STATUS OF THE SYSTEM

In evaluating the funded status of a public system two measures are generally looked at:

.   What percentage of the liabilities are covered by the assets, and are coverage ratios improving satisfactorily? (There is not a consensus as to what the coverage ratios ought to be.)

.   What is the ratio of unfunded liabilities to payroll? The point of this test is that a plan can be financially healthy even if the unfunded liability is increasing in dollars, provided it is not increasing as a percentage of payroll of plan members. The reason is that the payroll of plan members is one measure of the State's ongoing ability to pay the required contributions.

Liability Coverage Percentages

Liabilities of public plans are calculated in three separate ways:

a.   Level Percentage of Pay Measure:

For purposes of determining contributions to public plans, the actuarial liability is traditionally calculated as the reserve that is accumulated by contributing every year for every teacher the level percentage of pay that is required for each teacher to fully fund his/her pension on the date he/she retires. The liability calculated under this measure is always significantly greater than under the two measures described below.

b.   For purposes of evaluating how well funded a public plan is, a different calculation is used. For this purpose, the value of retirement benefits earned to date is used (whether or not these benefits are vested). Two primary variations of this calculation are used:

.   Earned Benefit Measure: The value of the retirement benefit earned to date is based on actual pay history.

.   Projected and Benefit Measure: The value of the retirement benefit earned to date is based on projected pay at retirement.

The following tables give the projected coverage ratio and the projected ratio of unfunded liabilities to payroll.

In evaluating the projected coverage ratios, the following points should be noted:

- Under the current funding law, the System should become fully funded under the Earned Benefit Measure in about 23 years. If the funding objective of the System is to keep fully funded on that measure, the funding law should be changed at that time to reduce contributions.

- Under the current funding law, the System should become fully funded under the Projected Benefit Measure in about 37 years.

- Under the proposed law, full funding under the Earned Benefit Measure is not projected to happen for about 33 years. Thus, it will be long enough before either funding objective is met under the proposed law that it is premature now to discuss when the law should again be changed to reduce contributions.

Ratio of Unfunded Liabilities to Payroll

The following table shows that the proposed law meets the test of having the unfunded liability not increase as a percentage of payroll of plan members. During the period to 1991 when contributions are less than normal cost plus 40-year amortization payments, the ratio is essentially level. After 1991 when contributions have increased to 100% of normal cost plus 40-year amortization the ratio starts decreasing steadily.

Projected Funded Status of the System
Earned Benefit Measure

Current Law

Proposed Law

Percent

Year Ending June 30

Projected Benefit Measure

Current Law

Proposed Law

Percent

Year Ending June 30
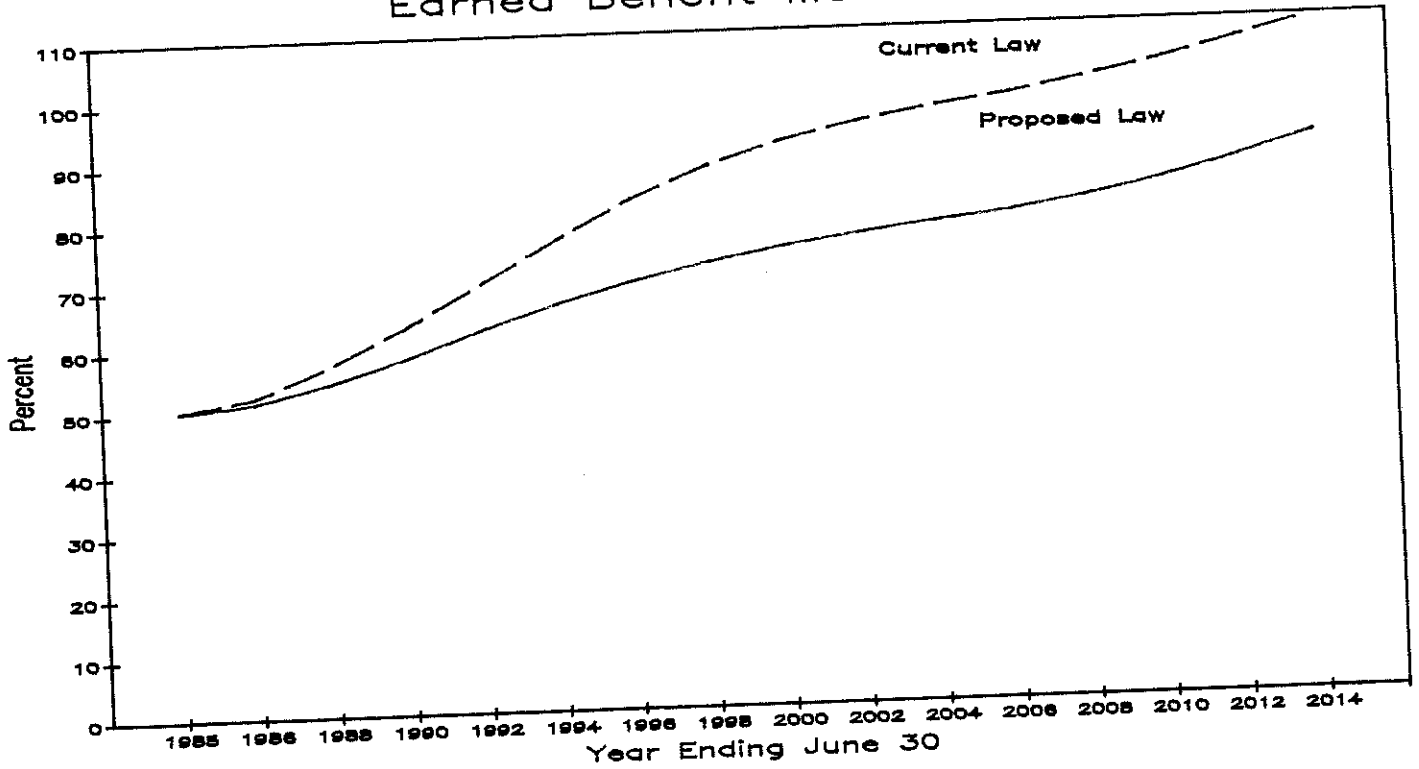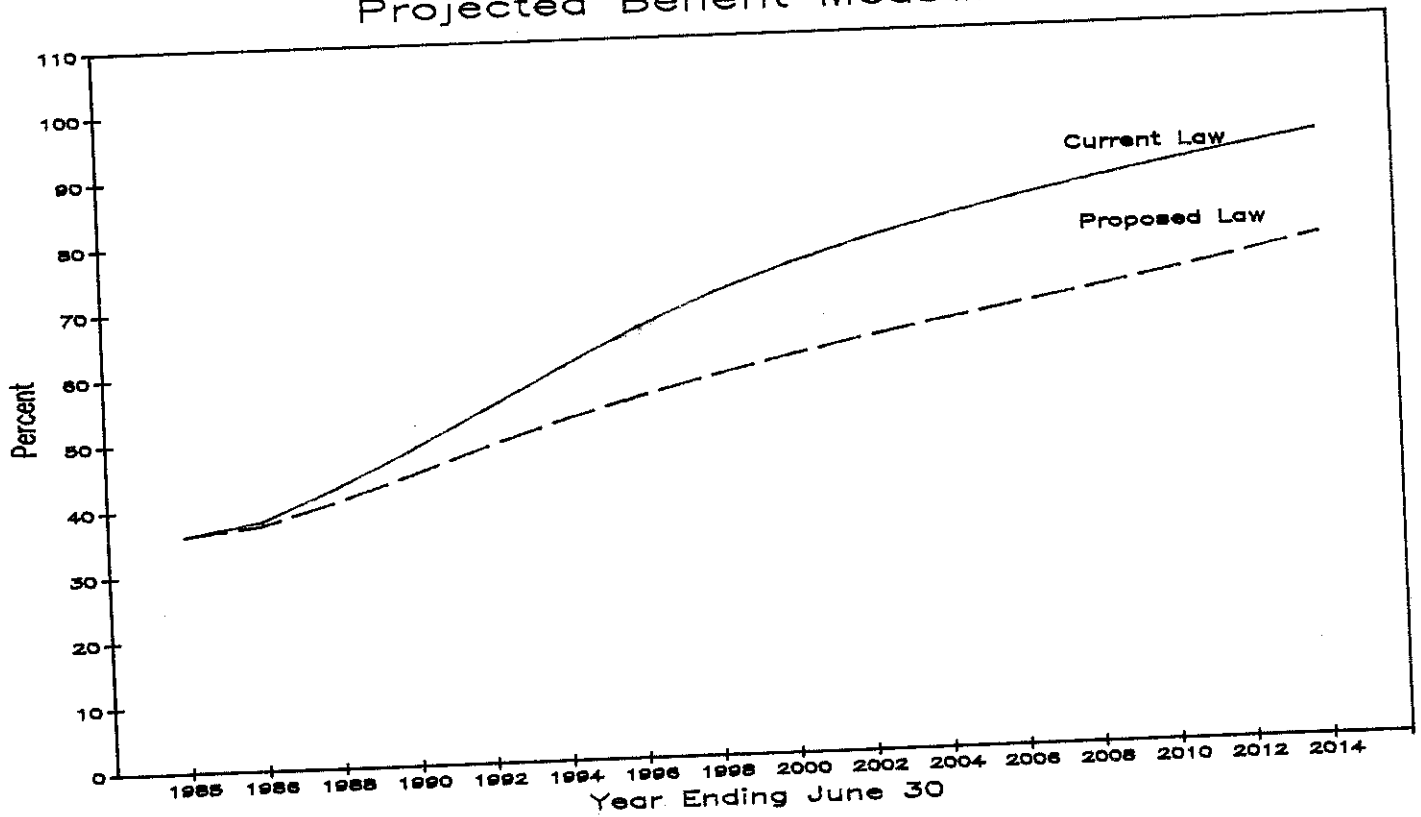
Projected Ratio of unfunded Liabilities to Payroll
Level Percentage of Pay Measure

Ratio

Current Law

Proposed Law

Year Ending June 30

1985 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
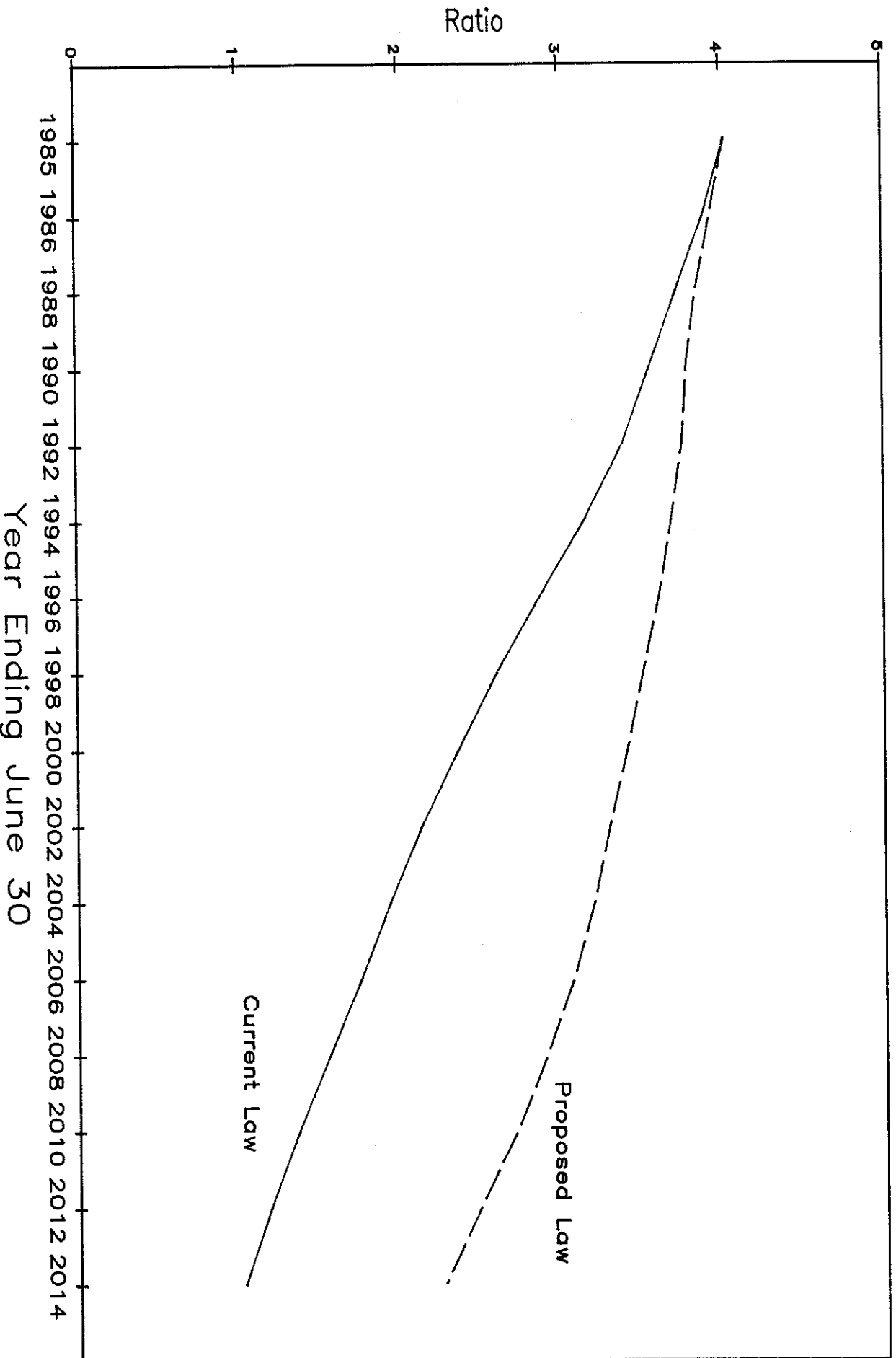
SECTION IV

EFFECT OF EXPECTED INVESTMENT RESULTS ON CONTRIBUTIONS

This section of the report will focus on the impact that fluctuations in capital markets can have on the investment experience of the System.

In August, 1984 the Treasurer conducted a study projecting the expected rates of return of several alternate investment portfolios which utilized different allocations to four asset classes: equities, long bonds, short bonds and real estate. We have examined two of these portfolios in this modeling study. Portfolio A was adopted by the Treasurer for System assets with the asset mix intended to be achieved by June 30, 1989. Portfolio B was chosen because it has a higher allocation to common stocks which should result in higher expected return over the long term, but is expected to be subject to greater variability in returns (risk) in any given year. The asset mix for each portfolio is as follows:

	Portfolio A	Portfolio B
Stocks	36%	49%
Long Bonds	38%	34%
Short Bonds	12%	10%
Real Estate	14%	7%
	100%	100%

Information from these portfolios was studied in this report to determine for each:

.   The projected contributions over the next 30 years, as
    compared with the projected contributions in Section II
    of this report under the proposed law whch are based on
    projected 8 per cent annualized returns.

.   The probability that contributions after five and ten years
    would be greater than the projected contributions in Section II.

The projected contributions under the alternate portfolios is based on the historic, annualized rates of return used in the Treasurer's study: inflation plus 3.72 per cent for portfolio A and inflation plus 4.47 per cent for portfolio B. Since the projections assume an underlying rate of inflation of 5 per cent, these rates translate to annualized rates of return of 8.72 per cent and 9.47 per cent, respectively.

The following chart shows the progression of contributions that would result if portfolios A and B produce the same investment results in the future that they would have averaged in the past based on historic rates of return.

State Contributions as a Percent of Payroll
Contribution Determined Under Proposed Law

8% Investment Return

8.72% Investment Return

9.47% Investment Return

Percent

Year Ending June 30

1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
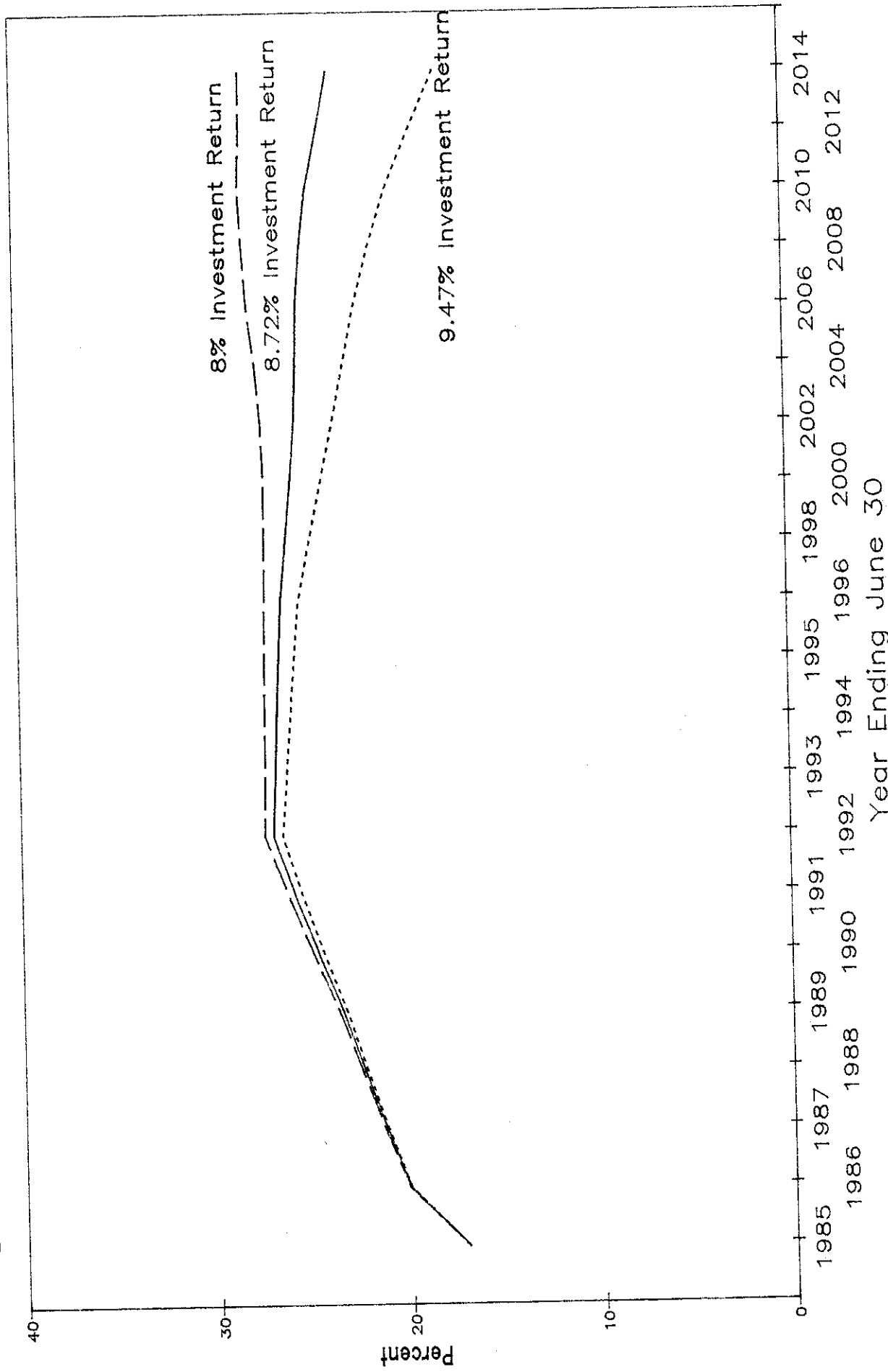
The chart shows that an 8.72% percent rate of return decreases contributions by a small amount, as compared with the 8% rate of return projections. However, even after 30 years the decrease is small enough so that it would not be appropriate to liberalize assumptions today in anticipation of an expected 8.72% long term rate of return.

Portfolio B, however, shows a substantial reduction in contribution over the 30 year period. This reduction is large enough to raise the question of whether assumptions should be liberalized to anticipate some of the expected 9.47% rate of return.

The second question we tested was the probability that contributions would be greater after one, five and ten years than projected contributions assuming an 8% return.

The basis of these calculations was the standard deviation for the two portfolios. The standard deviation of return is a measure of risk, or variability of return, on a specific time horizon. The standard deviations are 8.04 and 10.68 for portfolios A and B, respectively.

The technical meaning of these numbers is that in two out of three years, the return on portfolio A is expected to fall within 8.72% + 8.04%. Thus, in two out of three years, the rate of return is expected to be somewhere between .68% and 16.76%. In one out of three years, the rate of return is expected to be either higher or lower than that range.

Similarly, for portfolio B, in two out of three years, the rate of return is expected to be somewhere between -1.21% and +20.15%, with the third year either higher or lower.

Translating these probabilities for one year investment results into contributions after five and ten years produces the following probabilities:

Probability That Contributions Would Be Higher Than
If Investment Return Were 8% Each Year

Contribution After	Portfolio A	Portfolio B
Five Year	42%	38%
Ten Year	39%	33%

Points to note in above table:

- Under either portfolio, a significant probability exists that poor investment performance would result in contributions larger than projected.

- The numbers suggest that a higher allocation to common stocks would increase the probability that average returns over the years are at least 8%, in addition to decreasing the expected long-term contribution.

The numbers above are based on a relatively simple analysis and should not be the basis of any conclusions about how System assets should be allocated to equity and fixed income investments. However, the numbers do suggest that it would be worthwhile for the Treasurer and the actuary to collaborate in a more sophisticated study to examine whether the higher expected return from a larger allocation to common stocks is worth the risk of having higher contributions than expected from time-to-time. Input would be needed from the Office of Policy and Management to determine what degree of variability is acceptable to those preparing yearly State budgets.

Conclusion

Establishing the optimal asset allocation for the System involves the combined expertise of the Treasurer, the System's actuary, and the Office of Policy and Management. The Treasurer is needed to provide an understanding of potential risks and rewards of different asset portfolios. The System's actuary is needed to translate expected investment returns and expected variability in investment returns into expected State contributions. The Office of Policy and Management is needed to give the Treasurer and the Actuary guidance as to the degree of variability in expected contributions that is acceptable to the State.

Appendix A

Calculation Specifications

The purpose of the biannual actuarial valuation is to determine the appropriate level of expense to assign to the State's operations each year. The valuation is a snapshot of a single point in time based on the Plan's current participants and the actuary's best set of assumptions with respect to future experience.

To estimate the future financial obligations and funding requirements of the plan, we performed four projections which simulate future annual valuations. For each projection, a given set of actuarial assudmptions was used for each of the series of projected annual valuations, but each year a specific set of hypothetical actuarial experience is used for the updating. Different simulation runs can then be compared to isolate the effect that differences in actual experience will have on plan contribution levels and other important plan measures. With each change in "actual" future experience, the model provides answers to a number of "what if" questions.

For each set of "future experience" the model provides 30 year projections for such items as:

> Covered Payroll
> Benefit Payments
> State Contributions
> Assets
> Fund Earnings
> Actuarial Accrued Liability
> Discounted Value of Benefits Earned to Date

Thirty year projections are used because it takes many years for some patterns to emerge. It should be clear that projected contribution amounts 30 years from now are highly speculative, thus the relationship between contribution levels under the different scenarios should be focused on.

Specifications of projection calculations:

- Participant data, plan provisions and actuarial assumptions: as used for the June 30, 1984 actuarial valuation.

- Actuarial cost method: the entry age normal method was used because the Board has voted to change to that method from the frozen initial liability cost method used previously. Thus, the contribution used in this report for the current law contribution for the year beginning July 1, 1975 is slightly different than the contribution previously certified to by the actuary.

• Funding law:

- Run 1 was based on current funding law where the 1985-1985 contribution is 55% of the sum of normal cost plus 40-year level dollar amortization.

- Runs 2-4 were based on proposed funding law where the 1985-1986 contribution is 70% of the sum of normal cost plus 40-year level percent of payroll amortization.

• Projected actual experience:

- Runs 1 and 2 assume actual experience precisely matches all assumptions. (The purpose of run 1 and 2 is to measure the effect of the change in funding law.)

- Runs 3 and 4 assume actual experience precisely matches all assumptions except the investment return assumption. Run 3 assumes an actual investment return of 8.72% each year and run 4 assumes an actual investment return of 9.47%. (The purpose of runs 3 and 4 is to measure the effect of investment results different than the 8% assumed.)

The calculation of the probability that contributions in runs 3 and 4 exceed contributions at a projected 8% rate of return is based on the statistical formula that the standard deviation for n years is the standard deviation for one year divided by the square root of n. This formula is used here only as a device to raise the question whether an increased allocation to common stocks would be beneficial to the System. Answering this question calls for a more sophisticated statistical analysis in addition to important non-statistical considerations.

Appendix B

COMPUTER PROJECTION RESULTS

The following tables present the computer results that underly the charts in this report. In all the tables, dollar amounts are given in millions. The table show:

- Contributions in dollars and as a percent of payroll.

- Funded status of System separately for the earned benefit measure and the projected benefit measure. (2 tables)

- Summary information for each of the four projections. (4 tables)

Table 1

Contributions in Dollars and as a Percent of Payroll
(Dollars = 000,000's)

Year Ending 6/30	Payroll	Current Law Projection		8% Investment Return		8.72% Investment Return		9.47% Investment Return	
		$	%	$	%	$	%	$	%
1984									
1985	$ 854	146.0	17.09	146.0	17.09	146.0	17.09	146.0	17.09
1986	928	217.9	23.47	186.8	20.12	186.5	20.08	186.1	20.04
1987	993	250.4	25.21	212.0	21.34	211.2	21.26	210.3	21.18
1988	1060	284.4	26.83	238.8	22.52	237.3	22.38	235.8	22.24
1989	1129	319.7	28.31	267.0	23.64	264.8	23.45	262.5	23.24
1990	1182	354.3	29.99	294.6	24.93	291.4	24.66	288.0	24.38
1991	1234	389.1	31.53	323.2	26.19	318.8	25.83	314.1	25.45
1992	1291	424.3	32.87	353.1	27.36	347.3	26.91	340.9	26.42
1993	1350	459.3	34.01	368.9	27.31	361.5	26.77	353.5	26.18
1994	1412	493.8	34.97	385.4	27.29	376.3	26.65	366.4	25.94
1995	1478	527.6	35.70	402.9	27.26	391.8	26.51	379.6	25.68
1996	1549	535.3	34.55	421.5	27.21	408.1	26.35	393.3	25.39
1997	1624	543.2	33.45	441.1	27.17	425.1	26.28	407.3	25.08
1998	1699	551.3	32.45	461.4	27.16	442.4	26.04	421.2	24.79
1999	1779	559.9	31.48	483.0	27.15	460.5	25.89	435.4	24.48
2000	1863	569.0	30.54	505.8	27.15	479.4	25.74	449.8	24.15
2001	1947	578.2	29.70	529.4	27.20	498.8	25.62	464.1	23.84
2002	2038	588.4	28.87	554.9	27.23	519.3	25.48	478.1	23.50
2003	2128	598.7	28.13	581.4	27.32	540.2	25.38	493.3	23.18
2004	2217	609.4	27.50	609.2	27.48	561.8	25.35	507.4	22.89
2005	2301	620.5	26.97	638.2	27.74	583.9	25.38	521.2	22.65
2006	2413	635.5	26.33	672.0	27.85	609.9	25.27	537.9	22.29
2007	2533	651.0	25.70	707.5	27.94	636.6	25.14	554.2	21.88
2008	2655	667.4	25.13	744.9	28.05	664.3	25.02	570.1	21.47
2009	2783	684.2	24.59	783.8	28.17	692.3	24.88	585.0	21.02
2010	2931	703.7	24.01	826.4	28.19	722.9	24.66	600.8	20.50
2011	3101	724.8	23.37	871.9	28.11	754.9	24.34	616.4	19.88
2012	3270	745.8	22.81	918.4	28.09	786.5	24.05	629.6	19.25
2013	3443	768.0	22.30	967.4	28.10	818.8	23.78	641.3	18.63
2014	3617	787.6	21.78	1015.2	28.07	848.0	23.45	647.4	17.90

Table 2

Funded Status of System - Earned Benefit Measure
(Dollars = 000,000's)

| Year Encing 6/30 | Discounted Value of Benefits | Current Law Projections | | Proposed Law Projections | | | | | |
| | | | | 8% Investment Return | | 8.72% Investment Return | | 9.47% Investment Return | |
		Assets	Funded Ratio	Assets	Funded Ratio	Assets	Funded Ratio	Assets	Funded Ratio
1984	$ 3106	$ 1549	49.87%	$ 1549	49.87	$ 1549	48.97%	$ 1549	49.87%
1985	3417	1716	50.21	1716	50.21	1728	50.56	1740	50.92
1986	3764	1969	52.32	1937	51.45	1962	52.13	1989	52.85
1987	4141	2265	54.71	2190	52.88	2232	53.90	2276	54.98
1988	4554	2606	57.23	2477	54.39	2538	55.74	2603	57.17
1989	4986	2995	60.06	2799	56.15	2883	57.82	2972	59.61
1990	5432	3431	63.15	3157	58.12	3266	60.13	3383	62.29
1991	5892	3915	66.45	3551	60.26	3689	62.61	3838	65.14
1992	6376	4451	69.81	3983	62.46	4154	65.15	4340	68.70
1993	6887	5042	73.21	4441	64.49	4650	67.52	4878	70.84
1994	7425	5688	76.61	4925	66.33	5177	69.72	5453	73.44
1995	7995	6394	79.97	5439	68.03	5738	71.77	6068	75.89
1996	8600	7136	82.99	5986	69.61	6338	73.70	6728	78.24
1997	9243	7918	85.67	6569	71.07	6979	75.51	7437	80.46
1998	9929	8737	88.00	7186	72.37	7661	77.16	8194	82.53
1999	10655	9595	90.05	7838	73.56	8385	78.70	9001	84.47
2000	11429	10492	91.80	8529	74.63	9154	80.10	9861	86.28
2001	12251	11425	93.26	9254	75.53	9964	81.33	10772	87.93
2002	13103	12396	94.60	10015	76.44	10819	82.57	11737	89.57
2003	13986	13398	95.80	10809	77.29	11713	83.75	12751	91.17
2004	14897	14420	96.80	11624	78.03	12637	84.83	13804	92.66
2005	15829	15451	97.61	12449	78.65	13579	85.78	14887	94.05
2006	16752	16508	98.54	13305	79.42	14558	86.91	16017	95.61
2007	17661	17594	99.62	14194	80.37	15580	88.22	17200	97.39
2008	18556	18706	100.81	15115	81.46	16641	89.68	18432	99.33
2009	19446	19842	102.04	16069	82.63	17742	91.24	19714	101.38
2010	20329	21020	103.40	17073	83.99	18900	92.97	21064	103.62
2011	21209	22260	104.95	18152	85.59	20140	94.96	22504	106.11
2012	22123	23561	106.50	19305	87.26	21460	97.00	24034	108.64
2013	23065	24923	108.06	20537	89.04	22864	99.13	25655	111.23
2014	24028	26340	109.62	21842	90.90	24345	101.32	27360	113.87

Table 3

Funded Status of System - Projected Benefit Measure
(Dollars = 000,000's)

Year Ending 6/30	Discounted value of Benefits	Current Law Projections		Proposed Law Projections					
				8% Investment Return		8.72% Investment Return		9.47% Investment Return	
		Assets	Funded Ratio	Assets	Funded Ratio	Assets	Funded Ratio	Assets	Funded Ratio
1984	$ 4389	$ 1549	35.29%	$ 1549	35.29%	$ 1549	35.29%	$ 1549	35.29%
1985	4767	1716	36.00	1716	36.00	1728	36.25	1740	36.51
1986	5179	1969	38.02	1937	37.39	1962	37.89	1989	38.41
1987	5620	2265	40.30	2190	38.96	2232	39.71	2276	40.50
1988	6090	2606	42.80	2477	40.67	2538	41.68	2603	42.75
1989	6586	2995	45.47	2799	42.50	2883	43.77	2972	45.13
1990	7110	3431	48.25	3157	44.40	3266	45.94	3383	47.58
1991	7661	3915	51.11	3551	46.35	3689	48.16	3838	50.11
1992	8238	4451	54.03	3983	48.34	4154	50.43	4340	52.69
1993	8845	5042	57.00	4441	50.21	4650	52.58	4878	55.16
1994	9840	5688	60.00	4925	51.95	5177	54.61	5453	57.52
1995	10148	6394	63.00	5439	53.60	5738	56.54	6068	59.79
1996	10852	7136	65.76	5986	55.16	6338	58.40	6728	62.00
1997	11595	7918	68.29	6569	56.65	6979	60.20	7437	64.14
1998	12373	8737	70.61	7186	58.07	7661	61.91	8194	66.22
1999	13190	9595	72.74	7838	59.43	8385	63.57	9001	68.24
2000	14045	10492	74.70	8529	60.73	9154	65.18	9861	70.21
2001	14933	11425	76.51	9254	61.97	9964	66.73	10772	72.14
2002	15856	12396	78.18	10015	63.17	10819	68.24	11737	74.02
2003	16805	13398	79.72	10809	64.32	11713	69.70	12751	75.88
2004	17767	14420	81.16	11624	65.42	12637	71.12	13804	77.69
2005	18728	15451	82.50	12449	66.47	13579	72.50	14887	79.49
2006	19704	16508	83.78	13305	67.52	14558	73.89	16017	81.29
2007	20697	17594	85.01	14194	68.58	15580	75.28	17200	83.10
2008	21703	18706	86.19	15115	69.64	16641	76.67	18432	84.93
2009	22722	19842	87.33	16069	70.72	17742	78.08	19714	86.76
2010	23770	21020	88.43	17073	71.83	18900	79.51	21064	88.62
2011	24870	22260	89.50	18152	72.99	20140	80.98	22504	90.49
2012	26022	23561	90.54	19305	74.19	21460	82.47	24034	92.36
2013	27225	24923	91.54	20537	75.43	22864	83.98	25655	94.23
2014	28475	26340	92.51	21842	76.71	24345	85.50	27360	96.09

Table 4
Summary Information for Current Law Projections

YEAR ENDING 6/30	BENEFIT PAY'TS.	MEMBER CONTRIB.	NORMAL COST	UNF.P. S.PAY.	STATE CONT.	INVEST. EARNS.	UNF.P. S.LIAB	FUND BAL.	PAYROLL	STATE CONT. AS % OF PAYROLL
1984							3207.	1549.		
1985	157.1	51.	107.8	249.2	146.0	131.1	3430.	1716.	854.	17.09
1986	164.2	56.	115.9	267.2	217.9	150.0	3621.	1969.	928.	23.47
1987	179.2	60.	122.6	281.4	250.4	172.3	3792.	2265.	993.	25.21
1988	196.9	64.	129.3	294.7	284.4	198.1	3949.	2606.	1060.	26.83
1989	217.7	68.	136.1	306.8	319.7	227.5	4088.	2995.	1129.	28.31
1990	239.7	71.	140.6	317.7	354.3	260.5	4208.	3431.	1182.	29.99
1991	264.7	74.	145.1	327.0	389.1	297.2	4306.	3915.	1234.	31.53
1992	291.8	77.	150.0	334.7	424.3	337.8	4381.	4451.	1291.	32.87
1993	319.1	81.	155.2	340.5	459.3	382.4	4431.	5042.	1350.	34.01
1994	350.0	85.	160.6	344.4	493.8	431.3	4454.	5688.	1412.	34.97
1995	379.9	89.	166.4	346.3	527.6	484.6	4450.	6394.	1478.	35.70
1996	411.0	93.	172.8	347.4	535.3	540.6	4444.	7136.	1549.	34.55
1997	443.2	97.	179.5	348.4	543.2	599.6	4436.	7918.	1624.	33.45
1998	480.2	102.	186.3	349.4	551.3	661.5	4425.	8737.	1699.	32.45
1999	519.4	107.	193.8	350.3	559.9	726.3	4412.	9595.	1779.	31.48
2000	561.5	112.	201.7	351.2	569.0	794.2	4395.	10492.	1863.	30.54
2001	610.7	117.	209.9	352.0	576.2	864.9	4376.	11425.	1947.	29.70
2002	662.0	122.	219.1	352.7	588.4	938.6	4351.	12396.	2038.	28.87
2003	722.3	128.	228.6	353.2	596.7	1014.9	4327.	13398.	2128.	28.13
2004	796.3	133.	238.7	353.6	609.4	1093.2	4289.	14420.	2217.	27.50
2005	882.8	138.	249.2	353.8	620.5	1172.6	4253.	15451.	2301.	26.97
2006	958.8	145.	263.5	354.0	635.5	1253.5	4211.	16508.	2413.	26.33
2007	1034.7	152.	278.6	354.0	651.0	1336.6	4163.	17594.	2533.	25.70
2008	1118.4	159.	294.7	353.9	667.4	1421.8	4111.	18706.	2655.	25.13
2009	1204.1	167.	311.3	353.5	684.2	1509.0	4054.	19842.	2783.	24.59
2010	1280.9	176.	330.6	353.2	703.7	1598.7	3992.	21020.	2931.	24.01
2011	1343.1	186.	351.5	352.8	724.8	1692.5	3924.	22260.	3101.	23.37
2012	1411.0	196.	372.5	352.2	745.8	1791.1	3850.	23561.	3270.	22.81
2013	1464.8	207.	394.8	351.5	768.0	1894.4	3769.	24923.	3443.	22.30
2014	1567.3	217.	417.0	348.4	787.6	2002.1	3687.	26340.	3617.	21.78

Table 5
Summary Information for Proposed Law Projection, 8%
Projected Rate of Return

YEAR ENDING 6/30	BENEFIT PAY'TS.	MEMBER CONTRIB.	NORMAL COST	UNF.P. S.PAY.	STATE CONT.	INVEST. EARNS.	UNF.P. S.LIAB	FUND BAL.	PAYROLL	STATE CONT. AS % OF PAYROLL
1984							3207.	1549.	854.	17.09
1985	157.1	51.	107.8	249.2	146.0	131.1	3439.	1716.	928.	20.12
1986	164.2	56.	115.9	142.5	186.6	147.5	3654.	1937.	993.	21.34
1987	179.2	60.	122.6	151.3	212.0	166.7	3867.	2190.	1060.	22.52
1988	196.9	64.	129.3	160.1	236.6	188.5	4078.	2477.	1129.	23.64
1989	217.7	68.	136.1	168.8	267.0	213.0	4283.	2799.	1182.	24.93
1990	239.7	71.	140.6	177.2	294.6	240.2	4481.	3157.	1234.	26.19
1991	264.7	74.	145.1	185.4	323.2	270.2	4670.	3551.	1291.	27.36
1992	291.8	77.	150.0	193.2	353.1	303.1	4849.	3983.	1350.	27.31
1993	319.1	81.	155.2	203.3	368.9	338.0	5031.	4441.	1412.	27.29
1994	350.0	85.	160.6	213.9	385.4	374.8	5217.	4925.	1478.	27.26
1995	379.9	89.	166.4	225.1	402.9	413.9	5404.	5439.	1549.	27.21
1996	411.0	93.	172.8	236.8	421.5	455.4	5594.	5986.	1624.	27.17
1997	443.2	97.	179.5	249.1	441.1	499.6	5785.	6569.	1699.	27.16
1998	480.2	102.	186.3	262.1	461.4	546.5	5977.	7186.	1779.	27.15
1999	519.4	107.	193.8	275.6	483.0	596.2	6169.	7838.	1863.	27.15
2000	561.5	112.	201.7	289.8	505.6	648.7	6359.	8529.	1947.	27.20
2001	610.7	117.	209.9	304.6	529.4	704.1	6547.	9254.	2038.	27.23
2002	662.0	122.	219.1	320.1	554.9	762.3	6732.	10015.	2128.	27.32
2003	722.3	128.	228.6	336.4	581.4	823.1	6911.	10809.	2217.	27.48
2004	796.3	133.	238.7	353.3	609.2	886.0	7086.	11624.	2301.	27.74
2005	882.8	138.	249.2	371.0	636.2	950.3	7255.	12449.	2413.	27.85
2006	958.8	145.	263.5	389.6	672.0	1016.3	7414.	13305.	2533.	27.94
2007	1034.7	152.	278.6	409.0	707.5	1084.8	7563.	14194.	2655.	28.05
2008	1118.4	159.	294.7	429.2	744.9	1155.8	7701.	15115.	2783.	28.17
2009	1204.1	167.	311.3	450.3	783.8	1229.4	7827.	16069.	2931.	28.19
2010	1280.9	176.	330.6	472.5	826.4	1306.4	7939.	17073.	3101.	28.11
2011	1343.1	186.	351.5	495.7	871.9	1388.3	8032.	18152.	3270.	28.09
2012	1411.0	196.	372.5	519.9	916.4	1475.9	8105.	19305.	3443.	28.10
2013	1464.8	207.	394.8	545.3	967.4	1569.5	8156.	20537.	3617.	28.07
2014	1567.3	217.	417.0	569.6	1015.2	1668.9	8165.	21842.		

William M. Mercer—Meidinger Incorporated

Table 6
Summary Information for Proposed Law Projections, 8.72%
Projected Rate of Return

YEAR ENDING 6/30	BENEFIT PAY'TS.	MEMBER CONTRIB.	NORMAL COST	UNF.P. S.PAY.	STATE CONT.	INVEST. EARNS.	UNF.P. S.LIAB	FUND BAL.	PAYROLL	STATE CONT. AS % OF PAYROLL
1984							3207.	1549.		
1985	157.1	51.	107.8	249.2	146.0	142.9	3427.	1728.	854.	17.09
1986	164.2	56.	115.9	142.0	186.5	161.8	3628.	1962.	928.	20.08
1987	179.2	60.	122.6	150.3	211.2	183.9	3825.	2232.	993.	21.26
1988	196.9	64.	129.3	158.4	237.3	209.0	4017.	2538.	1060.	22.38
1989	217.7	68.	136.1	166.3	264.8	237.4	4200.	2883.	1129.	23.45
1990	239.7	71.	140.6	173.8	291.4	268.9	4372.	3266.	1182.	24.66
1991	264.7	74.	145.1	180.9	318.6	303.7	4532.	3689.	1234.	25.83
1992	291.8	77.	150.0	187.5	347.3	342.0	4678.	4154.	1291.	26.91
1993	319.1	81.	155.2	196.2	361.5	382.7	4822.	4650.	1350.	26.77
1994	350.0	85.	160.6	205.1	376.3	426.1	4965.	5177.	1412.	26.65
1995	379.9	89.	166.4	214.3	391.8	472.2	5106.	5738.	1478.	26.51
1996	411.0	93.	172.8	223.8	406.1	521.4	5242.	6338.	1549.	26.35
1997	443.2	97.	179.5	233.6	425.1	573.9	5375.	6979.	1624.	26.18
1998	480.2	102.	186.3	243.6	442.4	629.9	5501.	7661.	1699.	26.04
1999	519.4	107.	193.8	253.8	460.5	689.4	5622.	8385.	1779.	25.89
2000	561.5	112.	201.7	264.2	479.4	752.6	5734.	9154.	1863.	25.74
2001	610.7	117.	209.9	274.8	498.8	819.4	5836.	9964.	1947.	25.62
2002	662.0	122.	219.1	285.5	519.3	889.9	5928.	10819.	2038.	25.48
2003	722.3	128.	228.6	296.4	540.2	963.8	6007.	11713.	2128.	25.38
2004	796.3	133.	238.7	307.3	561.8	1040.7	6073.	12637.	2217.	25.35
2005	882.8	138.	249.2	318.2	583.9	1119.6	6125.	13579.	2301.	25.38
2006	958.8	145.	263.5	329.2	609.9	1201.0	6160.	14558.	2413.	25.27
2007	1034.7	152.	278.6	340.1	636.6	1285.8	6178.	15580.	2533.	25.14
2008	1118.4	159.	294.7	350.8	664.3	1373.9	6176.	16641.	2655.	25.02
2009	1204.1	167.	311.3	361.4	692.3	1465.5	6155.	17742.	2783.	24.88
2010	1280.9	176.	330.6	371.9	722.9	1561.2	6112.	18900.	2931.	24.66
2011	1343.1	186.	351.5	382.1	754.9	1662.7	6044.	20140.	3101.	24.34
2012	1411.0	196.	372.5	391.8	786.5	1771.0	5950.	21460.	3270.	24.05
2013	1484.8	207.	394.8	400.9	818.8	1886.1	5829.	22864.	3443.	23.78
2014	1567.3	217.	417.0	407.1	848.0	2007.9	5682.	24345.	3617.	23.45

Table 7
Summary Information for Proposed Law Projections, 9.47%
Projected Rate of Return

YEAR ENDING 6/30	BENEFIT PAY'TS.	MEMBER CONTRIB.	NORMAL COST	UNF.P. S.PAY.	STATE CONT.	INVEST. EARNS.	UNF.P. S.LIAB	FUND BAL.	PAYROLL	STATE CONT. AS % OF PAYROLL
1984							3207.	1549.		
1985	157.1	51.	107.8	249.2	146.0	155.2	3415.	1740.	854.	17.09
1986	164.2	56.	115.9	141.5	186.1	176.9	3601.	1989.	928.	20.04
1987	179.2	60.	122.6	149.2	210.3	202.2	3781.	2276.	993.	21.18
1988	196.9	64.	129.3	156.6	235.8	231.1	3952.	2603.	1060.	22.24
1989	217.7	68.	136.1	163.6	262.5	263.7	4110.	2972.	1129.	23.24
1990	239.7	71.	140.6	170.1	288.0	300.2	4255.	3383.	1182.	24.38
1991	264.7	74.	145.1	176.1	314.1	340.5	4383.	3838.	1234.	25.45
1992	291.8	77.	150.0	181.3	340.9	385.0	4492.	4340.	1291.	26.42
1993	319.1	81.	155.2	188.4	353.5	432.6	4594.	4878.	1350.	26.18
1994	350.0	85.	160.6	195.4	366.4	483.4	4689.	5453.	1412.	25.94
1995	379.9	89.	166.4	202.5	379.6	537.8	4776.	6068.	1478.	25.68
1996	411.0	93.	172.8	209.4	393.3	596.1	4852.	6728.	1549.	25.39
1997	443.2	97.	179.5	216.3	407.3	658.7	4917.	7437.	1624.	25.08
1998	480.2	102.	186.3	222.9	421.2	725.5	4969.	8194.	1699.	24.79
1999	519.4	107.	193.8	229.3	435.4	796.9	5006.	9001.	1779.	24.48
2000	561.5	112.	201.7	235.4	449.8	873.0	5026.	9861.	1863.	24.15
2001	610.7	117.	209.9	241.1	464.1	953.7	5029.	10772.	1947.	23.84
2002	662.0	122.	219.1	246.2	478.8	1039.2	5010.	11737.	2038.	23.50
2003	722.3	128.	228.6	250.7	493.3	1129.4	4969.	12751.	2128.	23.18
2004	796.3	133.	238.7	254.4	507.4	1223.5	4905.	13804.	2217.	22.89
2005	882.8	138.	249.2	257.3	521.2	1320.8	4817.	14887.	2301.	22.65
2006	958.8	145.	263.5	259.2	537.9	1421.6	4702.	16017.	2413.	22.29
2007	1034.7	152.	278.6	259.9	554.2	1527.0	4558.	17200.	2533.	21.88
2008	1118.4	159.	294.7	259.3	570.1	1636.9	4385.	18432.	2655.	21.47
2009	1204.1	167.	311.3	257.1	585.0	1751.3	4182.	19714.	2783.	21.02
2010	1280.9	176.	330.6	253.3	600.8	1871.1	3948.	21064.	2931.	20.50
2011	1343.1	186.	351.5	247.5	616.4	1998.0	3679.	22504.	3101.	19.88
2012	1411.0	196.	372.5	239.3	629.6	2132.9	3376.	24034.	3270.	19.25
2013	1484.8	207.	394.8	228.4	641.3	2275.9	3038.	25655.	3443.	18.63
2014	1567.3	217.	417.0	212.1	647.4	2426.6	2667.	27360.	3617.	17.90

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