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The Retirement Law Commission

COMPOSITE ACTUARIAL VALUATION

AS OF JANUARY 1, 1987

Retirement Law Commission

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The Commonwealth of Massachusetts

Retirement Law Commission

One Ashburton Place

Boston, Massachusetts 02108

COMMISSIONERS OF LABORATORY

CENTRAL LABORATORY

REPORT

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JANUARY 1989

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EXECUTIVE SUMMARY

COMMONWEALTH OF MASSACHUSETTS

INTRODUCTION

CONTRIBUTORY RETIREMENT SYSTEM

COMPOSITE

STATEMENT OF ALTERNATIVE CONTRIBUTION LEVELS
ACTUARIAL VALUATION REPORT

AS OF JANUARY 1, 1987

STATEMENTS AND PROJECTIONS OF CONTRIBUTIONS
REQUIREMENTS

PARTICIPANT DATA

STATEMENT OF ACTUARIAL PRESENT VALUE OF ACCUMULATED
BENEFITS UNDER PLAN STATEMENT NO. 5

OBSERVATIONS

ACTUARIAL COST METHOD, FACTORS AND ASSUMPTIONS
USED IN COST DETERMINATION

ANALYSIS OF FINANCIAL RESULTS AND LIABILITIES
PROVISIONS AS OF JANUARY 1, 1987

CLOSURE OF PLAN

TABLE OF CONTENTS

	<u>PAGE</u>
PART I EXECUTIVE SUMMARY	1
PART II INTRODUCTION	2
PART III DERIVATION OF ALTERNATIVE CONTRIBUTION LEVELS	7
PART IV TWENTY-YEAR PROJECTION OF CONTRIBUTION REQUIREMENTS	13
PART V PARTICIPANT DATA	43
PART VI STATEMENT OF ACTUARIAL PRESENT VALUE OF ACCRUED BENEFITS UNDER GASB STATEMENT NO. 5	45
PART VII OBSERVATIONS	47
PART VIII ACTUARIAL COST METHODS, FACTORS AND ASSUMPTIONS USED IN COST DETERMINATIONS	51
PART IX SUMMARY OF PRINCIPAL BENEFITS AND ELIGIBILITY PROVISIONS AS OF JANUARY 1, 1987	55
PART X GLOSSARY OF TERMS	60

PART I

EXECUTIVE SUMMARY

OF ALL SYSTEMS

AS OF JANUARY 1, 1987 AND JANUARY 1, 1983
(\$000 OMITTED)

	<u>1987</u>	<u>1987</u>	<u>1983</u>
	<u>w/o cap</u>	<u>w/cap</u>	
Active Employees	275,021	275,021	257,453
Inactive Members	122,279	122,279	80,622
Retired Members	129,737	129,737	109,249
Payroll of Actives	\$ 6,414,549	\$ 6,414,549	\$ 4,412,721
Normal Cost as a Percentage of Payroll:			
Employer	7.0%	4.6%	8.9%
Employees	6.4%	6.4%	5.7%
Total	<u>13.4%</u>	<u>11.0%</u>	<u>14.6%</u>
Employer Normal Cost	\$ 449,111	\$ 300,823	\$ 394,198
Actuarial Accrued Liability:			
Active Members:	\$13,409,982	\$12,852,333	\$ 8,902,789
Retired and Inactive Members	<u>9,978,523</u>	<u>10,196,262</u>	<u>7,054,913</u>
Total	\$23,388,505	\$23,048,595	\$15,957,702
Assets (Market Value)	\$ 8,067,275	\$ 8,067,275	\$ 4,134,574
Unfunded Actuarial Accrued Liability	\$15,321,230	\$14,981,320	\$11,823,128
Funding Contributions*	\$ 950,367	\$ 784,359	\$ 979,041
Pay-As-You-Go Contribution	\$ 950,879	\$ 950,878	\$ 713,212

* Normal cost plus 40-year Amortization of Unfunded Actuarial Accrued Liability with increasing amortization payments.

PART II
INTRODUCTION

This report presents a composite of the findings of the actuarial valuations for the 106 Contributory Retirement Systems as of January 1, 1987 under the Commonwealth of Massachusetts Retirement Plan.

The actuarial valuations are based on the provisions of the General Laws of the Commonwealth of Massachusetts (principally Chapter 32) as of January 1, 1987, employee data provided by the employer, asset information reported by the Public Employees' Retirement Administration, and actuarial assumptions approved by the Retirement Law Commission.

The valuation is prepared in accordance with Chapter 32 as of January 1, 1987, and does not take into account any subsequent changes in the law.

The resulting employer contributions have been determined on two alternative bases as follows:

1. The pay-as-you-go contribution required to fund benefits payable as of the first of the year, excluding the portion funded by accumulated member contributions.
2. The amount required to pay the employer normal cost (in addition to member contributions) plus amortize the unfunded actuarial accrued liability over 40 years with amortization payments increasing at 7 1/2% (4 1/2% for non-Commonwealth pension obligation) per year, payable at the beginning of year.

For most local counties, municipalities, and authorities, the cost required to pay normal cost plus amortize the unfunded actuarial accrued liability, expressed as a percentage of payroll, is less than that determined in the 1983 valuation. This is the result of many factors, including:

1. Employee Contribution Rates

A summary of the required employee contribution rates is as follows:

<u>Year Employed</u>	<u>Employee Contribution Rate</u>
Prior to 1975	5%
1975 - 1983	7%
1984 and Later	8%

As a result of the above, the average employee contribution rate has increased during the past 4 years. This has served to reduce the required employer contribution.

2. \$30,000 Pay Cap

A feature having significant impact on the results of the valuations is the \$30,000 pay cap. Under the provisions of the law, for employees hired on or after January 1, 1979, pay in excess of \$30,000 is not included when determining the amount of the participant's pension. While the majority of current employees do not make over \$30,000, the valuation cost determinations are not based upon current pay, but rather estimated final average pay. Since salaries are assumed to increase at the rate of 6% a year, most employees are projected to earn significantly more than \$30,000 by the time they retire. Accordingly, the projected retirement benefits reflect only a fraction of the benefit the employees would receive were it not for the \$30,000 pay cap.

On the other hand, employee contributions are based on total pay, not pay limited by the cap. For recent hires, the valuations anticipate that employees will contribute 8% of all pay. Much of this projected pay is over \$30,000. As a result, the valuations project employees to contribute on pay

which is not covered by benefits. For young employees, these factors can result in the employee contributions being more than adequate to fully fund the benefits promised. In this event, the resulting employer contribution is negative.

At the time of the 1983 actuarial valuation, only those employees employed within the preceding 4 years were covered by the pay cap. However, with the 1987 valuation, all employees hired within the last 8 years are covered.

3. Investment Performance

To the extent that the investment performance of the plan's assets has exceeded the assumed rate, investment gains have served to reduce unfunded liabilities and, therefore, reduce employer funding costs.

4. Actuarial Experience

Other actuarial experience due to items such as pay increase, employee turnover, mortality, disability, and retirement, if different from that assumed in the prior actuarial valuation, has served to increase or decrease the unfunded liability and, therefore, to increase or decrease employer funding costs.

5. Actuarial Assumptions

The actuarial assumptions used in the current valuations differ from those used in the prior valuations. These changes have impacted on both unfunded liabilities and normal costs. A study of the effect of the change on the State and Teachers Systems produced the following results with the \$30,000 cap:

State

	<u>Old</u> <u>Assumptions</u>	<u>New</u> <u>Assumptions</u>	<u>% Change</u>
Actuarial Accrued Liability			
- Actives	4,073,000	3,796,000	(6.8)
- Retired and Inactives	<u>2,748,000</u>	<u>2,650,000</u>	(3.6)
- Total	6,821,000	6,446,000	(5.5)
Normal Cost - ER	111,945	81,215	(27.5)
Funding Costs	329,800	292,300	(11.4)

Teachers

	<u>Old</u> <u>Assumptions</u>	<u>New</u> <u>Assumptions</u>	<u>% Change</u>
Actuarial Accrued Liability			
- Actives	4,881,000	4,494,000	(7.9)
- Retired and Inactives	<u>2,397,000</u>	<u>2,319,000</u>	(3.3)
- Total	7,278,000	6,813,000	(6.4)
Normal Cost - ER	126,891	75,399	(40.6)
Funding Cost	360,000	297,800	(17.3)

The main reason for the large decrease in Employer Normal Cost is due to the increase in the expected accumulation of employee contributions coupled with the decrease in Total Normal Cost due to the higher expected investment return.

Although the local board valuations did not include costs under the old assumptions, we have estimated the impact based on the State's results as follows:

	Old Assumptions	New Assumptions	% Change
Actuarial Accrued Liability			
- Actives	3,334,372	3,100,966	(7.0)
- Retired and Inactives	2,904,123	2,787,958	(4.0)
- Total	6,238,495	5,888,924	(5.6)
Normal Cost - ER	116,102	88,622	(23.7)
Funding Costs	299,899	256,948	(14.3)

PART III

DERIVATION OF CONTRIBUTION LEVELS

The purpose of this part is to present the consolidation of the costs of the Contributory Retirement Systems. Cost estimates have been determined on the basis of the entry age normal actuarial cost method. Pension costs are made up of two components, the normal cost and the payment towards the unfunded actuarial accrued liability.

A. Derivation of Normal Cost

The normal cost is calculated as the sum of the individual normal costs determined for each member based on the assumption that the plan had always been in existence and the actuarial assumptions underlying the cost determinations had been exactly realized. Individual normal costs represent that part of the cost of an individual's future benefits which are assigned to the current year if costs are to remain level as a percentage of the participant's pay. Benefits payable under all circumstances (i.e., retirement, death, disability and termination) are included in the calculations. From this result is subtracted the anticipated employee contributions to be made during the year to determine the employer normal cost. The employer normal cost is divided by total payroll to determine the normal cost as a percent of pay.

B. Derivation of the Unfunded Actuarial Accrued Liability

The actuarial accrued liability is determined as the sum of the actuarial present value of all normal costs which would have accumulated to December 31, 1986 if the actuarial assumptions had been exactly realized.

The market value of the assets of the fund as of January 1, 1987 is subtracted from the accrued liability in order to determine the unfunded actuarial accrued liability as of the valuation date.

For the systems for which the Commonwealth is responsible, the funded liability has been amortized over 40 years assuming payments increasing at 7 1/2%. The contribution determined under the pay-as-you-go funding method is the amount needed to meet the expected benefit payments for the year ending December 31, 1987. For all other systems, the unfunded liability has been amortized over 40 years assuming payments increasing at 4 1/2%.

COMMONWEALTH OF MASSACHUSETTS
CONTRIBUTORY RETIREMENT SYSTEM
CONTRIBUTIONS WITH THE \$30,000 CAP
AS OF JANUARY 1, 1987
(\$000 OMITTED)

	<u>State</u>	<u>Teachers</u>	<u>Boston Teachers</u>	<u>Boston Non-Teachers</u>	<u>State Authorities</u>	<u>Other Local Boards</u>	<u>COLA**</u>	<u>Total</u>
Normal Cost-Employer	81,215 (3.7)	75,399 (4.1)	4,403 (2.4)	12,588 (3.4)	1,406 (2.4)	88,622 (5.0)	37,190	300,823 (4.6)
Normal Cost-Employees	147,065 (6.7)	108,501 (5.9)	10,998 (6.1)	24,323 (6.5)	3,965 (6.8)	112,900 (6.4)	0	407,752 (6.4)
Total Normal Cost	228,280 (10.4)	183,900 (10.0)	15,401 (8.5)	36,911 (9.8)	5,371 (9.2)	201,522 (11.4)	37,190	708,575 (11.0)
Funding Cost*	188,643 (8.6)	188,621 (10.3)	13,728 (7.6)	53,052 (14.1)	1,944 (3.3)	256,948 (14.6)	81,423	784,359 (12.2)
Pay-As-You-Go Contribution	246,400 (11.2)	236,000 (12.8)	25,062 (13.8)	80,098 (21.3)	3,644 (6.2)	306,120 (17.3)	53,554	950,878 (14.8)
Total Payroll	2,195,000	1,839,000	181,300	375,631	58,297	1,765,321	0	6,414,549

Figures in parenthesis are the amount as a percent of Total Payroll

- * Normal Cost plus Increasing Amortization Payments at allowed limit (State, Teachers, Boston Teachers and COLA amortization payments increasing at 7 1/2% per year; Boston Non-Teachers, States Authorities and Other Local Boards amortization payments increase at 4 1/2% per year).
- ** Represents the Commonwealth assumptions of Boston Teachers and Local's present and future cost of living adjustment awarded or to be awarded after 1981.

COMMONWEALTH OF MASSACHUSETTS
 CONTRIBUTORY RETIREMENT SYSTEM
 ASSETS AND LIABILITIES WITH THE \$30,000 CAP
 AS OF JANUARY 1, 1987
 (\$000 OMITTED)

	State	Teachers	Boston Teachers	Boston Non-Teachers	State Authorities	Other Local Boards	COLA*	Total
Actuarial Liability								
- Active	3,796,000	4,494,000	342,439	657,185	69,467	3,100,966	392,376	12,852,333
- Retired and Inactive	<u>2,650,000</u>	<u>2,319,000</u>	<u>217,639</u>	<u>736,057</u>	<u>41,661</u>	<u>2,787,958</u>	<u>1,226,208</u>	<u>10,196,262</u>
- Total	6,446,000	6,813,000	560,078	1,393,242	111,128	5,888,924	1,618,584	23,048,595
Assets (Market Value)	<u>2,515,000</u>	<u>2,670,000</u>	<u>218,874</u>	<u>478,914</u>	<u>98,985</u>	<u>2,085,502</u>	-	<u>8,067,275</u>
Unfunded Accrued Liability	3,931,000	4,143,000	341,204	914,320	12,143	3,803,422	1,618,584	14,981,320
Funded Percentage**	39%	39%	39%	34%	89%	35%	0%	35%

* Represents the Commonwealth assumptions of Boston Teachers and Local's present and future cost of living adjustment awarded or to be awarded after 1981.

** Ratio of Assets over Actuarial Liability.

COMMONWEALTH OF MASSACHUSETTS
 CONTRIBUTORY RETIREMENT SYSTEM
 CONTRIBUTIONS WITHOUT THE \$30,000 CAP
 AS OF JANUARY 1, 1987
 (\$000 OMITTED)

	State	Teachers	Boston Teachers	Boston Non-Teachers	State Authorities	Other Local Boards	COLA**	Total
Normal Cost-Employer	\$ 147,065 (6.7)	101,145 (5.5)	9,191 (5.1)	23,348 (6.2)	3,739 (6.4)	123,741 (7.0)	40,882	449,111 (7.0)
Normal Cost-Employees	147,065 (6.7)	108,501 (5.9)	10,998 (6.1)	24,323 (6.5)	3,965 (6.8)	112,900 (6.4)	0	407,752 (6.4)
Total Normal Cost	294,130 (15.4)	209,646 (11.4)	20,189 (11.1)	47,671 (12.7)	7,704 (13.2)	236,641 (13.4)	40,882	856,863 (13.4)
Funding Cost*	261,243 (11.9)	217,400 (11.8)	18,983 (10.5)	65,272 (17.4)	4,617 (7.9)	296,758 (16.8)	86,094	950,367 (14.8)
Pay-As-You-Go Contribution	246,400 (11.2)	236,000 (12.8)	25,062 (13.8)	80,098 (17.4)	3,645 (6.3)	306,120 (17.3)	53,554	950,879 (14.8)
Total Payroll	2,195,000	1,839,000	181,300	375,631	58,297	1,765,321	0	6,414,549

Figures in parenthesis are the amount as a percent of Total Payroll

- * Employer Normal Cost plus Increasing Amortization Payments at allowed limits (State, Teachers, Boston Teachers and COLA amortization payments increasing at 7 1/2% per year; Boston Non-Teachers, States Authorities and Other Local Boards amortization payments increase at 4 1/2% per year).
- ** Represents the Commonwealth assumptions of Boston Teachers and Local's present and future cost of living adjustment awarded or to be awarded after 1981.

COMMONWEALTH OF MASSACHUSETTS
CONTRIBUTORY RETIREMENT SYSTEM
ASSETS AND LIABILITIES WITHOUT THE \$30,000 CAP
AS OF JANUARY 1, 1987
 (\$000 OMITTED)

	<u>State</u>	<u>Teachers</u>	<u>Boston Teachers</u>	<u>Boston Non-Teachers</u>	<u>State Authorities</u>	<u>Other Local Boards</u>	<u>COLA*</u>	<u>Total</u>
Actuarial Liability								
- Active	4,043,000	4,605,000	359,532	690,168	77,146	3,206,947	428,189	13,409,982
- Retired and Inactive	<u>2,650,000</u>	<u>2,319,000</u>	<u>217,639</u>	<u>736,057</u>	<u>41,661</u>	<u>2,787,958</u>	<u>1,226,208</u>	<u>9,978,523</u>
- Total	6,693,000	6,924,000	577,171	1,426,225	118,807	5,994,905	1,654,397	23,388,505
Assets (Market Value)	<u>2,515,000</u>	<u>2,670,000</u>	<u>218,874</u>	<u>478,914</u>	<u>98,985</u>	<u>2,085,502</u>	-	<u>8,067,275</u>
Unfunded Accrued Liability	4,178,000	4,254,000	358,297	947,311	19,822	3,909,403	1,654,397	15,321,230
Funded Percentage**	38%	39%	38%	34%	83%	35%	0%	34%

* Represents the Commonwealth assumptions of Boston Teachers Local's present and future cost of living adjustment awarded or to be awarded after 1981.

** Ratio of Assets over Actuarial Liability.

PART IV

TWENTY-YEAR PROJECTION OF CONTRIBUTION REQUIREMENTS

The following exhibits forecast the employer and employee contributions over the next 20 years.

With respect to this forecast, the following are noted:

1. The forecast is based upon an "open group" method. Under this method, it is assumed that a sufficient number of employees will be hired each year so as to keep the number of employees constant.

Primarily due to the impact of the \$30,000 pay cap and the higher rate of contributions made by recently hired employees, the normal cost and accrued liabilities for new employees is considerably less than for the current group of employees. As a result, each year the normal cost (the total normal cost less employee contributions) decreases and eventually becomes negative.

2. The pay-as-you-go costs shown on the attached exhibits represent annual benefit payments as of the beginning of the calendar year less the portion attributable to member contributions.
3. In some systems, the total payment (normal cost plus amortization payment) is less than the pay-as-you-go payment. In these situations, payment of the higher pay-as-you-go cost will serve to amortize the unfunded actuarial accrued liability more rapidly.
4. Since the forecast is an "open group" and the assumption for the group includes no growth in the active workforce, increases in the active workforce will increase the costs of the retirement benefits. The projected costs as a percentage of pay can be used for budget purposes as they are

expected to be approximately the same as if some growth is expected. Therefore, these projections can be useful for systems in which active workforce growth is expected.

5. Caution should be used in relying upon these projections as accurate. They are accurate only to the extent that the assumptions are exactly realized, a highly unlikely scenario. However, they do represent our best estimate of the growth in assets and liabilities of the system.

Gains or losses realized in future years will necessarily affect the projections for subsequent years. For example, if all assumptions are realized, except that assets do not perform as expected in 1989, then the cost projections for 1990 and beyond would be increased to reflect this loss. It is expected, however, that future gains and losses will offset each other to a certain extent, and any resulting net gain or loss will be amortized over time. Therefore, future potential volatility in funding contributions should be minimized.

STATE

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

(\$000 OMITTED)

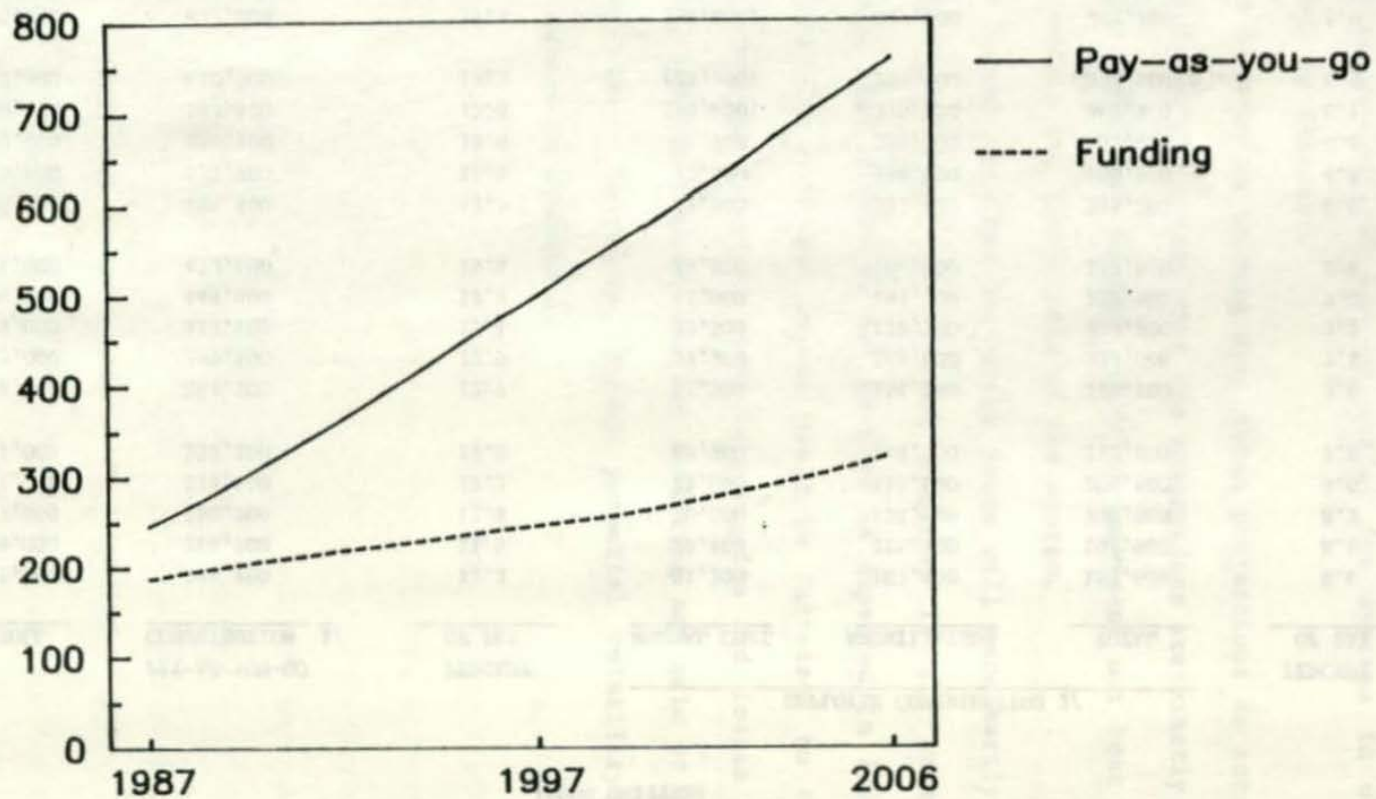
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	2,195,000	246,400	11.2	81,200	107,400	188,600	8.6
1988	2,319,000	266,700	11.5	79,400	115,500	194,900	8.4
1989	2,447,000	290,200	11.9	76,500	124,100	200,600	8.2
1990	2,581,000	314,500	12.2	73,000	133,500	206,500	8.0
1991	2,721,000	339,200	12.5	68,900	143,500	212,400	7.8
1992	2,868,000	364,100	12.7	63,900	154,200	218,100	7.6
1993	3,022,000	389,500	12.9	57,200	165,800	223,000	7.4
1994	3,179,000	417,100	13.1	49,500	178,200	227,700	7.2
1995	3,346,000	444,800	13.3	41,900	191,600	233,500	7.0
1996	3,521,000	472,600	13.4	33,500	206,000	239,500	6.8
1997	3,705,000	498,400	13.5	23,800	221,400	245,200	6.6
1998	3,898,000	527,700	13.5	12,500	238,000	250,500	6.4
1999	4,092,000	556,100	13.6	700	255,900	255,600	6.3
2000	4,298,000	583,300	13.6	(10,800)	275,100	264,300	6.1
2001	4,512,000	610,500	13.5	(23,200)	295,700	272,500	6.0
2002	4,735,000	637,800	13.5	(36,600)	317,900	281,300	5.9
2003	4,966,000	670,300	13.5	(51,800)	341,700	289,900	5.8
2004	5,200,000	699,700	13.5	(68,200)	367,300	299,100	5.8
2005	5,447,000	728,100	13.4	(84,600)	294,900	310,300	5.7
2006	5,704,000	756,700	13.3	(102,100)	424,500	322,400	5.7

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

State Employees with \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

TEACHERS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

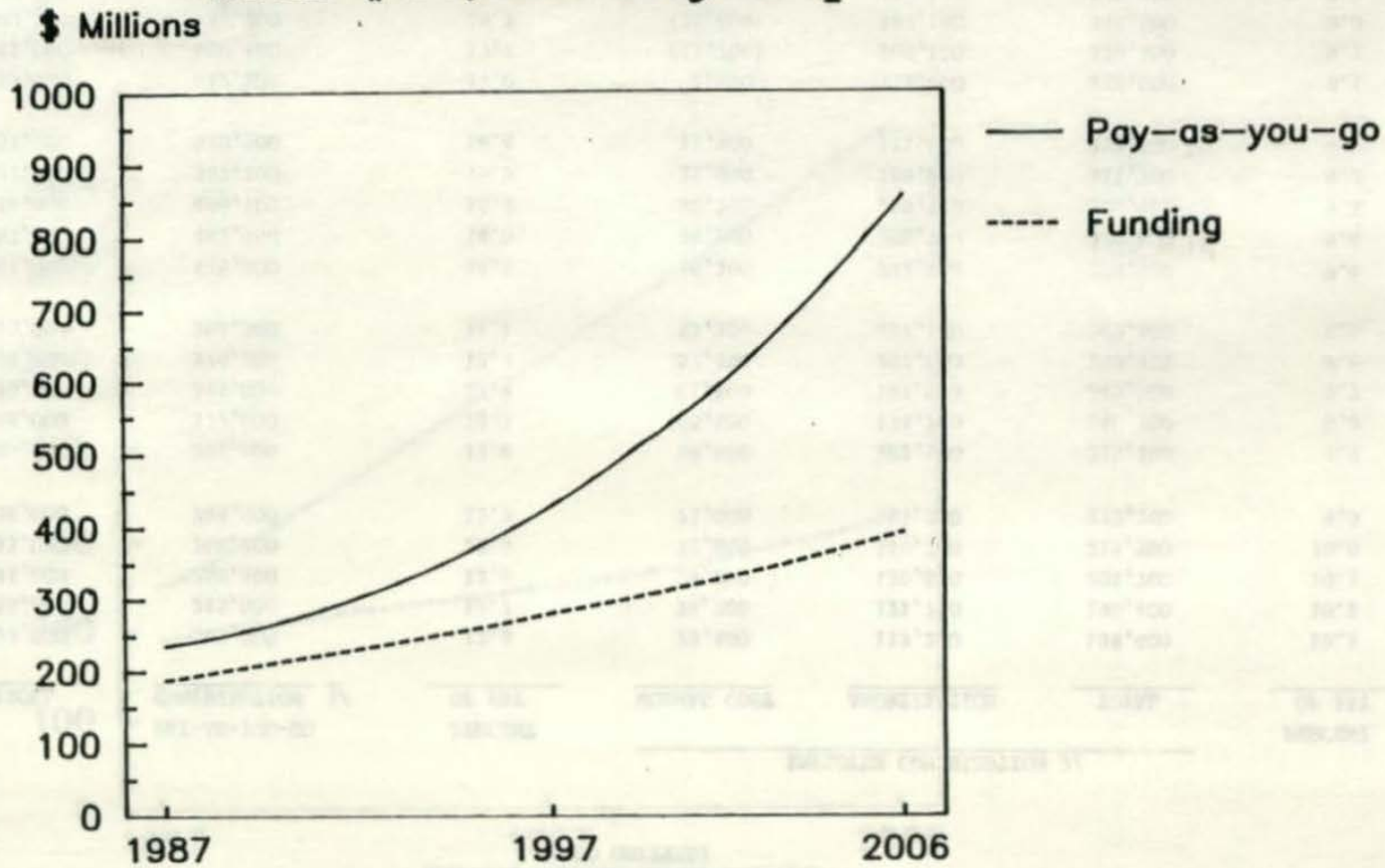
(\$000 OMITTED)

YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	1,839,000	236,000	12.8	75,400	113,200	188,600	10.3
1988	1,933,000	245,000	12.7	74,700	121,700	196,400	10.2
1989	2,031,000	255,800	12.6	73,900	130,800	204,700	10.1
1990	2,133,000	268,800	12.6	72,800	140,700	213,500	10.0
1991	2,239,000	284,000	12.7	71,000	151,200	222,200	9.9
1992	2,349,000	301,600	12.8	68,600	162,500	231,100	9.8
1993	2,463,000	322,000	13.1	65,600	174,700	240,300	9.8
1994	2,580,000	345,000	13.4	61,800	187,800	249,600	9.7
1995	2,703,000	370,200	13.7	57,400	202,000	259,400	9.6
1996	2,830,000	398,300	14.1	52,300	217,100	269,400	9.5
1997	2,961,000	428,300	14.5	46,100	233,400	279,500	9.4
1998	3,097,000	462,400	14.9	38,900	250,900	289,800	9.4
1999	3,236,000	498,700	15.4	30,700	269,700	300,400	9.3
2000	3,381,000	537,100	15.9	21,800	289,900	311,700	9.2
2001	3,531,000	578,900	16.4	11,900	311,600	323,500	9.2
2002	3,685,000	627,200	17.0	1,000	335,000	336,000	9.1
2003	3,841,000	680,400	17.7	(11,700)	360,100	348,400	9.1
2004	4,002,000	736,200	18.4	(25,600)	387,100	361,500	9.0
2005	4,167,000	793,800	19.0	(40,600)	416,200	375,600	9.0
2006	4,337,000	854,200	19.7	(56,800)	447,400	390,600	9.0

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

Teachers with \$30,000 Pay Cap



COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

BOSTON - TEACHERS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

(\$000 OMITTED)

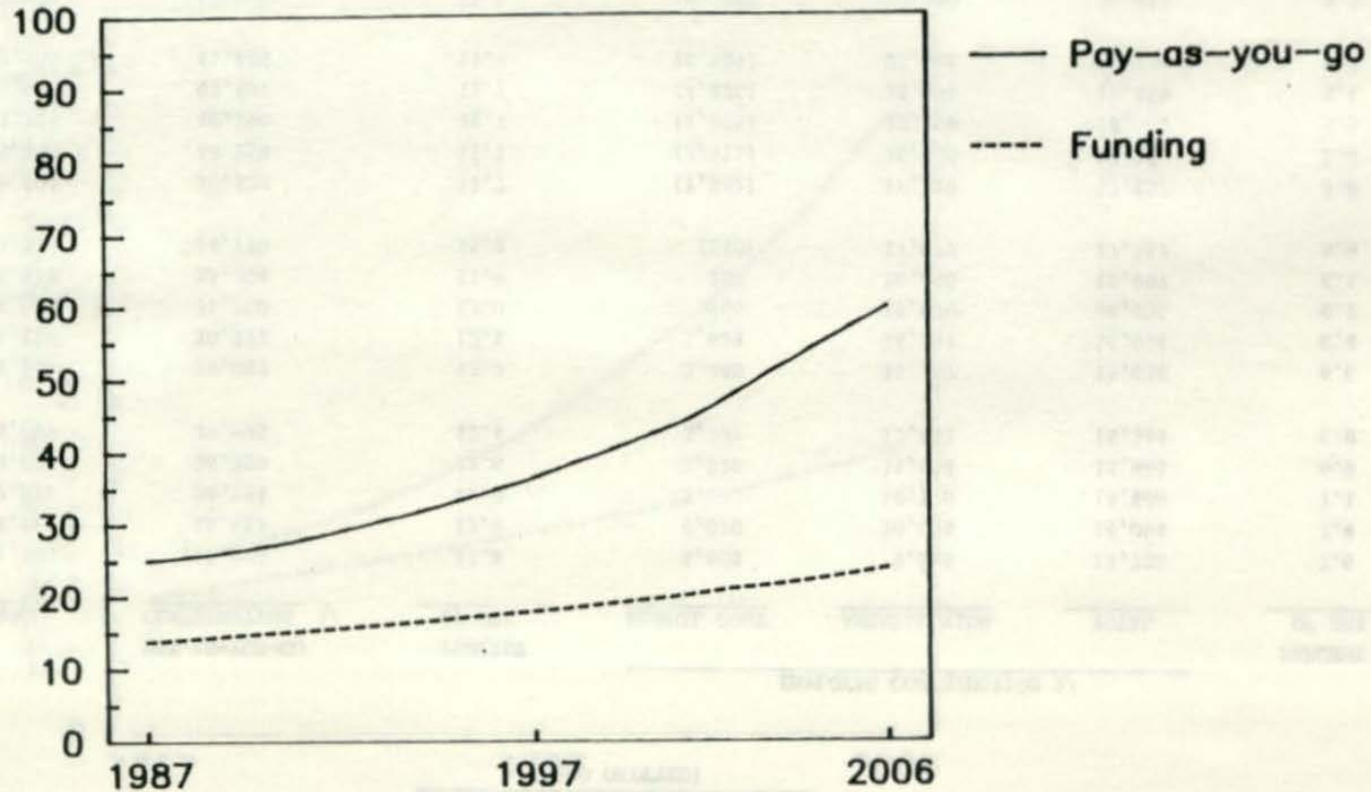
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	181,300	\$25,062	13.8	4,403	9,325	13,728	7.6
1988	191,715	25,553	13.3	4,070	10,024	14,094	7.4
1989	202,534	26,154	12.9	3,692	10,776	14,468	7.1
1990	213,873	26,959	12.6	3,279	11,584	14,863	6.9
1991	225,697	27,925	12.4	2,793	12,453	15,246	6.8
1992	238,144	29,059	12.2	2,249	13,387	15,636	6.6
1993	251,116	30,372	12.1	1,633	14,391	16,024	6.4
1994	264,666	31,710	12.0	966	15,470	16,436	6.2
1995	278,875	33,204	11.9	257	16,630	16,887	6.1
1996	293,732	34,770	11.8	(540)	17,877	17,337	5.9
1997	309,404	36,420	11.7	(1,381)	19,218	17,837	5.8
1998	325,805	38,258	11.7	(2,311)	20,660	18,349	5.6
1999	342,721	40,190	11.7	(3,305)	22,209	18,904	5.5
2000	360,360	42,301	11.7	(4,376)	23,875	19,499	5.4
2001	378,700	44,486	11.7	(5,529)	25,665	20,136	5.3
2002	397,879	47,529	11.9	(6,735)	27,590	20,855	5.2
2003	416,983	50,654	12.1	(8,264)	29,660	21,396	5.1
2004	437,223	53,659	12.3	(9,757)	31,884	22,127	5.1
2005	458,332	56,654	12.4	(11,343)	34,275	22,932	5.0
2006	480,207	59,716	12.4	(13,028)	36,846	23,818	5.0

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

Boston Teachers with \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

BOSTON - NON-TEACHERS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

(\$000 OMITTED)

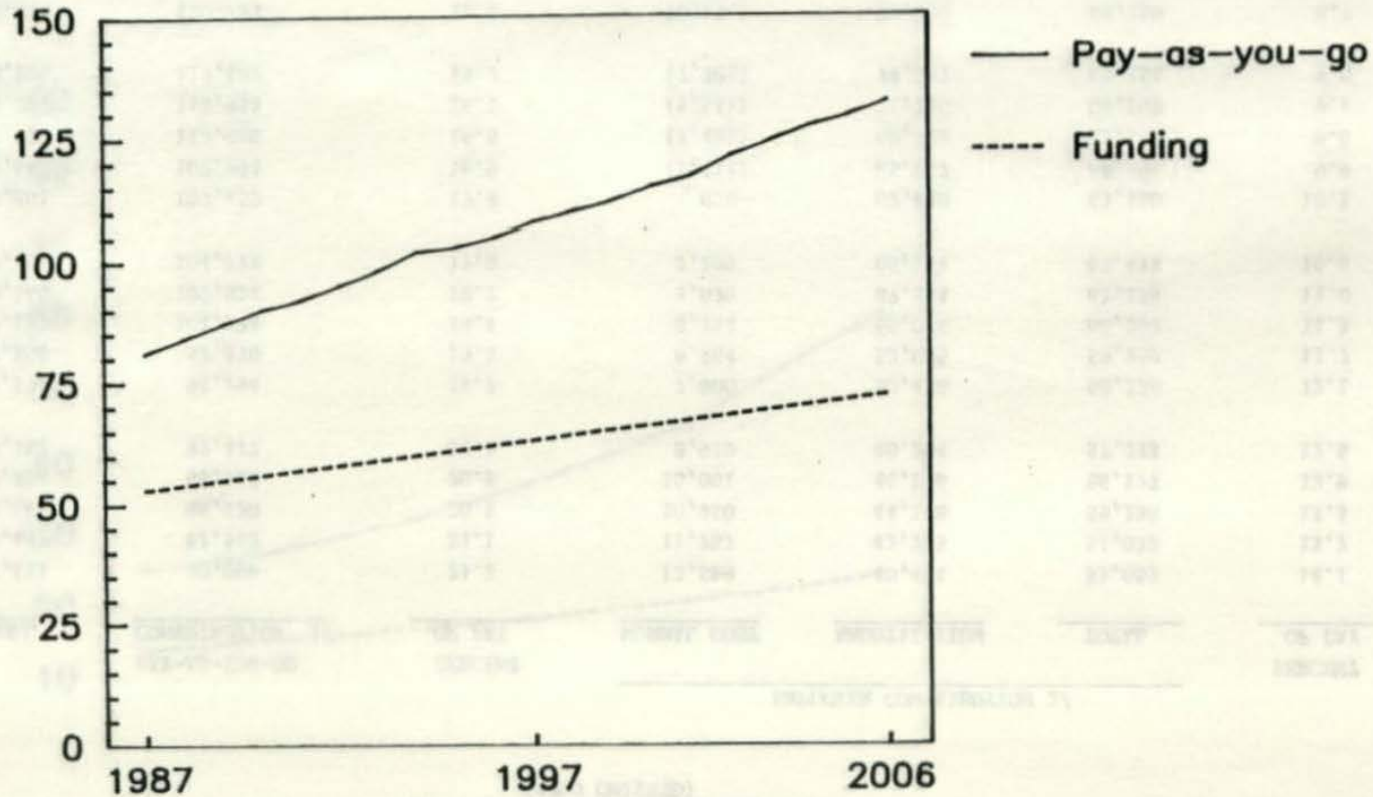
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	375,631	80,098	21.3	12,588	40,464	53,052	14.1
1988	395,467	83,542	21.1	11,787	42,285	54,072	13.7
1989	415,563	86,620	20.8	10,950	44,188	55,138	13.3
1990	436,856	89,562	20.5	10,001	46,176	56,177	12.9
1991	459,258	92,477	20.1	8,979	48,254	57,233	12.5
1992	482,575	95,294	19.7	7,800	50,426	58,226	12.1
1993	507,300	97,820	19.3	6,564	52,695	59,259	11.7
1994	533,137	101,574	19.1	5,231	55,066	60,297	11.3
1995	560,360	102,524	18.3	3,829	57,544	61,373	11.0
1996	588,868	104,723	17.8	2,299	60,134	62,433	10.6
1997	618,801	107,452	17.4	620	62,840	63,460	10.3
1998	649,649	109,994	16.9	(1,411)	65,667	64,256	9.9
1999	681,712	112,486	16.5	(3,435)	68,622	65,187	9.6
2000	715,282	114,954	16.1	(5,541)	71,710	66,169	9.3
2001	750,195	117,482	15.7	(7,783)	74,937	67,154	9.0
2002	786,840	120,783	15.4	(10,151)	78,310	68,159	8.7
2003	824,697	123,829	15.0	(12,915)	81,833	68,918	8.4
2004	864,247	126,537	14.6	(15,623)	85,516	69,893	8.1
2005	905,167	129,167	14.3	(18,378)	89,364	70,986	7.8
2006	947,661	131,893	13.9	(21,332)	93,386	72,054	7.6

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 4½% per year.

Boston Non-Teachers with \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

STATE AUTHORITIES

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

(\$000 OMITTED)

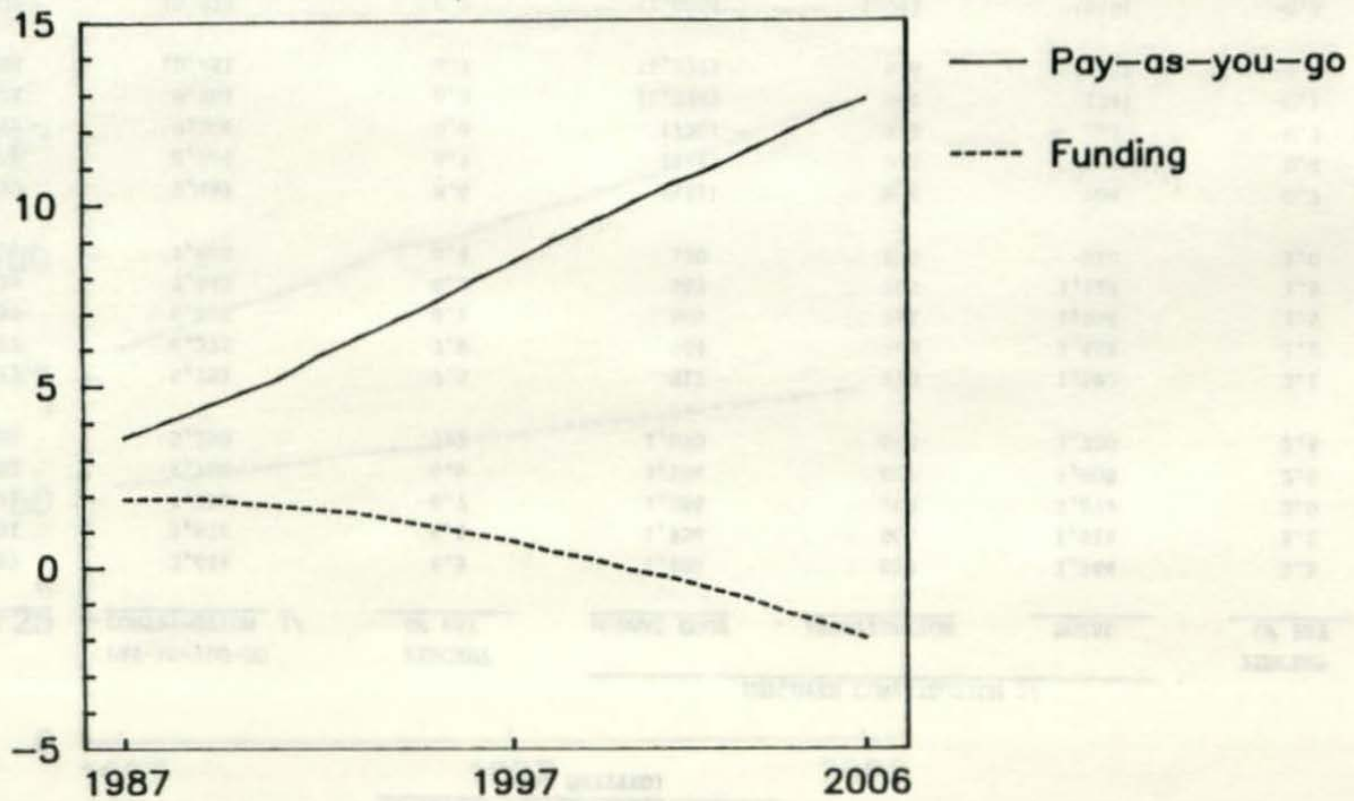
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	58,297	3,644	6.3	1,406	538	1,944	3.3
1988	61,601	3,976	6.5	1,356	562	1,918	3.1
1989	65,021	4,356	6.7	1,284	588	1,872	2.9
1990	68,602	4,760	6.9	1,194	614	1,808	2.6
1991	72,356	5,239	7.2	1,078	642	1,720	2.4
1992	76,213	5,751	7.5	912	670	1,582	2.1
1993	80,277	6,275	7.8	754	700	1,454	1.2
1994	84,533	6,813	8.1	565	731	1,296	1.5
1995	88,929	7,342	8.3	358	765	1,123	1.3
1996	93,524	7,880	8.4	130	800	930	1.0
1997	98,330	8,443	8.6	(131)	836	705	0.7
1998	103,268	8,992	8.7	(431)	874	443	0.4
1999	108,438	9,506	8.8	(720)	912	192	0.2
2000	113,801	9,981	8.8	(1,028)	954	(74)	-0.1
2001	119,458	10,451	8.7	(1,327)	996	(331)	-0.3
2002	125,320	10,923	8.7	(1,660)	1,041	(619)	-0.5
2003	131,235	11,416	8.7	(2,035)	1,088	(947)	-0.7
2004	137,514	11,909	8.7	(2,421)	1,138	(1,283)	-0.9
2005	143,944	12,359	8.6	(2,830)	1,188	(1,642)	-1.1
2006	150,753	12,811	8.5	(3,258)	1,241	(2,017)	-1.3

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 4% per year.

State Authorities with \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

OTHER LOCAL BOARDS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

(\$000 OMITTED)

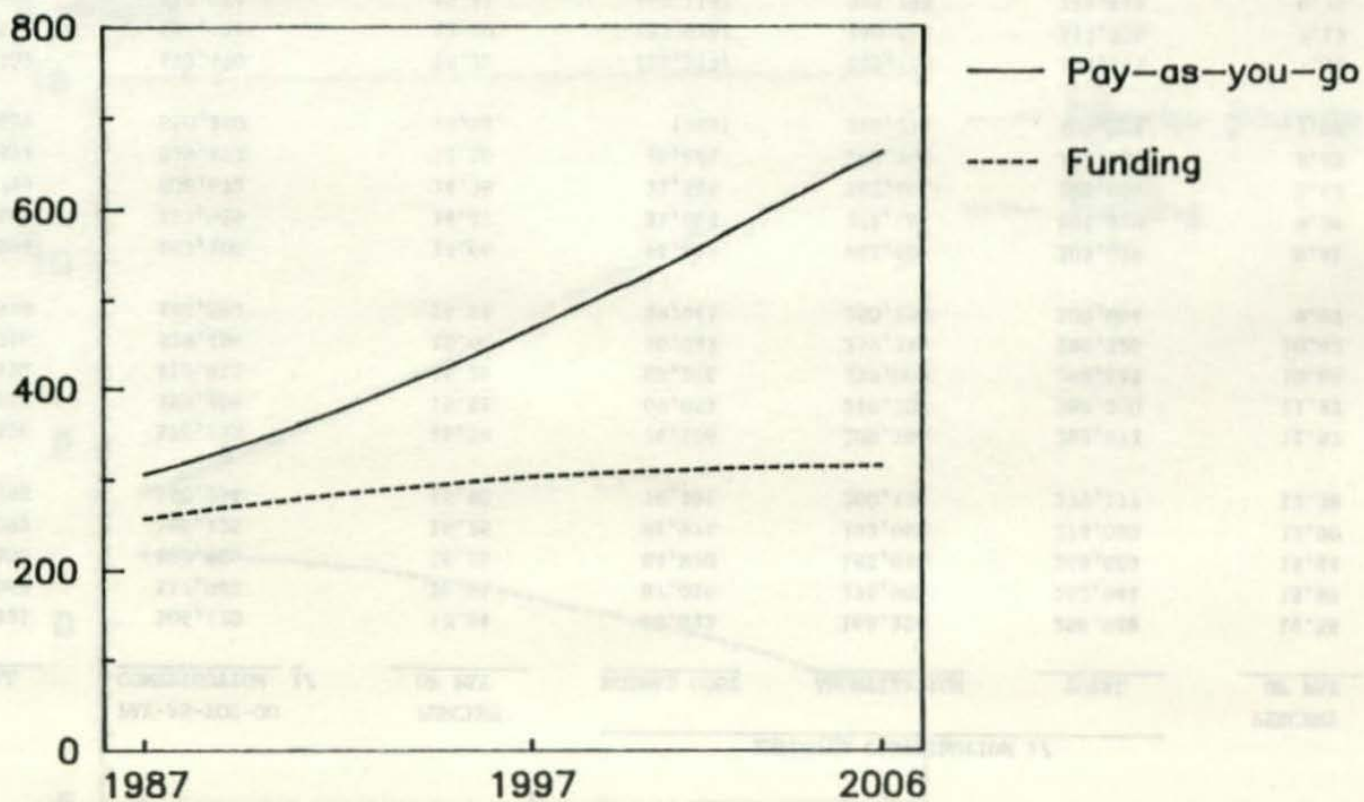
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	1,765,321	306,120	17.34	88,622	168,326	256,948	14.56
1988	1,880,067	317,988	16.91	87,039	175,905	262,944	13.99
1989	1,999,309	330,806	16.55	84,870	183,813	268,683	13.44
1990	2,124,092	345,125	16.25	81,971	192,088	274,059	12.90
1991	2,254,398	360,254	15.98	78,451	200,726	279,177	12.38
1992	2,391,516	376,332	15.74	74,106	209,766	283,872	11.87
1993	2,536,236	393,366	15.51	69,053	219,207	288,260	11.37
1994	2,686,372	410,813	15.29	63,276	229,069	292,345	10.88
1995	2,844,716	428,486	15.06	56,947	239,379	296,326	10.42
1996	3,010,938	446,892	14.84	49,941	250,153	300,094	9.97
1997	3,185,386	467,100	14.66	41,613	261,405	303,018	9.51
1998	3,372,866	487,939	14.47	31,664	273,166	304,830	9.04
1999	3,559,799	508,672	14.29	21,525	285,461	306,986	8.62
2000	3,754,871	529,472	14.10	10,681	298,308	308,989	8.23
2001	3,957,652	550,340	13.91	(789)	310,713	309,924	7.83
2002	4,168,702	573,570	13.76	(13,317)	325,758	312,441	7.49
2003	4,390,552	596,931	13.60	(27,634)	340,412	312,778	7.12
2004	4,616,865	619,034	13.41	(42,118)	355,733	313,615	6.79
2005	4,852,732	641,022	13.21	(57,385)	371,743	314,358	6.48
2006	5,097,607	662,453	13.00	(73,514)	388,468	314,954	6.18

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 4½% per year.

Other Local Boards with \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COST OF LIVING ADJUSTMENT

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITH \$30,000 PAY CAP

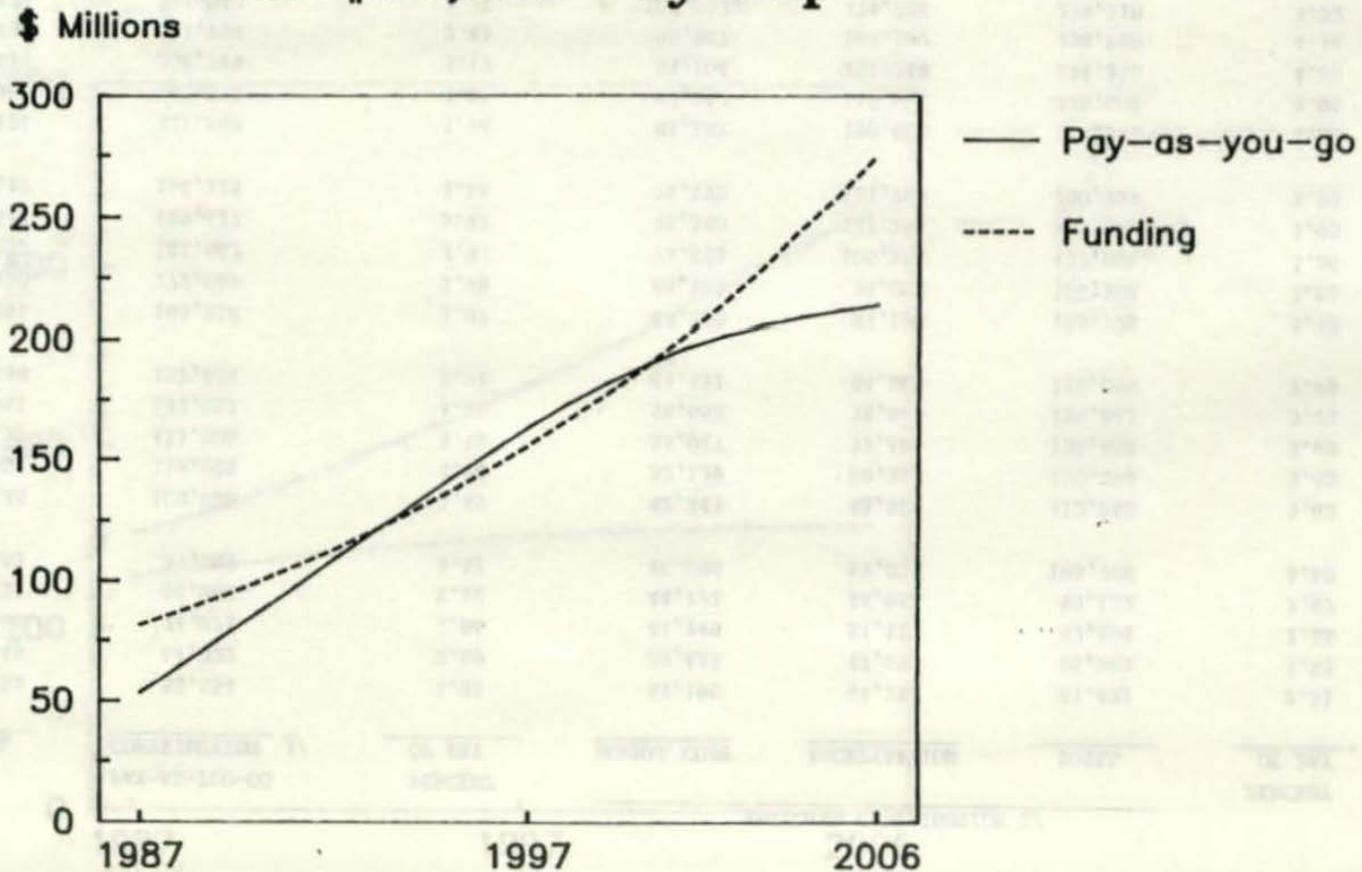
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YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	2,322,252	53,554	2.31	37,190	44,233	81,423	3.51
1988	2,467,249	64,022	2.59	39,433	47,550	86,983	3.53
1989	2,617,406	74,875	2.86	41,749	51,117	92,866	3.55
1990	2,774,821	85,982	3.10	44,171	54,951	99,122	3.57
1991	2,939,353	97,309	3.31	46,696	59,072	105,768	3.60
1992	3,112,235	108,638	3.49	49,343	63,502	112,845	3.63
1993	3,294,652	119,901	3.64	52,129	68,265	120,394	3.65
1994	3,484,175	131,006	3.76	55,017	73,385	128,402	3.69
1995	3,683,951	142,051	3.86	58,053	78,889	136,942	3.72
1996	3,893,538	152,824	3.93	61,231	84,805	146,036	3.75
1997	4,113,591	163,218	3.97	64,560	91,166	155,726	3.79
1998	4,348,320	172,989	3.98	68,105	98,003	166,108	3.82
1999	4,584,232	181,867	3.97	71,653	105,353	177,006	3.86
2000	4,830,513	189,637	3.93	75,348	113,255	188,603	3.90
2001	5,086,547	196,213	3.86	79,178	121,749	200,927	3.95
2002	5,353,421	201,549	3.76	83,161	130,880	214,041	4.00
2003	5,632,232	205,674	3.65	87,312	140,696	228,008	4.05
2004	6,018,335	208,789	3.47	93,104	151,248	244,352	4.06
2005	6,216,231	211,734	3.41	95,967	162,592	258,559	4.16
2006	6,525,475	214,047	3.28	100,532	174,786	275,318	4.22

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

Cost of Living Adjustment with \$30,000 Pay Cap



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

STATE

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

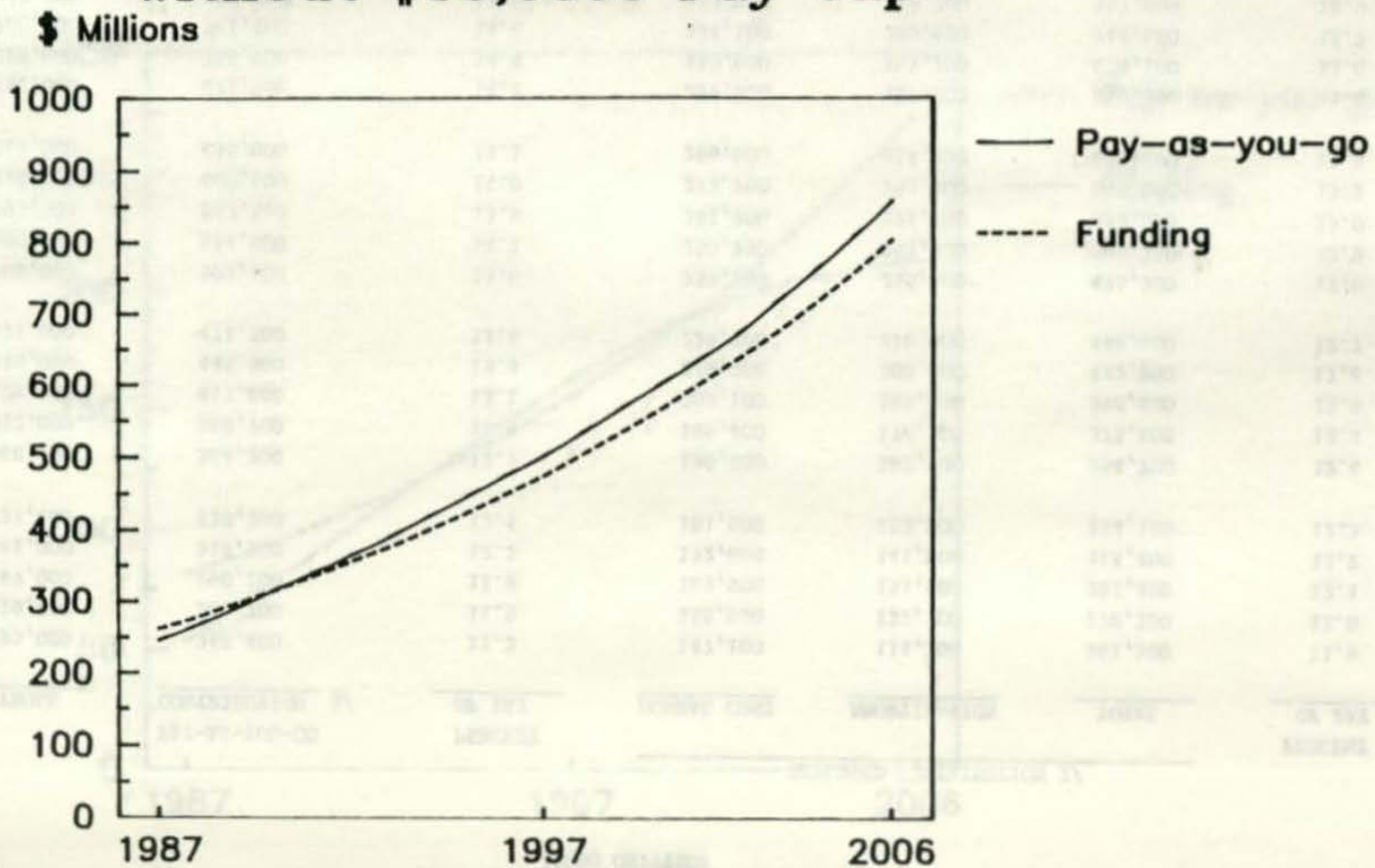
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YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	2,195,000	246,400	11.2	147,100	114,200	261,300	11.9
1988	2,319,000	266,700	11.5	155,500	122,700	278,200	12.0
1989	2,447,000	290,200	11.9	163,900	131,900	295,800	12.1
1990	2,581,000	314,500	12.2	172,600	141,800	314,400	12.2
1991	2,721,000	339,200	12.5	181,600	152,500	334,100	12.3
1992	2,868,000	364,200	12.7	190,800	163,900	354,700	12.4
1993	3,022,000	389,700	12.9	199,400	176,200	375,600	12.4
1994	3,179,000	417,600	13.1	209,100	189,400	398,500	12.5
1995	3,346,000	445,900	13.3	219,200	203,600	422,800	12.6
1996	3,521,000	474,700	13.5	229,700	218,900	448,600	12.7
1997	3,705,000	502,100	13.6	239,900	235,300	475,200	12.8
1998	3,898,000	534,600	13.7	250,700	253,000	503,700	12.9
1999	4,092,000	567,500	13.9	261,900	271,900	533,800	13.0
2000	4,298,000	600,600	14.0	273,700	292,300	566,000	13.2
2001	4,512,000	635,000	14.1	286,000	314,300	600,300	13.3
2002	4,735,000	671,900	14.2	298,400	337,800	636,200	13.4
2003	4,966,000	716,900	14.4	310,900	363,200	674,100	13.6
2004	5,200,000	761,500	14.6	324,100	290,400	714,500	13.7
2005	5,447,000	807,900	14.8	337,900	419,700	757,600	13.9
2006	5,704,000	857,500	15.0	352,300	451,200	803,500	14.1

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

State Employees without \$30,000 Pay Cap



20-Year Forecast as of January 1, 1987
8% Interest

TEACHERS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

(\$000 OMITTED)

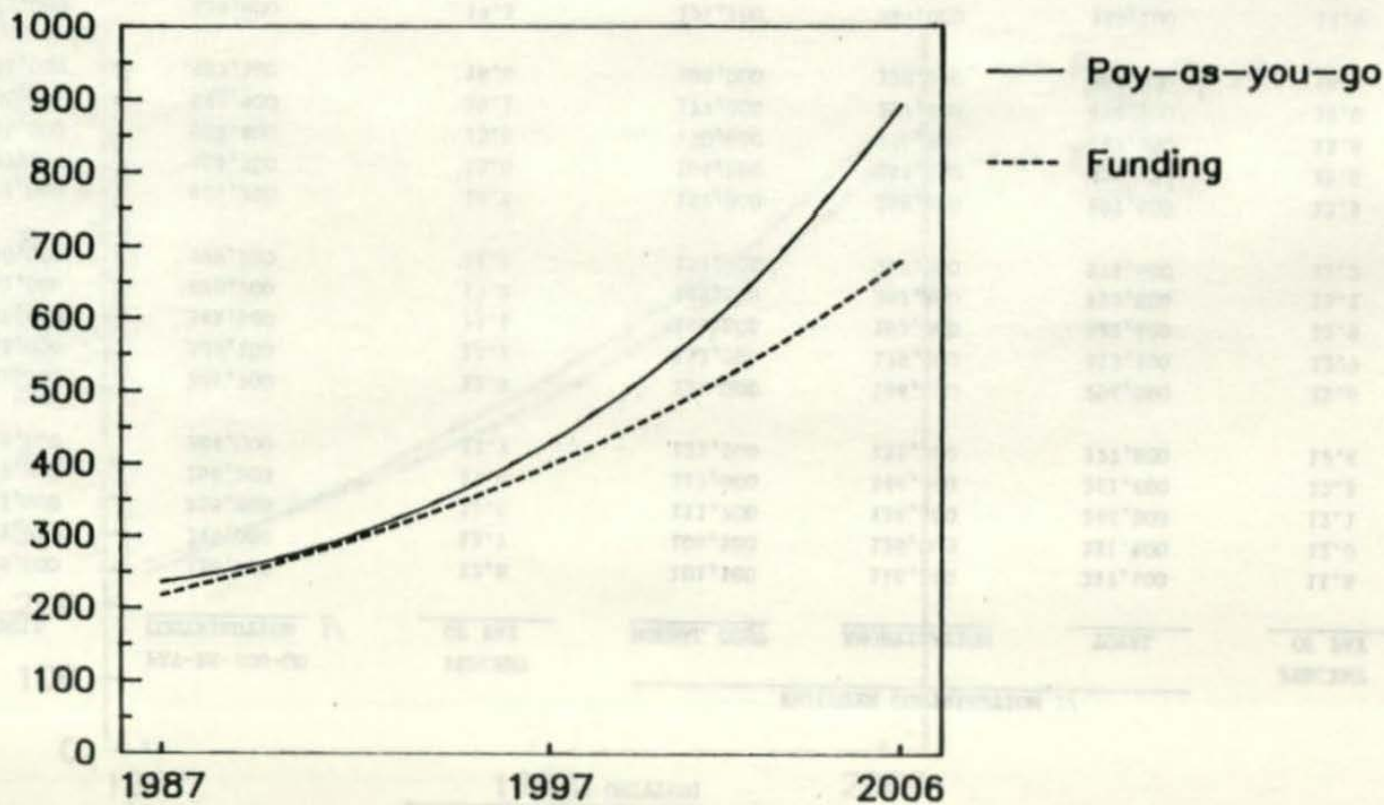
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	1,839,000	236,000	12.8	101,100	116,300	217,400	11.8
1988	1,933,000	245,000	12.7	106,500	125,000	231,500	12.0
1989	2,031,000	255,800	12.6	111,700	134,300	246,000	12.1
1990	2,133,000	268,800	12.6	117,000	144,400	261,400	12.3
1991	2,239,000	284,000	12.7	122,500	155,300	277,800	12.4
1992	2,349,000	301,700	12.8	128,000	166,900	294,900	12.6
1993	2,463,000	322,100	13.1	133,700	179,400	313,100	12.7
1994	2,580,000	345,300	13.4	139,500	192,900	332,400	12.9
1995	2,703,000	370,700	13.7	145,500	207,300	352,800	13.1
1996	2,830,000	399,200	14.1	151,700	222,900	374,600	13.2
1997	2,961,000	429,700	14.5	157,900	239,600	397,500	13.4
1998	3,097,000	464,700	15.0	164,200	257,600	421,800	13.6
1999	3,236,000	502,400	15.5	170,600	276,900	447,500	13.8
2000	3,381,000	542,900	16.1	177,200	297,700	474,900	14.0
2001	3,531,000	587,100	16.6	184,000	320,000	504,000	14.3
2002	3,685,000	638,800	17.3	191,100	344,000	535,100	14.5
2003	3,841,000	696,300	18.1	198,200	369,800	568,000	14.8
2004	4,002,000	758,100	18.9	205,400	397,500	602,900	15.1
2005	4,167,000	823,300	19.8	212,900	427,300	640,200	15.4
2006	4,337,000	892,600	20.6	220,700	459,400	680,100	15.7

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

Teachers without \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

BOSTON - TEACHERS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

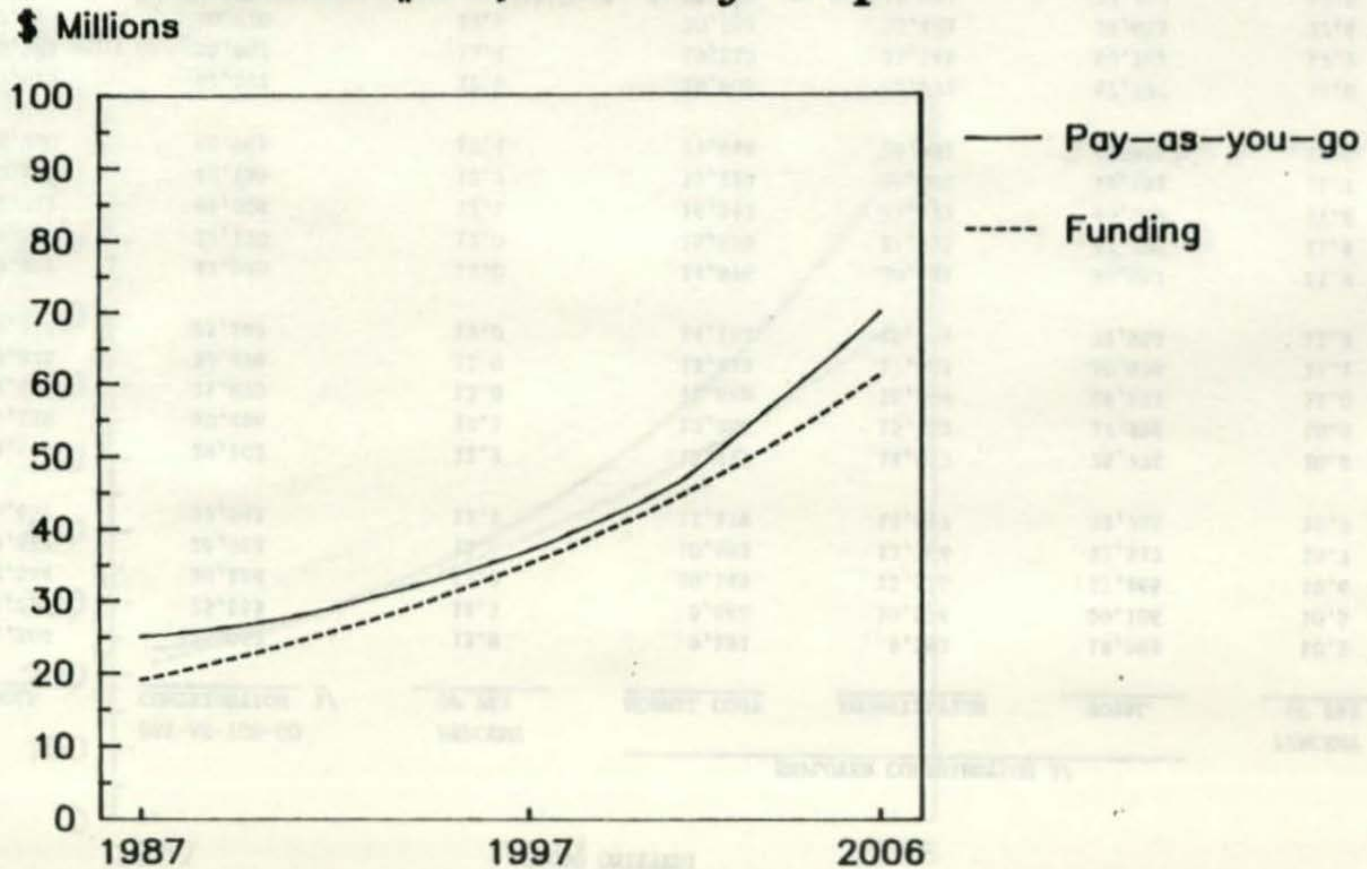
(\$000 OMITTED)

YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	181,300	\$25,062	13.8	9,191	9,792	18,983	10.5
1988	191,715	25,553	13.3	9,660	10,526	20,186	10.5
1989	202,534	26,154	12.9	10,149	11,316	21,465	10.6
1990	213,873	26,963	12.6	10,653	12,164	22,817	10.7
1991	225,697	27,943	12.4	11,178	13,077	23,255	10.7
1992	238,144	29,102	12.2	11,719	14,057	25,776	10.8
1993	251,116	30,456	12.1	12,286	15,112	27,398	10.9
1994	264,666	31,872	12.0	12,888	16,249	29,137	11.0
1995	278,875	33,478	12.0	13,513	17,463	30,976	11.1
1996	293,732	35,187	12.0	14,181	18,773	32,954	11.2
1997	309,404	37,040	12.0	14,876	20,181	35,057	11.3
1998	325,805	39,170	12.0	15,595	21,695	37,290	11.4
1999	342,721	41,508	12.1	16,347	23,322	39,669	11.6
2000	360,360	44,139	12.2	17,123	25,071	42,194	11.7
2001	378,700	46,965	12.4	17,944	26,951	44,895	11.9
2002	397,879	51,372	12.9	18,805	28,972	47,777	12.0
2003	416,983	55,882	13.4	19,617	31,145	50,762	12.2
2004	437,223	60,270	13.8	20,532	33,481	54,013	12.4
2005	458,332	64,973	14.2	21,468	35,992	57,460	12.5
2006	480,207	70,008	14.6	22,464	38,692	61,156	12.7

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

Boston Teachers without \$30,000 Pay Cap



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

BOSTON - NON-TEACHERS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

(\$000 OMITTED)

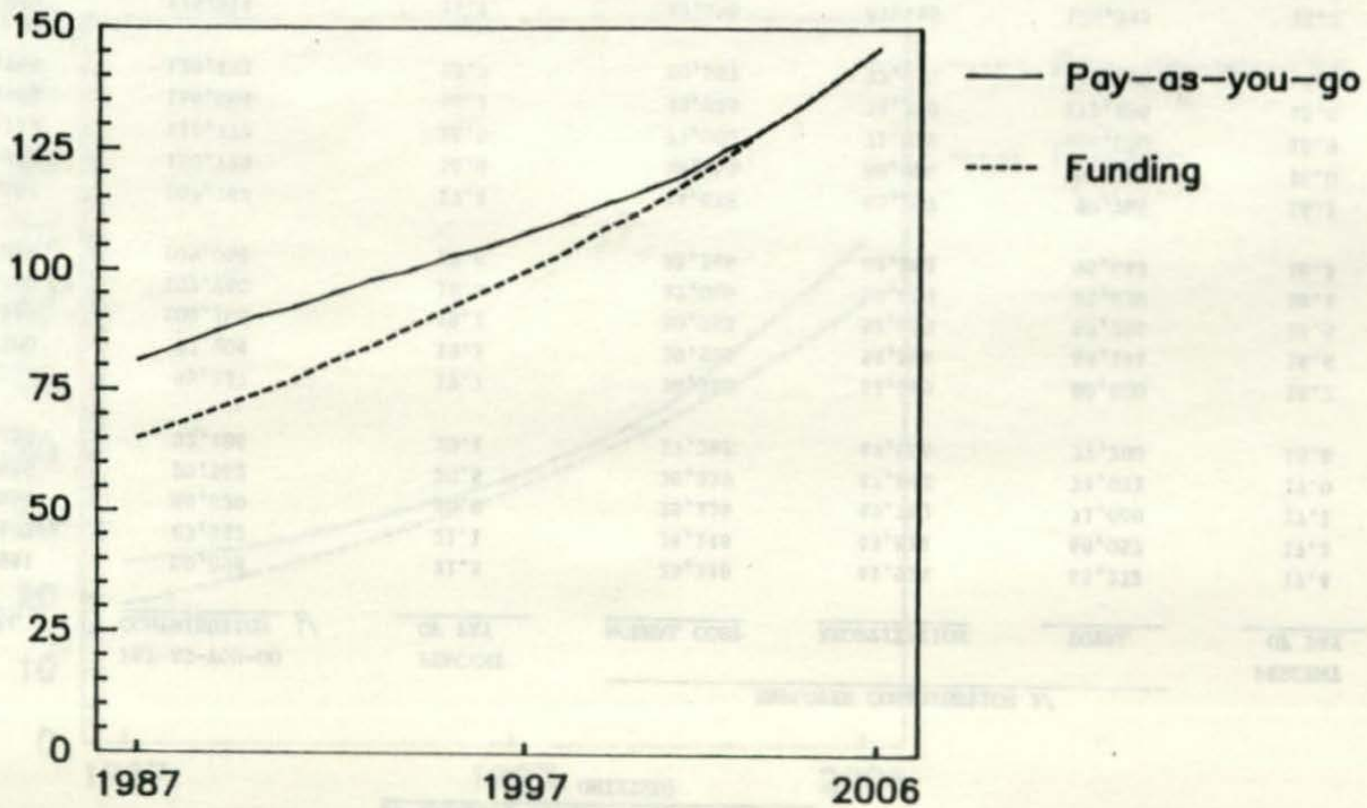
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	375,631	80,098	21.3	23,348	41,924	65,272	17.4
1988	395,467	83,542	21.1	24,246	43,811	68,057	17.2
1989	415,563	86,620	20.8	25,226	45,782	71,008	17.1
1990	436,856	89,562	20.5	26,229	47,842	74,071	17.0
1991	459,258	92,486	20.1	27,285	49,995	77,280	16.8
1992	482,575	95,337	19.7	28,355	52,245	80,600	16.7
1993	507,300	97,904	19.3	29,525	54,596	84,121	16.6
1994	533,137	100,366	19.1	30,733	57,053	87,786	16.5
1995	560,360	102,740	18.3	32,009	59,620	91,629	16.4
1996	588,868	105,056	17.8	33,346	62,303	95,649	16.2
1997	618,801	107,767	17.4	34,678	65,107	99,785	16.1
1998	649,649	110,779	16.9	36,051	68,036	104,087	16.0
1999	681,712	113,772	16.5	37,502	71,098	108,600	15.9
2000	715,282	116,984	16.1	38,988	74,298	113,286	15.8
2001	750,195	120,434	15.7	40,567	77,641	118,208	15.8
2002	786,840	124,914	15.4	42,198	81,135	123,333	15.7
2003	824,697	129,468	15.0	43,869	84,786	128,655	15.6
2004	964,247	134,343	14.6	45,628	88,601	134,229	15.5
2005	905,167	139,820	14.3	47,467	92,588	140,055	15.5
2006	947,661	145,879	13.9	49,361	96,755	146,116	15.4

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 4½% per year.

Boston Non-Teachers without \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

STATE AUTHORITIES

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

(\$000 OMITTED)

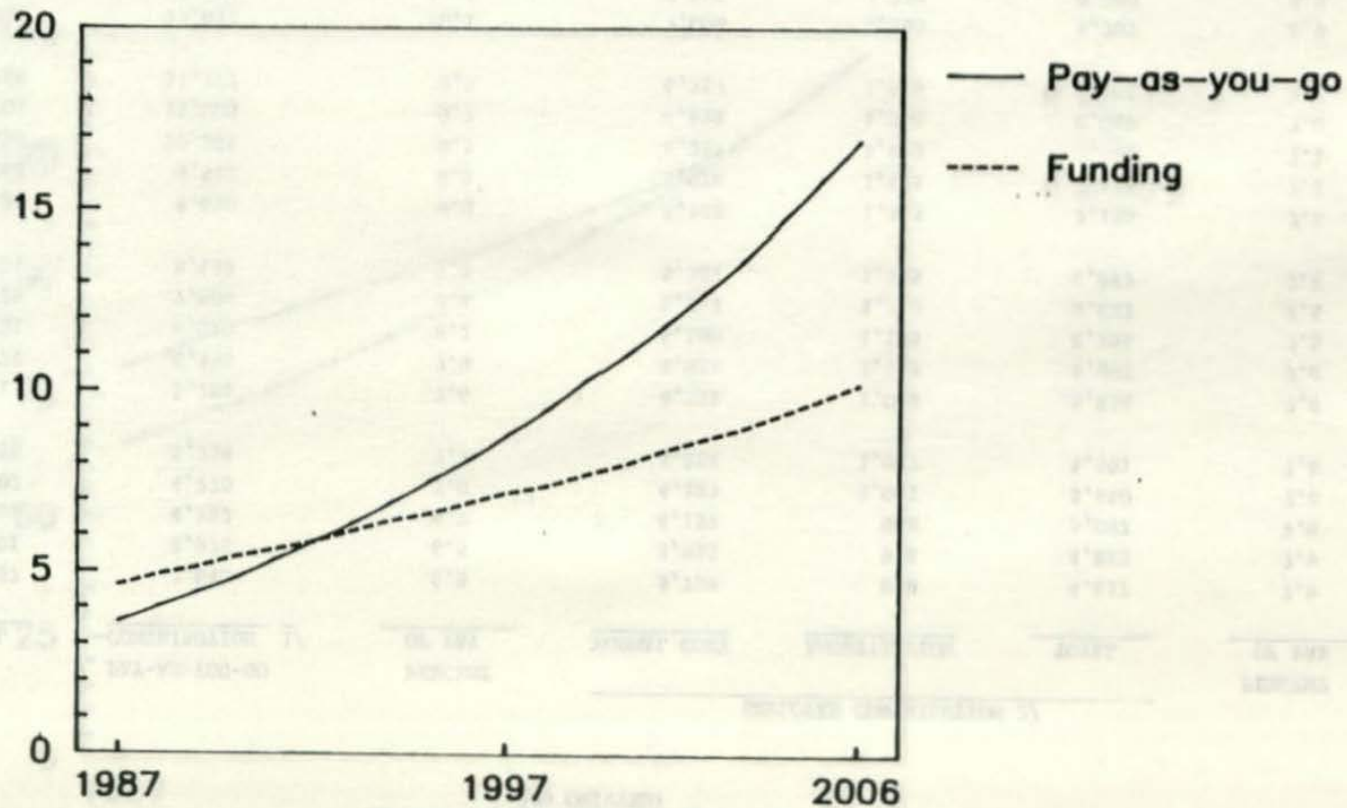
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	58,297	3,645	6.3	3,739	878	4,617	7.9
1988	61,601	3,978	6.5	3,935	918	4,853	7.9
1989	65,021	4,362	6.7	4,139	958	5,097	7.8
1990	68,602	4,770	7.0	4,349	1,001	5,350	7.8
1991	72,356	5,258	7.3	4,554	1,047	5,591	7.8
1992	76,213	5,784	7.6	4,731	1,093	5,824	7.6
1993	80,277	6,333	7.9	4,954	1,143	6,097	7.6
1994	84,533	6,910	8.2	5,160	1,195	6,355	7.5
1995	88,929	7,506	8.4	5,373	1,249	6,622	7.5
1996	93,524	8,139	8.7	5,587	1,305	6,892	7.4
1997	98,330	8,830	9.0	5,787	1,363	7,150	7.3
1998	103,268	9,542	9.2	6,018	1,425	7,443	7.2
1999	108,438	10,265	9.5	6,251	1,489	7,740	7.1
2000	113,801	11,005	9.7	6,493	1,556	8,049	7.0
2001	119,458	11,777	9.9	6,757	1,626	8,383	7.0
2002	125,320	12,671	10.1	7,008	1,699	8,707	6.9
2003	131,235	13,632	10.4	7,265	1,775	9,040	6.8
2004	147,514	14,678	10.7	7,539	1,856	9,395	6.8
2005	143,944	15,764	11.0	7,833	1,940	9,773	6.8
2006	150,753	16,925	11.2	8,140	2,026	10,166	6.7

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 4½% per year.

State Authorities without \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

OTHER LOCAL BOARDS

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

(\$000 OMITTED)

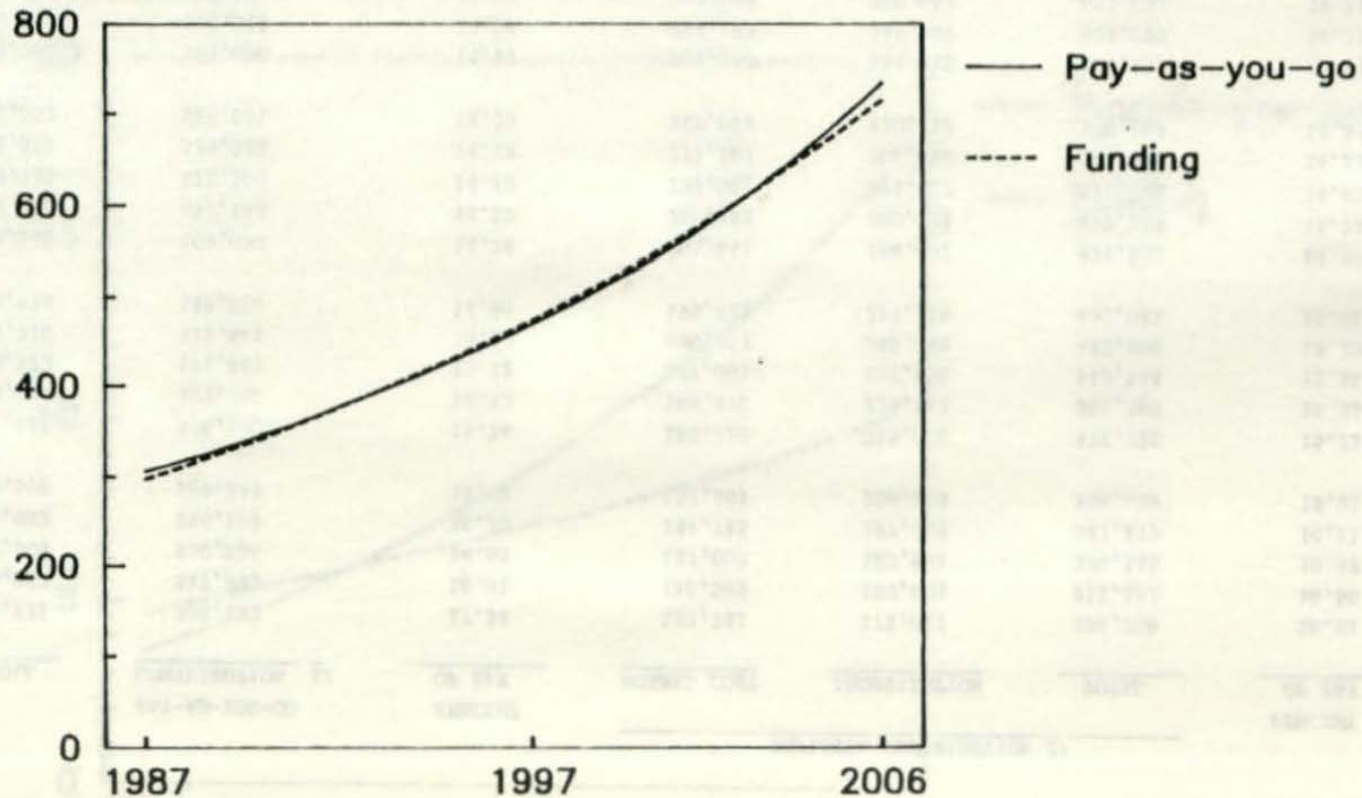
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	1,765,321	306,120	17.34	123,741	173,017	296,758	16.81
1988	1,880,067	317,992	16.91	130,589	180,803	311,392	16.56
1989	1,999,309	330,836	16.55	137,609	188,936	326,545	16.33
1990	2,124,092	346,193	16.30	144,733	197,444	342,177	16.11
1991	2,254,398	360,333	15.98	152,361	206,328	358,689	15.91
1992	2,391,516	376,530	15.74	160,129	215,606	375,735	15.71
1993	2,536,236	393,746	15.52	168,476	225,313	393,789	15.53
1994	2,686,372	411,445	15.32	177,081	235,453	412,534	15.36
1995	2,844,716	429,561	15.10	186,257	246,049	432,306	15.20
1996	3,010,938	448,618	14.90	195,925	257,118	453,043	15.05
1997	3,185,386	469,692	14.75	205,641	268,691	474,332	14.89
1998	3,372,866	492,184	14.59	216,435	280,784	497,219	14.74
1999	3,559,799	515,506	14.48	227,061	293,417	520,478	14.62
2000	3,754,871	539,949	14.38	238,107	306,616	544,723	14.51
2001	3,957,652	565,591	14.29	249,694	320,413	570,107	14.41
2002	4,168,702	594,856	14.27	261,580	334,839	596,419	14.31
2003	4,390,552	626,213	14.26	274,163	349,907	624,070	14.21
2004	4,616,865	659,282	14.28	287,029	365,653	652,682	14.14
2005	4,852,732	695,149	14.32	300,342	382,101	682,443	14.06
2006	5,097,607	733,012	14.38	314,391	399,301	713,692	14.00

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost less expected member contributions. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 4½% per year.

Other Local Boards without \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

COMMONWEALTH OF MASSACHUSETTS CONTRIBUTORY RETIREMENT SYSTEM

COST OF LIVING ADJUSTMENT

20-YEAR FORECAST AS OF JANUARY 1, 1987

8% INTEREST WITHOUT \$30,000 PAY CAP

(\$000 OMITTED)

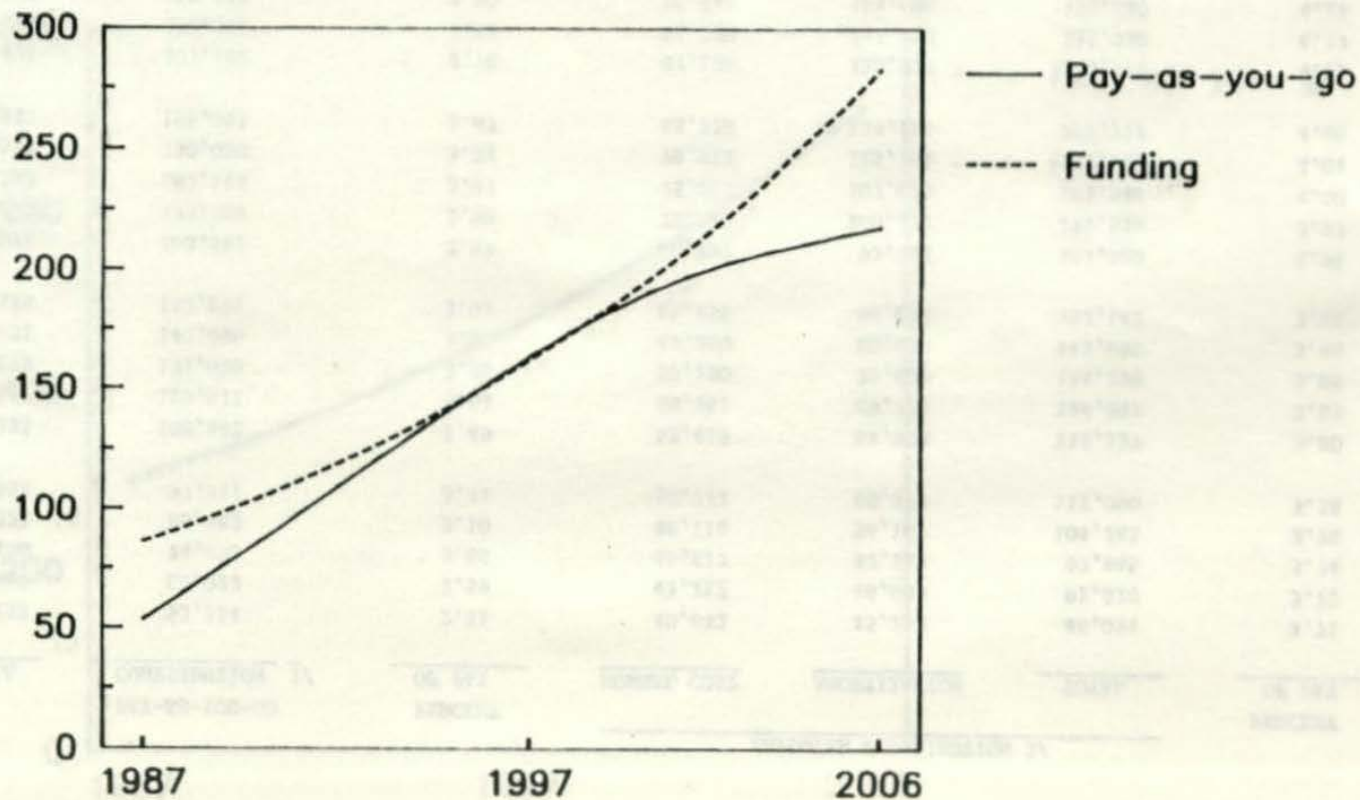
YEAR	PAYROLL	PAY-AS-YOU-GO CONTRIBUTION 1/	PERCENT OF PAY	EMPLOYER CONTRIBUTION 2/			PERCENT OF PAY
				NORMAL COST	AMORTIZATION	TOTAL	
1987	2,322,252	53,554	2.31	40,882	45,212	86,094	3.71
1988	2,467,249	64,022	2.59	43,217	48,603	91,820	3.72
1989	2,617,406	74,875	2.86	45,617	52,248	97,865	3.74
1990	2,774,821	85,982	3.10	48,116	56,167	104,283	3.76
1991	2,939,353	97,311	3.31	50,711	60,379	111,090	3.78
1992	3,112,235	108,643	3.49	53,419	64,908	118,327	3.80
1993	3,294,652	119,911	3.64	56,261	69,776	126,037	3.83
1994	3,484,175	131,028	3.76	59,190	75,009	134,199	3.85
1995	3,683,951	142,090	3.86	62,260	80,635	142,895	3.88
1996	3,893,538	152,892	3.93	65,459	86,682	152,141	3.91
1997	4,113,591	163,332	3.97	68,797	93,183	161,980	3.94
1998	4,348,320	173,166	3.98	72,340	100,172	172,512	3.97
1999	4,584,232	182,143	3.97	75,861	107,685	183,546	4.00
2000	4,830,513	190,060	3.93	79,511	115,761	195,272	4.04
2001	5,086,547	196,851	3.87	83,278	124,444	207,722	4.08
2002	5,353,421	202,482	3.78	87,176	133,777	220,953	4.13
2003	5,632,232	207,003	3.68	91,220	143,810	235,030	4.17
2004	6,018,335	210,644	3.50	96,944	154,596	251,540	4.18
2005	6,216,231	214,285	3.45	99,584	166,190	265,774	4.28
2006	6,525,475	217,493	3.33	103,964	178,655	282,619	4.33

1/ Annual benefit payments as of the beginning of the calendar year less portion attributable to member contributions.

2/ Gross normal cost. Amount necessary to amortize January 1, 1987 unfunded actuarial accrued liability over 40 years with payments increasing at 7½% per year.

Cost of Living Adjustment without \$30,000 Pay Cap

\$ Millions



20-Year Forecast as of January 1, 1987
8% Interest

PART V

PARTICIPANT DATA

	<u>1987</u>	<u>1983</u>	<u>Percent Change</u>
State			
Active Employees	90,570	80,120	13.0
Inactive Members	84,893	59,478	42.7
Retired Members	35,869	29,485	21.7
Total Payroll	\$2,195,000	\$1,334,213	64.5

Teachers

Active Employees	63,821	63,088	1.2
Inactive Members	20,099	8,695	131.2
Retired Members	25,951	20,420	27.1
Total Payroll	\$1,839,000	\$1,315,303	39.8

Boston Teachers and Non-Teachers

Active Employees	23,226	22,557	3.0
Inactive Members	9,285	2,867	223.9
Retired Members	13,153	12,807	37.3
Total Payroll	\$ 556,931	\$ 426,341	30.6

State Authorities and Other Local Boards

Active Employees	97,404	91,688	6.2
Inactive Members	8,002	9,582	(16.5)
Retired Members	54,764	46,537	17.7
Total Payroll	\$1,765,321	\$1,336,864	32.0

Although better than previous years, the data received for valuation contained a substantial amount of omissions. For example, the bad data for active employees in the State valuation is summarized as follows:

<u>Included</u>	<u>Date of Membership</u>			<u>Total</u>
	<u>Prior to 1946</u>	<u>1946 - 1972</u>	<u>1973 and Later</u>	
All Members	149	20,368	70,053	90,570
Missing Sex Code	45	2,334	26,024	28,403
Missing Date of Birth	20	599	9,700	10,319
Missing Service	0	39	9,763	9,802
Missing Service and Date of Birth	0	1	264	265

The quality of the data for the State Teachers was good. It was submitted with relatively few errors and omissions. Assumptions used for covering problems did not significantly impact the results of the valuation. Bad data for the Teachers Retirement System is summarized as follows:

<u>Included</u>	<u>Date of Membership</u>			<u>Total</u>
	<u>Prior to 1946</u>	<u>1946 - 1972</u>	<u>1973 and Later</u>	
All Members	187	34,626	29,008	63,821
Missing Sex Code	2	2,966	1,865	4,833
Missing Date of Birth	0	5	769	744
Missing Service	0	117	53	170
Missing Service and Date of Birth	0	0	1	1

Two significant problems were encountered regarding the data submitted by the City of Boston. First, 2,109 active members who are contributing had not yet applied for membership. Therefore, dates of hire and birth, salary and sex were missing. Assumptions based on available data were used to approximate the missing information. The impact of using assumptions for the missing information was minimal. Second, the tape did not include salaries for any active member. Salaries were accurately determined using total deductions in 1986, divided by the rate of contributions from the membership date and increasing 6% to reflect one year's increase in salary.

Data submitted for the State Authorities and other Local Boards varied from excellent to poor. Those systems which used magnetic medium versus hard copy listing generally provided data which was both more complete and more accurate. Data submitted on hard copy listings introduced potential margin for error and cost with the need to have the data keypunched.

PART VI

STATEMENT OF ACTUARIAL PRESENT VALUE OF
ACCRUED BENEFITS UNDER GASB STATEMENT NO. 5

The Governmental Accounting Standards Board (GASB) Statement No. 5 relates to the disclosure of pension liabilities on a public employer's financial statements. Beginning in 1987, GASB Statement No. 5 must be followed by any public employee retirement system that follows generally accepted accounting principles (GAAP).

The disclosures required by GASB Statement No. 5 are intended to provide users with information needed to assess the funding status of retirement systems on a going-concern basis, progress made in accumulating assets to pay benefits when due, and whether employers are making actuarially determined contributions to plans.

Footnote disclosures required by GASB Statement No. 5 include a description of the plan, a summary of significant accounting policies and actuarial assumptions, funding status of the plan using a standardized measure of pension obligation, and contributions required and contributions made during the period. The standardized measure of the pension obligation is the actuarial present value of credited projected benefits prorated on service. Ten-year historical trend information is to be included as required supplementary information. This historical information need not be supplied retroactively if information is not available.

It has been our interpretation of GASB No. 5 that vested liabilities do not include liabilities for future salary increases. Therefore, all liabilities for salary increases for vested members are included in non-vested liabilities.

Pension liabilities under GASB No. 5 are presented on the following exhibit.

COMMONWEALTH OF MASSACHUSETTS
CONTRIBUTORY RETIREMENT SYSTEM

GASB STATEMENT NO. 5, DISCLOSURE INFORMATION
AS OF JANUARY 1, 1987
(\$000 OMITTED)

	<u>State</u>	<u>Teachers</u>	<u>Boston Teachers</u>	<u>Boston Non-Teachers</u>	<u>Other State Authorities</u>	<u>Local Boards</u>	<u>Total</u>
<u>Current Employees</u>							
Employee Contributions	1,025,000	1,204,000	154,491	307,210	23,380	906,075	3,670,156
Employer-Financed Vested	1,077,000	1,289,000	46,833	148,223	22,699	1,129,336	3,713,091
Employer-Financed Non-Vested	1,502,000	1,519,000	113,742	187,757	18,749	976,246	4,317,494
<u>Non-Active Participants</u>							
Retirees and Beneficiaries Currently Receiving Benefits and Terminated Employees Not Yet Receiving Benefits	2,650,000	2,319,000	217,639	736,057	41,661	2,707,958	8,672,315
<u>Total Pension Benefit Obligation</u>	6,254,000	6,331,000	532,705	1,379,247	106,489	5,799,615	20,403,056
<u>Assets at Market Value</u>	2,515,000	2,670,000	218,874	478,914	98,985	2,085,502	8,067,275
<u>Unfunded Pension Benefit Obligation</u>	3,739,000	3,661,000	313,831	900,333	7,504	3,714,113	12,335,781

PART VII

OBSERVATIONS

1. Cost of Living Adjustments

Granting cost of living adjustments to retired participant's benefits has a much different effect than adjustments to expected pension payments for active participants. Adjustments to current retiree payments substantially increase the distributions on the effective date of the adjustment. These higher payments will be payable for about 15 years for the average retirement group. However, under the current amortization schedule for unfunded liabilities, substantial contributions to cover these added costs will not begin until after 15 years have elapsed. Consequently, under the pay-as-you-go method the retiree liabilities would be paid off during the lifetime of the recipients. By amortizing these liabilities over 40 years in a funding schedule, the Commonwealth Retirement System will not "fund" these liabilities until well after the benefits are actually received.

For future COLA increases to current active participants, the employer normal cost will increase immediately to help cover the added cost. An active participant's future COLA will also increase the unfunded liability to the extent that it has not been funded by prior contributions, and therefore that portion will be paid for, like the retiree adjustment, much further in the future.

We expect that the COLA unfunded actuarial liability will continue to increase for the near future. However, by prefunding future COLA adjustments for current active employees, the unfunded liability for COLA's will eventually decline.

2. Alternative Funding of Pension Liabilities

Subdivision (2) of Section 22C of Chapter 32 allows for an accelerated annual funding program of the pension liabilities to be equal to the pay-as-you-go contribution plus the employer normal cost. A comparison of the costs under Subsection (2) of Section 22C and the Funding Schedule (subsection (1) of Section 22C) is as follows:

	Section 22C(2)		Section 22C(1)	
	<u>With Cap</u>	<u>Without Cap</u>	<u>With Cap</u>	<u>Without Cap</u>
State	327,615	411,465	188,643	261,243
Teachers	311,399	337,145	188,621	217,400
Boston Teachers	29,465	34,253	13,728	18,983
COLA	<u>90,744</u>	<u>94,436</u>	<u>81,423</u>	<u>86,094</u>
Total	759,223	877,299	472,415	583,720

The accelerated funding program is a very aggressive funding approach which will decrease the unfunded liability for the Commonwealth's obligations in a relatively short period of time. However, it is not an actuarially sound method of funding. The pay-as-you-go component covers the cost of the current retirees whereas the normal cost covers the cost of the current actives. This is fine for the first few years when only a few actives will be retiring. Beyond that, pension liabilities will be paid for twice; once as the normal cost during a participant's active period and again as pay-as-you-go when he retires. For a limited period this method could be used to strengthen the retirement systems in the weakest condition.

3. Asset Performance

The investment return during the period of January 1, 1983 through December 31, 1986 was very strong as it rode the bull market of the early 80's. This high return period contributed to an increase in the assets above the expected return of 7½%. Therefore, the Unfunded Actuarial Accrued Liability did not grow as rapidly as it otherwise would.

4. Amortization

Assuming all the actuarial assumptions are exactly realized, the Unfunded Actuarial Accrued Liability for the Commonwealth's pensions obligations will grow for the next 28 years. The reason for the expected growth is that annually accruing interest on the Unfunded Actuarial Accrued Liability exceeds the amortization payments due under the funding schedules. The difference between the interest due and the payment made, is termed "negative amortization". This deficiency becomes part of the principal due, thereby causing the unfunded liability to grow. This negative amortization will occur for 28 years before the amortizations begin to pay off the principal due. At that point the payments very quickly become principal payments, and the unfunded liability will be paid off in the remaining 12 years of the amortization schedule.

The amortization schedules for the State Authority and Local Systems incorporate graduated amortization payments increasing at 4.5% per year. These schedules will result in negative amortization for 24 years. This "level percent of payroll" amortization is commonly used in public sector plans, where the potential for plan terminations is significantly less than in the private sector.

For example, assume a retirement system has an unfunded liability of \$100,000 and will pay the liability over 40 years with payments increasing at 7 1/2%. Assuming no gains or losses, the unfunded liability will grow to \$243,536 in the 28th year before decreasing to zero in the 40th. For amortization payments increasing at 4 1/2% per year, the unfunded liability peaks in the 24th year at \$161,168.

PART VIII

ACTUARIAL COST METHOD, FACTORS AND ASSUMPTIONS USED IN COST DETERMINATIONS

The actuarial cost method, factors and assumptions used in determining cost estimates are presented below.

1. Member Data: The member data used in the determination of cost estimates consists of pertinent information with respect to the active, inactive, retired, and disabled members of the employer as supplied by the employer to the actuary.
2. Valuation Date: January 1, 1987.
3. Actuarial Cost Method: The costs of the Plans have been determined in accordance with the individual entry age normal actuarial cost method.
4. Rate of Investment Return: It is assumed that the assets of the fund will accumulate at a compound annual rate of 8% per annum. The inflation rate has been assumed to be 4 1/2% per year which implies a real rate of return of 3 1/2% per year.
5. Salary Scale: It is assumed that salaries, including longevity, will increase at a compound annual rate of 6.0% per annum. This consists of a 4 1/2% assumption for inflation and 1 1/2% due to longevity, productivity, and merit increases.
6. Cost-of-Living Increases: No cost-of-living increases have been assumed.
7. \$30,000 Pay Cap: The \$30,000 limit on the amount of pay which can be used to determine benefits for employees hired after December 31, 1978, is assumed to remain at \$30,000. This cap does not apply to employee contributions.

8. Value of Investments: Assets held by the funds are valued at market value as reported by the Public Employees' Retirement Administration (PERA).
9. Annual Rate of Withdrawal Prior to Retirement: Based on an analysis of experience, the assumed annual rates of withdrawal may best be illustrated by the following probabilities at the following ages:

<u>Attained Age</u>	<u>General Employees</u>	<u>Police and Fire Employees</u>
20	.1200	.0210
30	.0555	.0165
40	.0231	.0056
50	.0146	.0000

10. Annual Rate of Mortality: It is assumed that both pre-retirement and post-retirement mortality are represented by the 1971 Group Annuity Mortality Table with ages set back one year for males and six years for females. Mortality for disabled members is represented by the 1971 Group Annuity Mortality Table set forward nine years for males and four years for females.
11. Service Retirement: Based on an analysis of experience, it is assumed that active members will retire in accordance with the following rates:

(Table on following page)

Percentage of Total Retirements at Each Age

<u>Age</u>	<u>General Employees</u>	<u>Police and Fire Employees</u>
50	0.00%	32.01%
51	0.00	4.88
52	0.00	3.74
53	0.00	4.77
54	0.00	4.20
55	12.55%	7.83%
56	2.81	3.86
57	2.62	3.86
58	2.74	3.52
59	2.76	3.52
60	6.00%	6.58
61	4.88	2.84
62	9.92	3.52
63	5.97	1.82
64	5.16	2.38
65	15.91%	10.33
66	6.35	0.00
67	4.82	0.00
68	3.79	0.00
69	3.48	0.00
70	10.24	0.00
	<u>100.00%</u>	<u>100.00%</u>

12. Annual Rate of Disability Prior to Retirement: Based on an analysis of experience, the assumed annual rates of disability may best be illustrated by the following probabilities at the following ages:

<u>Attained Age</u>	<u>General Employees</u>	<u>Police and Fire Employees</u>
20	.0006	.0010
30	.0011	.0023
40	.0022	.0087
50	.0061	.0150

In addition, it is assumed for the general employees that 45% of all disabilities are ordinary (55% are service connected). For police and fire employees, 10% of all disabilities are assumed to be ordinary (90% are service connected).

13. Family Composition: It is assumed that 80% of all members will be survived by a spouse and that females (males) are three years younger (older) than members.

Age	Female	Male	Spouse
20	1000	1000	1000
30	1000	1000	1000
40	1000	1000	1000
50	1000	1000	1000

PART IX

SUMMARY OF PRINCIPAL BENEFITS AND
ELIGIBILITY PROVISIONS AS OF JANUARY 1, 1987

This summary is prepared in accordance with Chapter 32 as of January 1, 1987, and does not take into account any subsequent changes.

1. Administration:

Each of the 106 contributory retirement systems for public employees for the Commonwealth of Massachusetts are guided by the applicable provisions of Chapter 32 of the Massachusetts general laws and other applicable statutes. Although these boards operate semi-independently, there is a uniform set of rules governing benefits, eligibility, contributions, financing, and account.

2. Participation:

Participation is mandatory for all full-time employees whose employment commences prior to age 65. Eligibility with respect to part-time, professional, temporaries or intermittal employment is governed by the local board. Membership is optional for certain elected officials, State officials appointed by the Governor, and certain hospital interns.

There are four classes of membership as following as follows:

- (i) Group 1: Most general employees in State and local government.
- (ii) Group 2: Certain specified hazardous duty positions.
- (iii) Group 3: State police officers and inspectors.
- (iv) Group 4: Local police and firefighters.

For members in more than one group, participation will be proportional.

3. Member Contributions:

Member contributions vary depending upon date hired as follows:

<u>Date of Hire</u>	<u>Member Contribution Rate</u>
Prior to 1975	5% of Salary
1975 - 1983	7% of Salary
1984 and Later	8% of Salary

4. Salary: Salary is defined as gross regular compensation. Salary does not include bonuses, overtime, severance pay, unused sick leave credit, and other similar compensation.

5. Average Salary: Average salary is used to determine a participant's benefit. It is defined as the average salary during the 3-consecutive-year period which produces the highest average. [Alternatively, if a greater amount results, it is the average rate of salary earned during the period or periods whether or not consecutive that constitutes the last 3 years preceding retirement.]

6. Credited Service: In general, credited service is awarded during the period in which a member contributes to the retirement system. In addition, certain periods of military service are credited subject to a maximum of 4 years (the 4-year maximum does not apply to involuntary military service).

7. Service Retirement:

a. Eligibility: For an employee to be eligible for service retirement (also referred to as superannuation), the following conditions are to be met:

- (i) completion of 20 years of service;
- (ii) for an employee prior to 1978, attainment of age 55 as an active member;
- (iii) if a State police officer (Group 3), attainment of age 50.

b. Benefit Amount: The retirement allowance is determined as a product of the participant's benefit rate times average salary times creditable service, where benefit rate is determined from the following table:

Age at Retirement	Percentage of Average Salary		
	Group 1	Group 2	Group 4
65 or Over	.025	.025	.025
64	.024	.025	.025
63	.023	.025	.025
62	.022	.025	.025
61	.021	.025	.025
60	.020	.025	.025
59	.019	.024	.025
58	.018	.023	.025
57	.017	.022	.025
56	.016	.021	.025
55	.015	.020	.025
54	.014	.014	.024
53	.013	.013	.023
52	.012	.012	.022
51	.011	.011	.021
50	.010	.010	.020
49	.009	.009	.019
48	.008	.008	.018
47	.007	.007	.017
46	.006	.006	.016
45	.005	.005	.015
44	.004	.004	.004
43	.003	.003	.003
42	.002	.002	.002
41	.001	.001	.001

For Group 3 (State police), the benefit is 50% of the participant's final year's rate of regular salary, plus an additional 1% for each year of service in excess of 20 years.

In addition, for veterans (all groups) there is an additional benefit of \$15 per year for each year of service, up to a maximum of 20 years.

Important note: For participants employed in 1979 or later, the maximum salary used in the benefit computation is \$30,000. This limit does not apply when determining the employee contribution amount.

8. Deferred Vested Retirement:

a. Eligibility:

A participant who has completed 10 or more years of creditable service is eligible for a deferred vested retirement benefit. If termination is involuntary, the participant is vested after 6 years.

b. Benefit Amount:

The participant's accrued benefit is payable commencing at age 55, or may be deferred until later at the employee's option. With respect to withdrawal of contribution, participants hired before January 1, 1984 receive interest on their contributions; participants hired after January 1, 1984 receive half the credited interest if they leave with greater than 5 and less than 10 years of service.

9. Accidental Disability:

a. Eligibility:

A participant is eligible for an accidental disability benefit, regardless of service or age, if he becomes permanently and totally incapacitated for further duty as a result of personal injury sustained while in the performance of duties.

b. Benefit Amount:

Seventy-two percent of annual salary plus \$312 per year for each child plus additional annuity based upon accumulated member contributions with credited interest. The total benefit may not exceed 100% of final salary.

10. Ordinary Disability:

a. Eligibility:

An ordinary disability occurs when a member becomes permanently and totally disabled due to sickness or injury which is not job related. In order to be eligible for an ordinary disability benefit, a member must have 15 years of service (and be less than age 55). For veterans, the 15-year requirement is reduced to 10 years and the age 55 restriction is waived.

b. Benefit Amount:

The ordinary disability amount is equal to the accrued retirement benefit as if the member was age 55. If the member was a veteran, the benefit is 50% of the member's final rate of salary during the preceding 12 months, plus an annuity based upon accumulated member contributions plus credited interest. If the participant is over age 55, he will receive not less than the superannuation allowance to which he is entitled.

11. Survivor Benefits:

a. Occupational Death:

The survivors of a member who dies due to an occupational injury will be entitled to a lump sum return of contributions plus a pension benefit equal to 72% of the participant's annual salary.

b. Non-Occupational Death:

Upon the death of a member other than due to an occupational injury, the designated beneficiary will be entitled to a retirement benefit as if Option C had been elected with a minimum of \$250.00 per month to the surviving spouse, plus \$120.00 if one child, plus \$90.00 each additional child. If no beneficiary is designated and if the employee worked 2 years, and if the employee is married at least 1 year, the spouse may elect benefits. If no designated beneficiary or surviving spouse, then there is a return of contributions. If there are dependent children but no surviving spouse, they may elect minimum survivor benefits of \$250.00 per month plus \$120.00 for the first child and \$90.00 for each additional child.

c. Refund of Contributions:

Upon the death of a member entitled to survivor benefits, the beneficiary is entitled to a refund of all member contributions with interest.

12. Cost-of-Living Increases:

If the Consumer Price Index for any year increases by at least 3% over the Consumer Price Index used in the last determination, the general court determines a cost-of-living increase for all participants who have been retired for at least 12 months as of the end of such year. This increase is then applied to the first \$9,000 of annual pension effective on the following July 1.

13. Post-Retirement Death Benefits:

Any benefits following the death of a member after retirement are based upon the form of benefit the participant elected at the time of retirement. There are three available forms as follows:

- (i) Option A -- Life annuity;
- (ii) Option B -- Life annuity with death benefit equal to excess of member contributions plus credited interest to retirement over annuity benefit paid to member;
- (iii) Option C -- Life annuity with 66 2/3% of benefit continued after death of member to designated joint annuitant.

PART X

GLOSSARY OF TERMS

This glossary summarizes the technical terms contained in this report.

1. Actuarial Accrued Liability: That portion of the Actuarial Present Value of plan benefits which is not provided for by future employer Normal Costs or employee contributions.
2. Actuarial Assumptions: Assumptions as to the occurrence of future events affecting the Retirement System such as:
 - a. rates of investment returns;
 - b. increases in a member's salary;
 - c. inflation;
 - d. the probability of mortality, turnover, disablement, and retirement at each age and other relevant items.
3. Actuarial Cost Method: A procedure for allocating the Actuarial Present value of pension plan benefits between Normal Cost and Actuarial Accrued Liability.
4. Actuarial Present Value: The single-sum amount required at the valuation date which is required to provide for anticipated future events based upon the terms of the plan and the Actuarial Assumptions.
5. Forecast: A projection of future benefit payments or contribution requirements based upon the terms of the plan, the current asset amounts, the Actuarial Assumptions and additional assumptions as to the replacement of terminating employees with new employees.
6. Normal Cost: That portion of the Actuarial Present Value of future benefits which is assigned to the current year.

7. Unfunded Actuarial Accrued Liability: That portion of the Actuarial Accrued Liability which is not provided for by current market value of assets.
8. Valuation Method: The method used to divide the cost of future benefits between the actuarial accrued liability, the current year's normal costs and future years' normal costs. The resulting current funding requirement is then determined as the current year's normal cost plus the payment necessary to amortize the unfunded actuarial liability.
9. Vested Liability: That portion of the Actuarial Present Value of Accrued Benefits which a member would be entitled to were he to terminate his employment with the employer as of the valuation date.
10. Projected Benefit Obligation: The actuarial present value of plan benefits multiplied by past service and divided by all service for each employee, then summed for all employees.
11. Unfunded Project Benefit Obligation: The excess of the Projected Benefit Obligation over the plan assets.