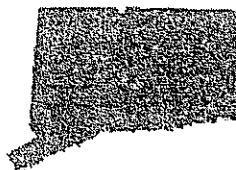


**CONNECTICUT STATE TEACHERS' RETIREMENT SYSTEM**



**1989 - 1994 EXPERIENCE STUDY**

**GABRIEL, ROEDER, SMITH & COMPANY  
ACTUARIES AND CONSULTANTS**

January 23, 1996

State Teachers' Retirement Board  
State of Connecticut  
165 Capitol Avenue  
Hartford, Connecticut 06106

Dear Members of the Board:

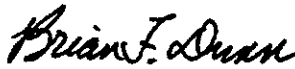
The results of the 5-year *investigation of experience* of the Connecticut State Teachers' Retirement System are presented in this report. The investigation was made for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the System in compliance with Section 10-183nm of the Connecticut Statutes.

The investigation was based upon the statistical data furnished for annual actuarial valuations and submitted to us by the prior actuary for the plan, and upon supplemental information furnished by the Staff concerning members who died, withdrew, became disabled or retired during the 5-year period July 1, 1989 through July 30, 1994 and on published economic historical data.

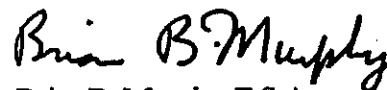
The investigation was carried out using generally accepted actuarial principles and techniques.

**We believe that the proposed new actuarial assumptions that are the result of this investigation represent a reasonable estimate of future experience of the Connecticut State Teachers' Retirement System based upon the data reviewed in the study and general trends among public employee retirement systems.**

Respectfully submitted,



Brian F. Dunn, A.S.A.



Brian B. Murphy, F.S.A.

BFD/alv

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## *INTRODUCTION*

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Each year as of June 30, census data and financial information for the Connecticut State Teachers' Retirement System are collected. In even numbered years an actuarial valuation is completed. The purpose of the valuation is to determine the State's contributions for the fiscal years ending two and three years hence. The valuation takes into account changes in participant demographics and recent financial results and measures the financial soundness of the benefit program. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

### **NON-ECONOMIC ASSUMPTIONS**

- Rates of quitting among active members.
- Rates of disability among active members.
- Rates of retirement among active members.
- Rates of mortality among active members, retired members, and beneficiaries.
- Patterns of merit and longevity pay increases to active members.

### **ECONOMIC ASSUMPTIONS**

- Long-term rates of investment return to be generated by the assets of the Teachers' Retirement System.
- Long-term rates of growth of the total payroll for System members.

Assumptions should be carefully chosen and continually monitored. Use of outdated assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or sharp increases in required contributions at some point in the future;
- Overstated costs resulting in either benefit levels that are kept below the level that could be supported by the computed rate, or an unnecessarily large burden on the current generation of members, employers and taxpayers.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes.

In recognition of this, Connecticut statutes require that assumptions used to value the liabilities of Teachers' Retirement System be studied in depth every five years. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year to year fluctuations. Actuarial assumptions were last revised in 1989.

This report contains the following Sections:

**Section I** presents recommendations for the non-economic assumptions (rates of quitting, becoming disabled, retiring, and dying either before or after retiring, and the component of active member pay increases attributable to merit and longevity). Tables of the tabulated data are included to support the recommendations.

**Section II** presents recommendations for the economic assumptions (rates of long-term investment return on the plan's assets and the long-term rate of payroll growth). Information is included on the historical returns of various classes of assets and a discussion of the role that long-term inflation assumption plays in setting other assumptions in a consistent manner.

In **Section III** some suggestions are offered regarding certain methods and procedures that have been used in the actuarial valuations.

**Section IV** shows the impact of all of the proposed changes on the State's contribution rate as a percent of member payroll.

**Section V** summarizes all of the proposed changes.

## *SOME HISTORICAL COMMENTS*

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The last experience study of this System was completed in 1989. In the years preceding that study, the Education Enhancement Act (EEA) had affected several patterns within the System, most notably the salary progression and the retirement pattern. The Act mandated widespread pay increases for teachers, with a minimum starting pay of \$20,000. In addition, a number of teachers deferred retirement because of EEA-driven raises. These changing patterns had an effect on the data, and hence the results of the 1989 experience study.

In 1992, new legislation removed the automatic cost-of-living adjustment (COLA) provision for teachers who retire on or after September 1, 1992. Teachers who had retired before that date would still receive an automatic annual COLA of between 3% and 5%. In anticipation of the change in the law, an unusually high number of teachers retired between June 30 and August 31, 1992. This has somewhat impacted the data for the 1989-1994 study.

In 1995, the Board elected to change its retained actuary to the firm of Gabriel, Roeder, Smith & Company. As a result, we have had to rely on data files supplied by the prior retained actuary. We commend them for their cooperation and professionalism.

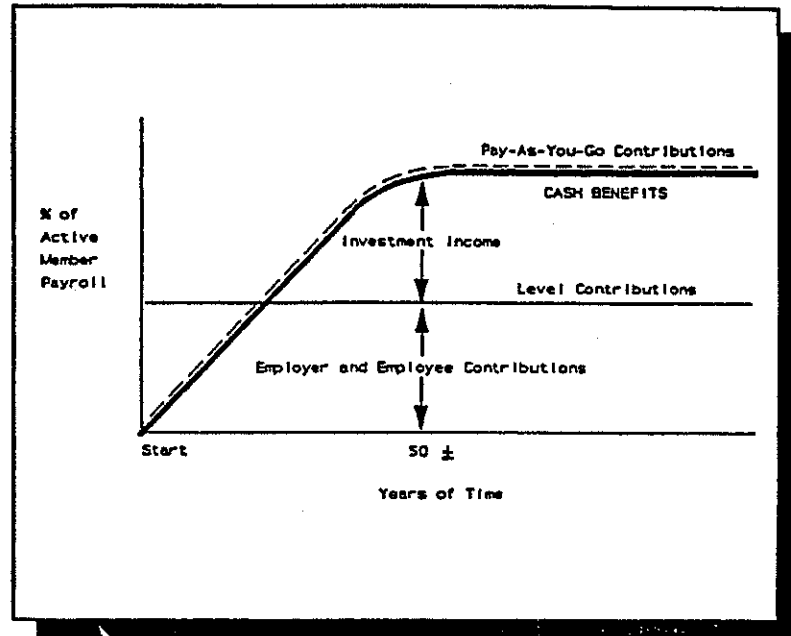
## SELECTION OF ASSUMPTIONS USED IN ACTUARIAL VALUATIONS

### Economic Assumptions

- Investment return
- Pay increases to individual employees:  
the portion for economic changes
- Active member group size and  
total payroll growth

### Demographic Assumptions

- Actual ages at service retirement
- Pay increases to individual members:  
the portion for merit & seniority
- Disability while actively employed
- Separations before retirement
- Mortality after retirement
- Mortality before retirement



## RELATIONSHIP BETWEEN PLAN GOVERNING BODY AND THE ACTUARY

The actuary should have the primary responsibility for choosing the demographic assumptions used in the actuarial valuation, making use of specialized training and experience.

The actuary and other professionals can provide guidance concerning the choice of suitable economic assumptions, but the basis of the economic assumptions is the assumed rate of inflation, a quantity which defies accurate prediction by anyone. Given an assumed rate of future inflation, however, it is very important that this rate be applied in a consistent manner in deriving the assumed rate of investment return, the economic portion of the assumption on pay increases to individual employees, and the assumed rate of growth of active member payroll. Consistent application of assumptions is an area in which the actuary has specialized training.

A sound procedure is that the actuary suggests reasonable alternatives for economic assumptions, followed by discussion involving the actuary, the Plan Governing Body, and other professionals, and the Plan Governing Body then makes a final choice from the various alternatives.

**SECTION I: NON-ECONOMIC ASSUMPTIONS**



## *SUMMARY OF FINDINGS* *(NON-ECONOMIC ASSUMPTIONS)*

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As a result of this study, we are proposing changes to certain actuarial assumptions used in the valuation of the System. We believe these new assumptions better reflect the actual experience under the plan. However, complete recognition of actual experience over a limited period is rarely given. This would cause contribution requirements and the funding status to be unduly sensitive to short-term experience fluctuations.

Comments on specific assumptions are as follows:

***Quit:*** A quit or a "withdrawal" occurs when a member separates from service without entitlement to an immediate benefit. Under the current assumptions, the probability of quitting is a function of how long the member has been in the System, with higher rates applicable to shorter service teachers. The data for this study suggest this phenomena is valid until the member has completed five years of service. Thereafter, the rates appear to be dependent on age. Detail is presented beginning on page 7.

***Disability Rates:*** There were fewer disabilities than assumed throughout the five-year experience period. A table of moderately lower rates is recommended on page 9.

***Retirement Experience:*** As noted earlier, the change in the COLA provisions induced an unprecedented number of retirements in 1992. This was followed by a below average number of retirements the following year. Separate rates are proposed for the three types of retirement: normal, early, and proratable. Detail is presented beginning on page 10.

***Mortality among Retirees:*** Mortality rates among retired public employees have been declining for a number of years. Retired life mortality experience for both males and females was substantially less than expected based on the current assumptions. The difference was most dramatic with regard to retired males. A table of lower rates that is used on other teacher retirement systems is proposed. Details begin on page 13.

***SUMMARY OF FINDINGS (CONTINUED)***  
***(NON-ECONOMIC ASSUMPTIONS)***

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*Mortality among Active Members:* Use of the same table for active teacher mortality as for retired teachers is recommended, except the active member rates are 75% of those found in the retiree table. Experience with other systems suggests that actual "Death in Service" is a relatively rare event. More typically, an individual suffers a decline in health, retires as a disability case, and then dies.

*Pay Increase Rates: (portion related to merit and longevity)* For many, many years the merit and longevity component of the salary increase assumption has consisted of a single flat rate of 2.5% for each of the first 15 years of service followed by a second flat rate of 0.0% for all subsequent years of service. Considering the plan's recent experience, an age-based scale that is higher at the younger ages and grades downward at the older ages is proposed. (Note: The wage-inflation component of the salary scale will be covered in Section II: Economic Assumptions). Detail is on page 15.

**WITHDRAWAL EXPERIENCE**

**WITHDRAWAL EXPERIENCE 1989 - 1994**  
**(AMONG MEMBERS WITH LESS THAN 5 YEARS OF SERVICE)**

Service	Life Years of Exposure	Number of Terminations			Termination Rates		
		Actual	Expected		Actual	Expected	
			Present	Proposed		Present	Proposed
0	898.5	140	80.9	125.8	.16	.09	.14
1	7,910.0	928	711.9	949.2	.12	.09	.12
2	7,440.0	620	669.6	595.2	.08	.09	.08
3	7,685.5	471	691.7	538.0	.06	.09	.07
4	<u>8,172.5</u>	<u>414</u>	<u>735.5</u>	<u>490.4</u>	.05	.09	.06
	32,106.5	2,573	2,889.6	2,698.6	.08	.09	.084

During the five-year select period (from 0 years of service to 4 years of service), the difference between male and female withdrawal experience was not significant.

**WITHDRAWAL EXPERIENCE 1989 - 1994**  
**(AMONG MEMBERS WITH 5 OR MORE YEARS OF SERVICE)**

Age	Life Years of Exposure	Number of Terminations			Termination Rates		
		Actual	Expected		Actual	Expected	
			Present*	Proposed		Present*	Proposed
26	16.5	6	0.8	1.0	.36	.05	.06
27	451.5	29	22.6	27.1	.06	.05	.06
28	906.0	55	45.3	54.4	.06	.05	.06
29	1,270.0	79	63.5	76.2	.06	.05	.06
30	1,562.0	111	78.1	78.1	.07	.05	.05
31	1,790.5	98	35.8	89.5	.05	.02	.05
32	2,001.0	97	40.0	104.5	.05	.02	.05
33	2,300.0	119	46.0	92.0	.05	.02	.04
34	2,568.0	112	51.4	102.7	.04	.02	.04
35	2,925.0	114	58.5	117.0	.04	.02	.04
36	3,298.0	109	66.0	115.4	.03	.02	.035
37	3,859.0	116	77.2	135.1	.03	.02	.035
38	4,574.0	91	91.5	160.1	.02	.02	.035
39	5,283.0	88	105.7	132.1	.02	.02	.025
40	6,032.0	93	120.6	150.8	.02	.02	.025
41	6,905.5	85	69.1	103.6	.01	.01	.015
42	7,828.5	96	78.3	117.4	.01	.01	.015
43	8,567.0	97	85.7	128.5	.01	.01	.015
44	9,034.0	120	90.3	135.5	.01	.01	.015
45	9,099.0	87	91.0	136.5	.01	.01	.015
46	8,946.5	95	89.5	134.2	.01	.01	.015
47	8,555.0	98	85.6	128.3	.01	.01	.015
48	7,899.0	100	79.0	118.5	.01	.01	.015
49	7,191.5	67	71.9	107.9	.01	.01	.015
50	6,622.0	72	66.2	99.3	.01	.01	.015
51	6,035.5	77	60.4	90.5	.01	.01	.015
52	5,328.0	79	53.3	79.9	.01	.01	.015
53	4,821.5	65	48.2	72.3	.01	.01	.015
54	4,540.5	48	45.4	68.1	.01	.01	.015
55	<u>4,257.5</u>	<u>58</u>	<u>42.6</u>	<u>63.9</u>	.01	.01	.01
Totals	144,467.5	2,561	1,959.5	3,020.4	.02	.01	.02

\* The current withdrawal table is based on service. For purposes of comparison, age 21 at hire has been assumed.

Note: Proposed number counts may be somewhat overstated because proposed rates do not apply to people eligible for retirement.

**DISABILITY EXPERIENCE**

***DISABILITY EXPERIENCE***  
***1989 - 1994***

Age	Life Years of Exposure	Number of Disablements			Disability Rates			
		Actual	Expected		Actual	Present	Expected	
			Present	Proposed			M	F
Below 40	52,092.0	6	35.5	22.9				
40	7,350.5	2	7.4	4.8	.0003	.0010	.0005	.0007
41	8,225.0	5	9.9	5.9	.0006	.0012	.0005	.0008
42	9,201.5	4	12.9	7.5	.0004	.0014	.0006	.0009
43	9,902.0	4	15.8	9.3	.0004	.0016	.0008	.0010
44	10,300.0	5	18.5	11.3	.0005	.0018	.0011	.0011
45	<u>10,217.0</u>	<u>7</u>	<u>20.4</u>	<u>12.9</u>	.0007	.0020	.0014	.0012
Totals	107,288.0	33	120.4	74.6	.0003	.0011	.0005	.0008

Note: Proposed rates above age 45 are operative only on people not eligible for retirement. The proposed rates result in 41 expected disabilities during the 1994/95 school year.

**RETIREMENT EXPERIENCE**

- NORMAL
- EARLY
- PRORATABLE





***NORMAL RETIREMENT EXPERIENCE***  
***1989 - 1994***

Age	Life Years of Exposure	Number of Normal Retirements			Normal Retirement Rates		
		Actual	Expected		Actual	Expected	
			Present	Proposed		Present	Proposed
55	22.0	22	0.2	4.4	1.00	.01	.20
56	168.0	126	8.4	33.6	.75	.05	.20
57	269.5	147	13.5	53.9	.55	.05	.20
58	346.0	164	17.3	69.2	.47	.05	.20
59	410.5	185	20.5	82.1	.45	.05	.20
60	1,991.0	586	298.7	398.2	.29	.15	.20
61	1,534.5	411	230.2	306.9	.27	.15	.20
62	1,274.5	379	191.2	254.9	.30	.15	.20
63	1,017.5	306	152.6	203.5	.30	.15	.20
64	781.5	255	117.2	156.3	.33	.15	.20
65	568.0	212	113.6	170.4	.37	.20	.30
66	395.5	135	94.9	118.7	.34	.24	.30
67	297.0	100	83.2	89.1	.34	.28	.30
68	218.0	81	69.8	65.4	.37	.32	.30
69	169.0	70	60.8	50.7	.41	.36	.30
70	109.0	40	43.6	54.5	.37	.40	.50
71	82.0	36	42.6	41.0	.44	.52	.50
72	54.0	21	34.6	27.0	.39	.64	.50
73	34.0	15	25.8	17.0	.44	.76	.50
74	17.5	10	15.4	8.8	.57	.88	.50
75	8.0	4	8.0	8.0	.50	1.00	1.00
76+	<u>27.5</u>	<u>7</u>	<u>27.5</u>	<u>27.5</u>	.25	1.00	1.00
Totals	9,794.5	3,312.0	1,669.6	2,241.1	.33	.17	.23

Actual retirement counts may include some people retiring from deferred vested status. This would cause an overstatement of "actual" rate. The current retirement assumptions do not distinguish between the three types of retirement, while separate rates are proposed for normal, early, and proratable retirement.

**EARLY RETIREMENT EXPERIENCE**  
**1989 - 1994**

Age	Life Years of Exposure	Number of Early Retirements			Early Retirement Rates		
		Actual	Expected		Actual	Expected	
			Present	Proposed		Present	Proposed
45	6.0	3	0	0.1	.50	.00	.01
46	187.5	21	0	1.9	.11	.00	.01
47	1,702.0	17	0	17.0	.01	.00	.01
48	2,411.5	20	0	24.1	.01	.00	.01
49	2,687.0	30	0	26.9	.01	.00	.01
50	2,757.0	35	0	55.1	.01	.00	.02
51	2,705.5	65	0	54.1	.02	.00	.02
52	2,479.5	58	0	74.4	.02	.00	.03
53	2,321.5	76	0	69.6	.03	.00	.03
54	3,221.5	170	0	128.9	.05	.00	.04
55	3,104.5	216	31.0	155.2	.07	.01	.05
56	2,890.5	185	144.5	173.4	.06	.05	.06
57	2,535.5	217	126.8	177.5	.09	.05	.07
58	2,302.5	278	115.1	161.2	.12	.05	.07
59	<u>2,080.5</u>	<u>432</u>	<u>104.0</u>	<u>145.6</u>	.21	.05	.07
Totals	33,392.5	1,823	521.4	1,265.0	.05	.02	.04

Note: The current retirement assumptions do not distinguish between the three types of retirement, while separate rates are proposed for normal, early, and proratable retirement.

***PRORATABLE RETIREMENT EXPERIENCE***  
***1989 - 1994***

Age	Life Years of Exposure	Number of Proratable Retirements			Proratable Retirement Rates		
		Actual	Expected		Actual	Expected	
			Present	Proposed		Present	Proposed
60	517.5	93	77.6	51.8	.18	.15	.10
61	409.5	52	61.4	41.0	.13	.15	.10
62	316.0	37	47.4	31.6	.12	.15	.10
63	239.5	32	35.9	24.0	.13	.15	.10
64	180.5	24	27.1	18.1	.13	.15	.10
65	125.0	19	25.0	12.5	.15	.20	.10
66	94.5	15	22.7	9.5	.16	.24	.10
67	71.5	12	20.0	7.2	.17	.28	.10
68	50.5	11	16.2	5.1	.22	.32	.10
69	33.0	6	11.9	3.3	.18	.36	.10
70	27.0	5	10.8	27.0	.19	.40	1.00
71	19.0	4	9.9	19.0	.21	.52	1.00
72	11.5	2	7.4	11.5	.17	.64	1.00
73	5.0	1	3.8	5.0	.20	.76	1.00
74	4.0	1	3.5	4.0	.25	.88	1.00
75+	<u>6.0</u>	<u>2</u>	<u>6.0</u>	<u>6.0</u>	.33	1.00	1.00
Totals	2,110.0	316	386.6	276.6	.15	.18	.13

**Note:** The current retirement assumptions do not distinguish between the three types of retirement, while separate rates are proposed for normal, early, and proratable retirement. It is possible that the reported "actual" proratable retirement may be somewhat overstated due to operational difficulties in distinguishing between retirement directly from active status, and retirement from terminated vested status.

**MORTALITY EXPERIENCE**



**RETIRED LIFE MORTALITY EXPERIENCE FOR MALES**  
**1989 - 1994**

Age	Life Years of Exposure	Number of Deaths			Mortality Rates		
		Actual	Expected		Actual	Expected	
			Present	Proposed		Present	Proposed
50	39.5	0	0.2	0.2	.0000	.0056	.0049
51	63.5	1	0.4	0.3	.0157	.0062	.0054
52	76.5	1	0.5	0.5	.0131	.0069	.0060
53	79.5	0	0.6	0.5	.0000	.0075	.0065
54	122.0	0	1.0	0.9	.0000	.0083	.0072
55	193.5	1	1.7	1.5	.0052	.0090	.0078
56	295.5	2	2.9	2.5	.0068	.0099	.0085
57	420.5	4	4.5	3.9	.0095	.0108	.0092
58	560.5	4	6.6	5.6	.0071	.0119	.0100
59	777.5	5	10.1	8.6	.0064	.0130	.0110
60	1,045.5	5	14.8	12.7	.0048	.0142	.0121
61	1,256.0	9	19.5	16.7	.0072	.0155	.0133
62	1,394.5	4	23.7	20.4	.0029	.0170	.0146
63	1,441.0	7	26.9	23.1	.0049	.0187	.0160
64	1,457.0	6	29.9	25.6	.0041	.0205	.0176
65	1,441.5	5	32.5	28.1	.0035	.0226	.0195
66	1,402.0	3	34.8	30.7	.0021	.0248	.0219
67	1,398.0	15	38.1	34.0	.0107	.0272	.0243
68	1,321.0	9	39.1	35.7	.0068	.0296	.0270
69	1,218.5	17	39.1	36.6	.0140	.0321	.0300
70	1,076.0	12	37.4	35.9	.0112	.0347	.0334
71	951.5	19	35.8	35.7	.0200	.0377	.0375
72	816.0	7	33.4	33.5	.0086	.0409	.0411
73	738.5	9	32.9	32.9	.0122	.0445	.0445
74	646.0	14	31.3	31.0	.0217	.0485	.0480
75	588.0	13	31.1	30.5	.0221	.0529	.0518
76	512.5	16	29.6	29.2	.0312	.0578	.0570
77	445.0	9	28.1	27.9	.0202	.0631	.0626
78	400.0	14	27.5	27.6	.0350	.0686	.0689
79	349.0	11	26.1	26.3	.0315	.0746	.0756
80	321.5	16	26.1	26.7	.0498	.0813	.0830
81	264.5	11	23.4	24.3	.0416	.0885	.0918
82	243.0	19	23.4	24.2	.0782	.0962	.0997
83	219.5	13	22.9	23.7	.0592	.1043	.1080
84	199.5	14	22.5	23.2	.0702	.1128	.1165
85	164.0	12	20.0	20.5	.0732	.1221	.1251
Totals	23,938.0	307	778.4	741.2	.0128	.0325	.0310

**RETIRED LIFE MORTALITY EXPERIENCE FOR FEMALES**  
**1989 - 1994**

Age	Life Years of Exposure	Number of Deaths			Mortality Rates		
		Actual	Expected		Actual	Expected	
			Present	Proposed		Present	Proposed
50	38.5	0	0.1	0.1	.0000	.0034	.0018
51	45.0	1	0.2	0.1	.0222	.0038	.0020
52	70.5	0	0.3	0.1	.0000	.0042	.0021
53	97.5	0	0.5	0.2	.0000	.0046	.0023
54	138.5	1	0.7	0.3	.0072	.0051	.0025
55	227.5	2	1.3	0.6	.0088	.0056	.0027
56	356.0	0	2.2	1.1	.0000	.0062	.0030
57	483.5	1	3.3	1.6	.0021	.0069	.0033
58	609.0	3	4.6	2.3	.0049	.0075	.0037
59	783.0	7	6.5	3.2	.0089	.0083	.0041
60	1,091.5	8	9.9	5.0	.0073	.0090	.0046
61	1,412.0	4	13.9	7.3	.0028	.0099	.0052
62	1,603.5	10	17.3	9.3	.0062	.0108	.0058
63	1,760.0	13	20.9	11.4	.0074	.0119	.0065
64	1,834.5	7	23.8	13.4	.0038	.0130	.0073
65	1,866.0	23	26.4	15.1	.0123	.0142	.0081
66	1,818.5	11	28.2	16.4	.0060	.0155	.0090
67	1,762.5	9	30.0	17.4	.0051	.0170	.0099
68	1,712.5	14	32.0	18.7	.0082	.0187	.0109
69	1,651.0	19	33.9	20.3	.0115	.0205	.0123
70	1,652.0	18	37.3	23.1	.0109	.0226	.0140
71	1,705.0	24	42.4	27.8	.0141	.0248	.0163
72	1,652.5	29	45.0	31.2	.0175	.0272	.0189
73	1,593.5	19	47.2	34.4	.0119	.0296	.0216
74	1,605.5	23	51.5	39.5	.0143	.0321	.0246
75	1,542.5	36	53.6	43.0	.0233	.0347	.0279
76	1,466.5	39	55.2	46.8	.0266	.0377	.0319
77	1,408.0	40	57.5	50.4	.0284	.0409	.0358
78	1,396.5	36	62.1	55.7	.0258	.0445	.0399
79	1,440.5	52	69.9	64.0	.0361	.0485	.0444
80	1,448.0	51	76.6	71.2	.0352	.0529	.0492
81	1,437.0	67	83.0	80.0	.0466	.0578	.0557
82	1,364.0	59	86.1	83.5	.0433	.0631	.0612
83	1,360.0	96	93.3	91.1	.0706	.0686	.0670
84	1,221.0	69	91.1	89.6	.0565	.0746	.0734
85	<u>1,140.5</u>	<u>75</u>	<u>92.7</u>	<u>91.6</u>	.0678	.0813	.0803
Totals	42,794.0	866	1,300.5	1,066.8	.0202	.0304	.0249

**PAY INCREASES  
MERIT & LONGEVITY PORTION**

**MERIT AND LONGEVITY COMPONENT OF SALARY EXPERIENCE**  
**1989 - 1994**

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Age	Estimated Average Merit and Longevity Increase	Present Assumption	Proposed Assumption
25-29	2.9%	2.5%	2.3%
30-34	3.6	2.5	2.0
35-39	2.8	2.5	1.8
40-44	2.2	0.0	1.6
45-49	1.4	0.0	1.2
50-54	1.0	0.0	0.8
55-59	0.6	0.0	0.4

Note: The present assumption was a flat 2.5% increase for each of the first 15 years of service and 0% per year thereafter. The present assumption is illustrated for an individual hired at age 25. The proposed assumption is dependent upon age rather than upon service.



## **SECTION II: ECONOMIC ASSUMPTIONS**

## *SUMMARY OF FINDINGS* *(ECONOMIC ASSUMPTIONS)*

---

The basis of the economic assumptions is the assumed rate of **inflation**, a quantity that defies accurate prediction. Given an assumed rate of inflation, however, it is very important that this rate be applied in a consistent manner in deriving:

- The assumed rate of investment return,
- The assumed rate of growth of the total payroll, and
- The assumed rate of pay increases to individual members.

In an experience study, the actuary reviews the economic assumptions to ensure that they are being applied consistently, provides information to the Board regarding past economic patterns, and provides information to the Board regarding similarly situated retirement systems. (While it is not necessarily prudent to follow the pack, it is helpful to be informed regarding the activities of the pack.) The actuary can also furnish the Board with actuarial cost computations that illustrate the effect of changes in the economic assumptions.

The economic assumptions most recently used to value the Teachers' Retirement System are:

Investment Return:	8.50%
Payroll Growth:	<u>5.50</u>
Real Rate of Return	3.00%

The actuary has reviewed the process by which these assumptions are applied and believes it to be reasonable and consistent. Information presented on the following pages indicates further that:

- The assumptions are reasonable in light of historical investment performance, and
- The assumptions are "mainstream" when compared with the assumptions of other large Public Employee Retirement Systems.

While changes in these assumptions could be made at this time, the information provided in this experience study does not indicate a compelling need to do so.

The real rate of return is also called the "spread." Payroll growth drives benefits upward, while investment return helps to fund the benefits. A positive spread is essential to plan survival.

It will be helpful to see how inflation fits into the principal economic assumptions.

## *ECONOMIC ASSUMPTIONS AND INFLATION*

---

A. Investment Return % =

Real Return  
+ INFLATION (Consumer Price Index, or CPI)

B. Base Portion of Individual Pay Increase Assumptions =

0%  
+ Non-Inflation Base ("productivity")  
+ INFLATION Base

C. Change in Active Member Total Payroll =

0%  
+ Non-Inflation Base ("productivity")  
+ INFLATION Base

D. Post-Retirement Benefit Increase

---

*Increases in Assumptions A and/or C will decrease computed contribution rates.*

*Increases in Assumptions B and/or D will increase computed contribution rates.*

---

The INFLATION rate should be the same within each financial assumption, to have logical consistency.

In a stationary population, current 5.5% payroll growth assumption can be interpreted as an estimate of expected wage inflation, while the 4.0% COLA assumption used for pre-September 1, 1992 retirees is a measure of price inflation.

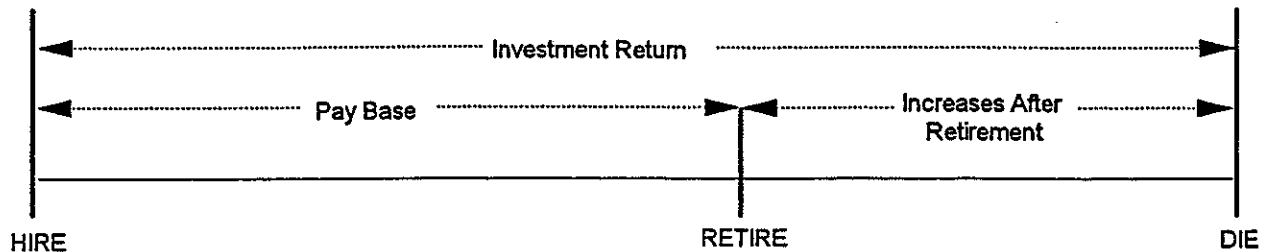
This 1.5% difference is higher than the trend over the past 50 years. As a result, the Board may want to consider lowering the payroll growth assumption from 5.5% to 5.0%. In reviewing the proposal, the information on the next pages should be helpful.

This would result in the following real rate of return assumption (spread):

Investment Return:	8.50%
Proposed Payroll Growth:	<u>5.00</u>
Proposed Real Rate of Return	3.50%

---

## Relationship of Fiscal Assumptions In Computing Contributions to a Retirement System



### Investment Return

An increase in this assumption reduces computed contributions. The assumption operates over all parts of an employee's lifetime.

### Pay Base

An increase in this assumption increases computed contributions. However, a 1% increase in this assumption, coupled with a 1% increase in Investment Return reduces computed contributions. This is because the Pay Base assumption operates only over an employee's working lifetime, while the Investment Return assumption operates over the employee's entire lifetime, and therefore has a greater effect.

### Increases After Retirement

An increase in this element increases computed contributions.

---

If Investment Return, Pay Base, and Increases After Retirement are each increased by equal amounts, computed contributions remain the same (except in plans using Final Average Pay as a factor in computing benefits; the multi-year average used for Final Average Pay causes computed contributions to decrease slightly).

If Investment Return and Pay Base are increased by equal amounts, with no change in Increases After Retirement, computed contributions decrease - sometimes significantly. The decreases represent the projected devaluation of an employee's benefits following retirement.

## COMPARISON WITH MARKET INDICES

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The next two pages show market statistics and sample fund results over several different time periods as well as over the 50 year period ended December 31, 1994. These market statistics cite real return in two ways. First, as total return after (price) inflation. Second, as total return after wage inflation. The current payroll growth assumption of 5.5% reflects wage inflation. Over the last 50 years, pay increases have outpaced price increases by about 1% per year. If this trend is assumed to continue, it would be reasonable to say that the 5.5% assumed payroll growth corresponds to 4.50% assumed price inflation. By putting these two assumptions together with the 8.5% assumed rate of investment return, it can be seen that the CTRS assumed real rate of return is 4.0% ( $=8.5\% - 4.5\%$ ) after price inflation and 3.0% ( $=8.5\% - 5.5\%$ ) after wage inflation. The 4.0% and 3.0% assumptions can now be compared with the results on pages 20 and 21.

The stock component of Sample Fund A is 40%. Sample Fund B illustrates historical investment results if the stock component had been 50%. Notice that both Sample Funds A and B did, for the most part, achieve Connecticut Teachers' Retirement System's present real return assumption over the 50 year period ended in 1994. Over the 30 year period ended December 31, 1994, neither portfolio achieved a 3.7% return over price inflation.

*The historical results indicate that increasing the assumed real return assumption would not be unreasonable. However, investment market statistics are very highly sensitive to the time period chosen for observation.*

Historical results are important mostly as an educational tool and as a guide to judgment. The real question is not what happened in the past, but rather what will happen in the future. Will the next 50 years be like the 70's when there was almost no way to achieve a positive real return, like the first half of the 80's where cash equivalent investments were moneymakers, or will it be completely different?

## Historical Patterns of Investment Return, Pay Increases & Inflation

Calendar Period <u>December</u>	Nominal Investment Return (incl. income)				Inflation (CPI)	Nat'l Average Earnings	Sample Fund A*			Sample Fund B#		
	<u>Bonds (Long)</u> U.S. Corp. Treas. (Sal Bro)	Cash Equiv. (T. Bills)	Stocks (S&P 500)				Total	Price Inf.	Wage Inf.	Total	Price Inf.	Wage Inf.
1945-54	2.5%	2.2%	1.0%	17.1%	4.2%	5.0%	8.4%	4.0%	3.2%	9.9%	5.5%	4.7%
1955-64	1.7	2.7	2.6	12.8	1.6	3.8	6.9	5.2	3.0	8.0	6.3	4.0
1965-74	2.2	2.1	5.4	1.2	5.2	5.8	2.5	(2.6)	(3.1)	2.4	(2.7)	(3.2)
1975-84	7.0	8.4	8.8	14.8	7.3	7.2	11.0	3.4	3.5	11.7	4.1	4.2
1985-94	11.9	11.6	5.8	14.4	3.6	3.9	12.3	8.4	8.1	12.6	8.7	8.4
Last 30 Years	7.0%	7.3%	6.7%	9.9%	5.4%	5.6%	8.5%	2.9%	2.7%	8.8%	3.2%	3.0%
Last 50 Years	5.0%	5.3%	4.7%	11.9%	4.4%	5.1%	8.2%	3.6%	2.9%	8.8%	4.2%	3.5%

\* Fund A: 40% Stocks + 10% Cash Equivalents + 25% Corporate Bonds + 25% Government Bonds

# Fund B: 50% Stocks + 10% Cash Equivalents + 20% Corporate Bonds + 20% Government Bonds

Basic Series

Year-by-Year Total Returns (1926-1994)

For a type of investment,  
 Red means a REAL Return less than 3%  
 [(Total - inflation) < 3%]

For Inflation,  
 RED means a purchasing power loss

Year	Common Stocks	Small Company Stocks	Long-Term Corporate Bonds	Long-Term Government Bonds	Intermediate-Term Government Bonds	U.S. Treasury Bills	Inflation
1926	11.62	0.28	7.37	7.77	5.38	3.27	-1.49
1927	37.49	22.10	7.44	8.93	4.52	3.12	-2.08
1928	43.61	39.69	2.84	0.10	0.92	3.56	-0.97
1929	-8.42	-51.36	3.27	1.17	6.01	4.75	0.20
1930	-24.90	-38.15	7.98	4.66	6.72	2.41	-6.03
1931	-43.34	-49.75	-1.85	-5.31	-2.32	1.07	-9.52
1932	-8.19	-5.39	10.32	16.84	8.81	0.96	-10.30
1933	53.99	142.67	10.38	-0.07	1.83	0.30	0.51
1934	-1.44	24.22	13.84	10.03	9.00	0.16	2.03
1935	47.67	40.19	9.61	4.98	7.01	0.17	2.99
1936	33.92	64.80	6.74	7.52	3.06	0.18	1.21
1937	-35.03	-58.01	2.75	0.23	1.56	0.31	3.10
1938	31.12	32.80	6.13	5.53	6.23	-0.02	-2.78
1939	-0.41	0.35	3.97	5.94	4.52	0.02	-0.48
1940	-9.78	-5.16	3.39	6.09	2.96	0.00	0.96
1941	-11.59	-9.00	2.73	0.93	0.50	0.06	9.72
1942	20.34	44.51	2.60	3.22	1.94	0.27	9.29
1943	25.90	88.37	2.83	2.08	2.81	0.35	3.16
1944	19.75	53.72	4.73	2.81	1.80	0.33	2.11
1945	36.44	73.61	4.08	10.73	2.22	0.33	2.25
1946	-8.07	-11.63	1.72	-0.10	1.00	0.35	18.16
1947	5.71	0.92	-2.34	-2.62	0.91	0.50	9.01
1948	5.50	-2.11	4.14	3.40	1.85	0.81	2.71
1949	18.79	19.75	3.31	6.45	2.32	1.10	-1.80
1950	31.71	38.75	2.12	0.06	0.70	1.20	5.79
1951	24.02	7.80	-2.69	-3.93	0.36	1.49	5.87
1952	18.37	3.03	3.52	1.16	1.63	1.66	0.88
1953	-0.99	-8.49	3.41	3.64	3.23	1.82	0.62
1954	52.62	60.58	5.39	7.19	2.58	0.86	-0.50
1955	31.56	20.44	0.48	-1.29	-0.65	1.57	0.37
1956	6.56	4.28	-6.81	-5.59	-0.42	2.46	2.86
1957	-10.78	-14.57	8.71	7.48	7.84	3.14	3.02
1958	43.36	64.89	-2.22	-6.09	-1.29	1.54	1.76
1959	11.96	16.40	-0.97	-2.26	-0.39	2.95	1.50
1960	0.47	-3.29	9.07	13.78	11.76	2.66	1.48
1961	26.89	32.09	4.82	0.97	1.95	2.13	0.67
1962	-8.73	-11.90	7.95	6.89	5.56	2.73	1.22
1963	22.80	23.57	2.19	1.21	1.84	3.12	1.65
1964	16.48	23.52	4.77	3.51	4.04	3.54	1.19
1965	12.45	41.75	-0.46	0.71	1.02	3.93	1.92
1966	-10.06	-7.01	0.20	3.65	4.69	4.76	3.35
1967	23.98	83.57	-4.95	-9.18	1.01	4.21	3.04
1968	11.06	35.97	2.57	-0.28	4.54	5.21	4.72
1969	8.50	-25.05	-8.09	-5.07	-0.74	6.58	6.11
1970	4.01	-17.43	18.37	12.11	16.86	6.52	5.49
1971	14.31	16.50	11.01	13.23	8.72	4.39	3.36
1972	18.98	4.43	7.26	5.69	5.16	3.84	3.41
1973	-14.66	-30.90	1.14	-1.11	4.61	6.93	8.80
1974	-26.47	-19.95	-3.06	4.35	5.69	8.00	12.20
1975	37.20	52.82	14.64	9.20	7.83	5.80	7.01
1976	23.84	57.38	18.65	16.75	12.97	5.08	4.81
1977	7.18	25.38	1.71	-0.69	1.41	5.12	6.77
1978	6.56	23.46	-0.07	-1.18	3.49	7.18	9.03
1979	18.44	43.46	-4.18	-1.23	4.09	10.38	13.31
1980	32.42	39.88	-2.62	-3.95	3.91	11.24	12.40
1981	-4.91	13.88	-0.96	1.86	9.45	14.71	8.94
1982	21.41	28.01	43.79	40.36	29.10	10.54	3.87
1983	22.51	39.67	4.70	0.65	7.41	8.80	3.80
1984	6.27	-6.67	16.39	15.48	14.02	9.85	3.95
1985	32.16	24.66	30.90	30.97	20.33	7.72	3.77
1986	18.47	6.85	19.85	24.53	15.14	6.16	1.13
1987	5.23	-9.30	-0.27	-2.71	2.90	5.47	4.41
1988	16.81	22.87	10.70	9.67	6.10	6.35	4.42
1989	31.49	10.18	16.23	18.11	13.29	6.37	4.65
1990	-3.17	-21.56	6.78	6.18	9.73	7.81	6.11
1991	30.55	44.63	19.89	19.30	15.46	5.60	3.06
1992	7.67	23.35	9.89	8.05	7.19	3.51	2.90
1993	9.99	20.98	13.19	18.24	11.24	2.90	2.75
1994	1.31	3.11	-5.76	-7.77	-5.14	3.90	2.67

## *COMPARISON WITH OTHER RETIREMENT SYSTEMS NATIONWIDE*

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The statistics cited in this section unless otherwise noted, are taken from the "Survey of State and Local Government Employee Retirement Systems" by Paul Zorn for the Members of the Public Pension Coordinating Council. This survey is dated June, 1994 and is based on responses to a questionnaire sent to State and Local Government Retirement Systems in the United States. There were 291 respondents representing 76% of the covered active members and 83% of the assets held by state and local retirement systems.

There follows a quote from pages 40 and 41 of the survey. Exhibit V-3 (referenced in the quote) is also reproduced as page 24 of this report:

"The assumptions used by actuaries play an important role in determining the amount of the computed contributions. Because it is impossible to know the future, assumptions must be made concerning a number of variables including: rates of investment return, salary increases, withdrawal from employment and mortality. Of these, the assumptions regarding investment return and salary increase are especially critical, since even small changes in these assumptions can result in large changes in computed contributions.

The mean actuarial assumption regarding the investment rate of return for all plans was 7.83 percent. Exhibit V-3 shows the average assumed rates of investment return and other key actuarial variables by the size of plan assets. The exhibit indicates a correlation between asset size and assumed investment return, showing that as asset size increases so does the assumed rate of return. On average, plans with assets of less than \$100 million assumed annual returns of 7.67 percent while plans with \$10 billion or more assumed returns of 8.24 percent.

In addition to assumptions about the long-term rates of return on investments, plans must also establish assumptions about the long-term rate of growth in employees' salaries. These assumptions usually include estimates of increases due to merit and seniority as well as inflation, although some survey respondents did not show these components separately.

Exhibit V-3 shows the distribution of assumptions regarding salary increases, which averaged 5.97 percent for all plans. As with investment return, the values for the smaller plans were generally lower than for the larger plans. On average, respondent plans with less than 1,000 members assumed rates of salary increase of 5.73 percent, while plans with 100,000 members or more assumed salary increases of 6.73 percent.

It should be noted that the rates for total salary increase include both inflation and merit/step increases. Although not all plans disaggregated their salary assumptions into these various subcomponents, an analysis of the plans that did indicates that the assumptions regarding inflation averaged 4.98 percent. Exhibit V-3 shows the assumed rate of inflation distributed by the asset size of the plans. Unlike assumptions about the rate of return and total salary increase, the assumed rate of inflation does not appear to be correlated with size of plan."



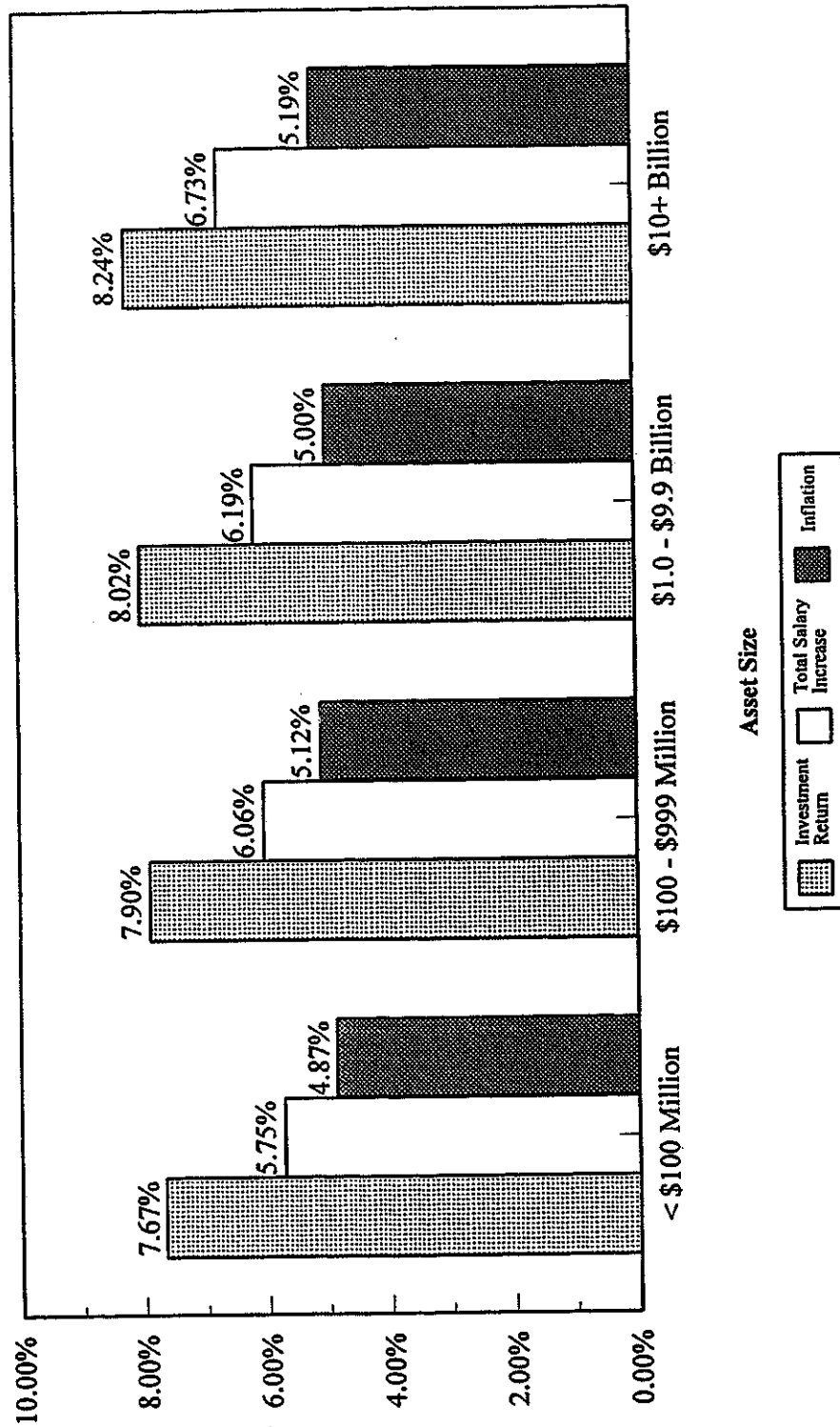
**COMPARISON WITH OTHER RETIREMENT SYSTEMS NATIONWIDE**  
**(CONTINUED)**

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In order to compare the average investment return assumption in the survey with CTRS assumptions, it is necessary to have a sound basis for comparison. It cannot be known for certain whether each of the responding plans reported the actuarial investment return assumption as net after expenses or not. But based upon GRS experience with many State and Local Government retirement systems, it can be assumed that many of them did so. Since CTRS expenses are paid by separate appropriation, and not from the investment fund, CTRS' potential investment return is higher than the systems in the study. For this reason, the investment return figures shown on page 24 should be increased by about 0.5% for comparison with CTRS' 8.5% assumption.

Exhibit V-3

Distribution of Respondent Plans by Asset Size and Actuarial Assumptions Regarding Inflation, Total Salary Increase, and Investment Return



Source: June 1994 Survey of State and Local Government Employee Retirement Systems

**SECTION III: OTHER PROPOSED CHANGES**

## *OTHER PROPOSED CHANGES*

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Based on an initial review of the assumptions, methods, and procedures used in the valuation process, the following changes are offered for the Board's consideration:

**1. Timing of data "snapshot"**

It appears that the following procedure has been used for many years:

Teachers who retire between July 1 and August 31 of the valuation year are treated as having retired on June 30. As a result, the actuary's report understates the number of active teachers in Connecticut as well as the corresponding valuation payroll. This can lead to confusion with other published statistics.

Proposed change:

Starting in 1996 and for each year thereafter the data snapshot will be taken as of June 30 of the given year, and anyone who retires on or after July 1 will be treated as: (a) active in that year's data and (b) retired in the following plan year.

(Note: The financial analysis in Section V does not reflect the proposed change).

**2. The current method of determining the actuarial value of assets is a reasonable one and is used by other systems. Basically, it calls for recognition of 20% of the market value appreciation at a time over an open-ended period.**

The Board may want to consider modifying this method so that 25% of the market value appreciation is recognized over a closed four-year period. Alternatively, 20% of the appreciation could be recognized over a closed five-year period.

The use of a closed period permits the actuarial value of assets to track the market value of assets more closely.

Tables showing the three alternatives appear beginning on page 26.

## FUNDING VALUE OF ASSETS - 5 YEAR OPEN SMOOTHING (PRESENT METHOD)

Valuation Date June 30	1992	1993	1994	1995	1996	1997	1998
A. Funding Value Beginning of Year	\$4,692,007,000	\$5,094,095,312	\$5,501,887,961				
B. Market Value End of Year	5,305,850,000	5,846,443,000	5,985,275,000				
C. Market Value Beginning of Year	4,952,089,000	5,305,850,000	5,846,443,000				
D. Non-Investment Net Cash Flow	(47,646,000)	(106,805,000)	(102,818,000)				
E. Investment Return							
E1. Market Total: B-C-D	401,407,000	647,398,000	241,650,000				
E2. Assumed Rate	8.50%	8.50%	8.50%				
E3. Amount for Immediate Recognition	396,795,640	428,458,889	463,290,712				
E4. Amount for Phased In Recognition	264,693,360	430,693,799	122,914,327				
F. Phased-In Recognition of Investment Return	52,938,672	86,138,760	24,582,865				
G. Funding Value End of Year: A+D+E3+F5	5,094,095,312	5,501,887,961	5,886,943,538				
				If there are no future investment gains or losses			
H. Difference Between Market & Funding Values	211,754,688	344,555,039	98,331,462	\$78,665,170	\$62,932,136	\$50,345,709	\$40,276,567
I. Recognized Rate of Return	9.63%	10.21%	8.95%				

The Funding Value of Assets recognizes assumed investment return (line E3) fully each year. Other Differences between funding value and market value are phased in over an open 5 year period. During periods when investment performance exceeds the assumed rate, Funding Value of Assets will tend to be less than market value. During periods when investment performance is less than the assumed rate, Funding Value of Assets will tend to be greater than market value. It takes approximately 13 future years to achieve 95% recognition of any individual years gain or loss with this method.

## FUNDING VALUE OF ASSETS - 5 YEAR CLOSED SMOOTHING

Valuation Date June 30	1992	1993	1994	1995	1996	1997	1998
A. Funding Value Beginning of Year	\$4,692,007,000	\$5,107,099,412	\$5,539,368,174				
B. Market Value End of Year	5,305,850,000	5,846,443,000	5,985,275,000				
C. Market Value Beginning of Year	4,952,089,000	5,305,850,000	5,846,443,000				
D. Non-Investment Net Cash Flow	(47,646,000)	(106,805,000)	(102,818,000)				
E. Investment Return							
E1. Market Total: B-C-D	401,407,000	647,398,000	241,650,000				
E2. Assumed Rate	8.50%	8.50%	8.50%				
E3. Amount for Immediate Recognition	396,795,640	429,564,238	466,476,530				
E4. Amount for Phased In Recognition	4,611,360	217,833,762	(224,826,530)				
F. Phased-In Recognition of Investment Return							
F1. Current Year: 0.20xE4	922,272	43,566,752	(44,965,306)	0	0	0	0
F2. First Prior Year	65,020,500	922,272	43,566,752	(44,965,306)	0	0	0
F3. Second Prior Year	0	65,020,500	922,272	43,566,752	(44,965,306)	0	0
F4. Third Prior Year	0	0	65,020,500	922,272	43,566,752	(44,965,306)	0
F5. Fourth Prior Year	0	0	0	65,020,500	922,272	43,566,752	(44,965,306)
F6. Total Recognized Investment Gain	65,942,772	109,509,524	64,544,218	64,544,218	(476,282)	(1,398,554)	(44,965,306)
G. Funding Value End of Year: A+D+E3+F5	5,107,099,412	5,539,368,174	5,967,570,922				
H. Difference Between Market & Funding Values	198,750,588	307,074,826	17,704,078	(46,840,142)	(46,363,860)	(44,965,306)	0
I. Recognized Rate of Return	9.91%	10.67%	9.68%				

The Funding Value of Assets recognizes assumed investment return (line E3) fully each year. Differences between actual and assumed investment return (Line E4) are phased in over a closed 5 year period. During periods when investment performance exceeds the assumed rate, Funding Value of Assets will tend to be less than market value. During periods when investment performance is less than the assumed rate, Funding Value of Assets will tend to be greater than market value. If assumed rates are exactly realized for 4 consecutive years, funding value will become equal to market value.

## FUNDING VALUE OF ASSETS - 4 YEAR CLOSED SMOOTHING

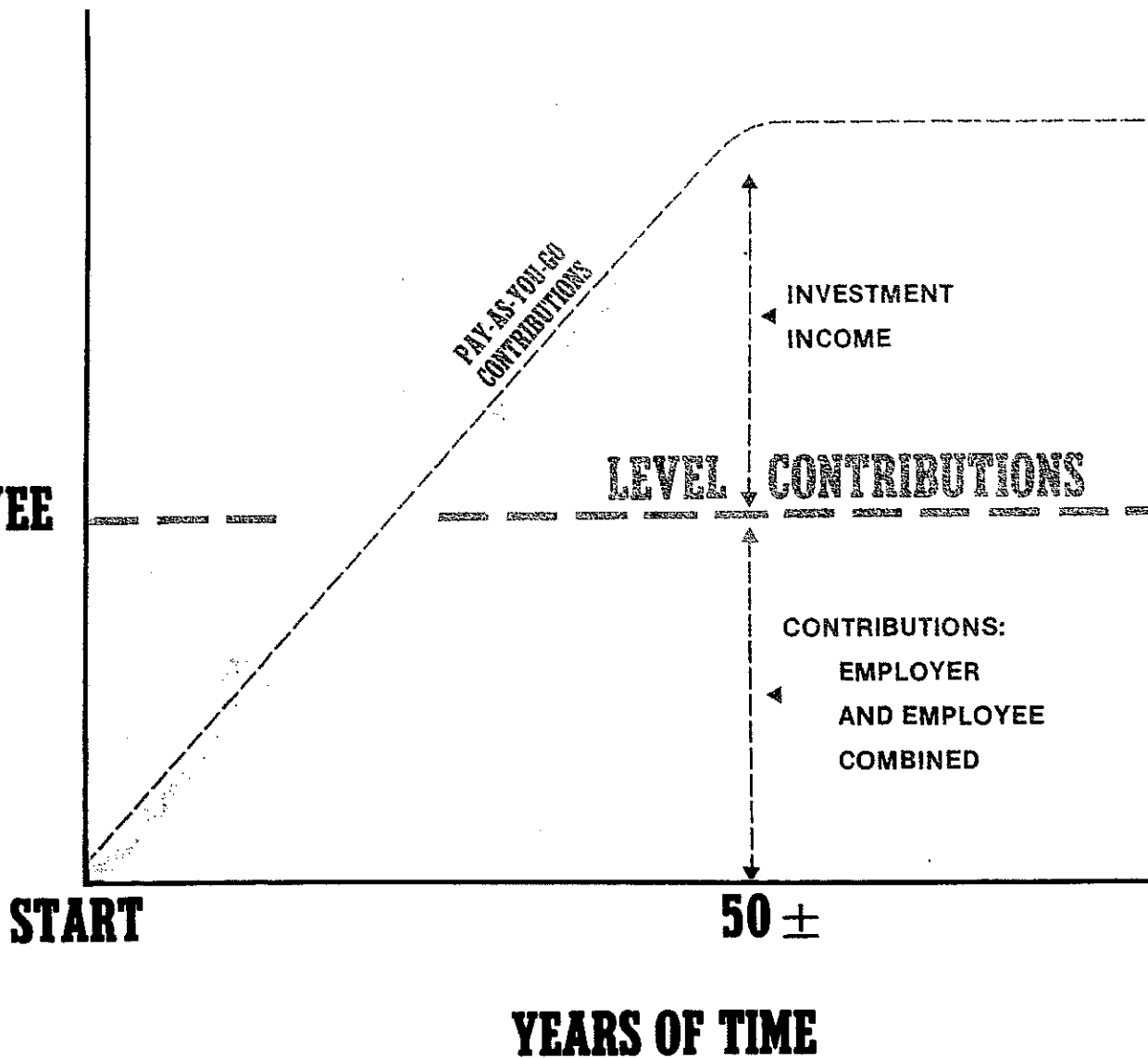
Valuation Date June 30	1992	1993	1994	1995	1996	1997
A. Funding Value Beginning of Year	\$4,692,007,000	\$5,129,003,480	\$5,595,464,382			
B. Market Value End of Year	5,305,850,000	5,846,443,000	5,985,275,000			
C. Market Value Beginning of Year	4,952,089,000	5,305,850,000	5,846,443,000			
D. Non-Investment Net Cash Flow	(47,646,000)	(106,805,000)	(102,818,000)			
E. Investment Return						
E1. Market Total: B-C-D	401,407,000	647,398,000	241,650,000			
E2. Assumed Rate	8.50%	8.50%	8.50%			
E3. Amount for Immediate Recognition	396,795,640	431,426,083	471,244,707			
E4. Amount for Phased In Recognition	4,611,360	215,971,917	(229,594,707)			
F. Phased-In Recognition of Investment Return						
F1. Current Year: 0.25xE4	1,152,840	53,992,979	(57,398,677)	0	0	0
F2. First Prior Year	86,694,000	1,152,840	53,992,979	(57,398,677)	0	0
F3. Second Prior Year	0	86,694,000	1,152,840	53,992,979	(57,398,677)	0
F4. Third Prior Year	0	0	86,694,000	1,152,840	53,992,979	(57,398,677)
F5. Total Recognized Investment Gain	87,846,840	141,839,819	84,441,142	(2,252,858)	(3,405,698)	(57,398,677)
G. Funding Value End of Year: A+D+E3+F5	5,129,003,480	5,595,464,382	6,048,332,231			
H. Difference Between Market & Funding Values	176,846,520	250,978,618	(63,057,231)	(60,804,375)	(57,398,677)	0
I. Recognized Rate of Return	10.38%	11.29%	10.02%			

The Funding Value of Assets recognizes assumed investment return (line E3) fully each year. Differences between actual and assumed investment return (Line E4) are phased in over a closed 4 year period. During periods when investment performance exceeds the assumed rate, Funding Value of Assets will tend to be less than market value. During periods when investment performance is less than the assumed rate, Funding Value of Assets will tend to be greater than market value. If assumed rates are exactly realized for 3 consecutive years, funding value will become equal to market value.

**SECTION IV: FINANCIAL IMPACT OF PROPOSED CHANGES**



**% OF  
ACTIVE  
EMPLOYEE  
PAYS**



CA This relentlessly increasing line is the fundamental reality of retirement plan financing. It happens each time a new benefit is added for future retirements (and happens regardless of the design for contributing for benefits).

**LEVEL CONTRIBUTION LINE.** Determining the level contribution line requires detailed assumptions concerning a variety of experiences in future decades, including:

**Economic Risk Areas**

- Rates of investment return
- Rates of pay increase
- Changes in active member group size

**Non-Economic Risk Areas**

- Ages at actual retirement
- Rates of mortality
- Rates of withdrawal of active members (turnover)
- Rates of disability

## A COMPARISON OF JUNE 30, 1994 RESULTS

	(A)	(B)		(C)		(D)	(E)
	Based on Prior Actuary's Report	Based on Proposed Assumptions with 5.5% Payroll Growth	Based on Proposed Assumptions with 5.0% Payroll Growth	Based on Proposed Assumptions with 5.0% Payroll Growth	Based on Proposed Assumptions with 5.0% Payroll Growth	(C) with Closed 5-Year Period	(C) with Closed 4-Year Period
Total Normal Cost	8.5%	9.8%	9.2%	9.2%	9.2%	9.2%	9.2%
Member Contributions	<u>6.0</u>	<u>6.0</u>	<u>6.0</u>	<u>6.0</u>	<u>6.0</u>	<u>6.0</u>	<u>6.0</u>
Net Normal Cost	2.5	3.8	3.2	3.2	3.2	3.2	3.2
Amortization of Unfunded Actuarial Accrued Liability	<u>5.6</u>	<u>6.0</u>	<u>6.2</u>	<u>6.2</u>	<u>6.0</u>	<u>6.0</u>	<u>5.8</u>
Total State Contribution Rate	8.1%	9.8%	9.4%	9.4%	9.2%	9.2%	9.0%

The results shown as (B), (C), (D) and (E) are for illustrative purposes only. The contribution rates for the 1996 and 1997 fiscal years have already been developed. Contribution rates for fiscal year 1998 and beyond will be based on financial and demographic experience that occur between now and then and the assumptions selected by the Board.

**SECTION V: COMPLETE LIST OF PROPOSED  
ASSUMPTIONS**

**PROPOSED ACTUARIAL ASSUMPTIONS  
BASED ON 1989 - 1994 EXPERIENCE STUDY**

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**SELECT AND ULTIMATE WITHDRAWAL RATES**

Age	Service	Rates
	0	14.0%
	1	12.0
	2	8.0
	3	7.0
	4	6.0
26	5 & Up	6.0
27		6.0
28		6.0
29		6.0
30		5.0
31		5.0
32		5.0
33		4.0
34		4.0
35		4.0
36		3.5
37		3.5
38		3.5
39		2.5
40		2.5
41		1.5
42		1.5
43		1.5
44		1.5
45		1.5
46		1.5
47		1.5
48		1.5
49		1.5
50		1.5
51		1.5
52		1.5
53		1.5
54		1.5
55		1.0

Withdrawal rates do not apply to members who are eligible for retirement.

## *DISABILITY RATES*

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Age	Male	Female
21	.05%	.05%
22	.05	.05
23	.05	.05
24	.05	.05
25	.05	.05
26	.05	.05
27	.05	.05
28	.05	.05
29	.04	.04
30	.04	.04
31	.04	.04
32	.04	.04
33	.04	.04
34	.04	.04
35	.04	.04
36	.05	.04
37	.05	.05
38	.05	.05
39	.05	.06
40	.05	.07
41	.05	.08
42	.06	.09
43	.08	.10
44	.11	.11
45	.14	.12
46	.17	.13
47	.20	.14
48	.29	.18
49	.38	.22
50	.47	.26
51	.56	.30
52	.65	.35
53	.72	.38
54	.79	.41
55	.86	.44
56	.93	.47
57	1.00	.50
58	1.00	.50
59	1.00	.50
60	1.00	.50

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Disability rates do not apply to members who are eligible for retirement

## *RETIREMENT RATES*

Age	Normal	Early	Proratable
45		1.0%	
46		1.0	
47		1.0	
48		1.0	
49		1.0	
50		2.0	
51		2.0	
52		3.0	
53		3.0	
54		4.0	
55	20.0%	5.0	
56	20.0	6.0	
57	20.0	7.0	
58	20.0	7.0	
59	20.0	7.0	
60	20.0		10.0%
61	20.0		10.0
62	20.0		10.0
63	20.0		10.0
64	20.0		10.0
65	30.0		10.0
66	30.0		10.0
67	30.0		10.0
68	30.0		10.0
69	30.0		10.0
70	50.0		100.0
71	50.0		100.0
72	50.0		100.0
73	50.0		100.0
74	50.0		100.0
75	100.0		100.0

## MORTALITY RATES

### RETIRED MEMBERS AND BENEFICIARIES

Age	% Dying Next Year		Age	% Dying Next Year		Age	% Dying Next Year	
	Male	Female		Male	Female		Male	Female
1	0.0419%	0.0197%	41	0.1644%	0.0855%	81	9.1789%	5.5720
2	0.0419	0.0197	42	0.1837	0.0923	82	9.9719	6.1200
3	0.0419	0.0197	43	0.2076	0.1000	83	10.8001	6.6979
4	0.0419	0.0197	44	0.2360	0.1085	84	11.6477	7.3420
5	0.0419	0.0197	45	0.2684	0.1178	85	12.5118	8.0337
6	0.0390	0.0163	46	0.3048	0.1281	86	13.5736	9.1319
7	0.0370	0.0137	47	0.3449	0.1395	87	14.4894	9.9736
8	0.0360	0.0121	48	0.3884	0.1520	88	15.4414	10.8894
9	0.0357	0.0113	49	0.4355	0.1659	89	16.4375	11.8888
10	0.0358	0.0111	50	0.4855	0.1815	90	17.4842	12.9835
11	0.0365	0.0121	51	0.5390	0.1960	91	19.0489	15.1192
12	0.0372	0.0131	52	0.5953	0.2126	92	20.1681	16.5077
13	0.0379	0.0141	53	0.6548	0.2310	93	21.2986	18.0401
14	0.0388	0.0152	54	0.7172	0.2516	94	22.6535	19.7349
15	0.0398	0.0163	55	0.7827	0.2747	95	24.1164	21.6129
16	0.0408	0.0173	56	0.8509	0.3015	96	25.6204	23.6970
17	0.0420	0.0184	57	0.9223	0.3330	97	27.2480	25.8059
18	0.0433	0.0195	58	1.0004	0.3702	98	29.0163	28.0237
19	0.0446	0.0207	59	1.0955	0.4134	99	30.9125	30.4679
20	0.0462	0.0219	60	1.2053	0.4630	100	32.9825	33.1630
21	0.0480	0.0232	61	1.3266	0.5193	101	35.2455	36.1361
22	0.0500	0.0246	62	1.4574	0.5819	102	37.7220	39.4167
23	0.0520	0.0261	63	1.5998	0.6506	103	40.6205	43.0366
24	0.0543	0.0276	64	1.7626	0.7261	104	44.1497	47.1522
25	0.0569	0.0293	65	1.9532	0.8067	105	48.5182	51.9196
26	0.0597	0.0310	66	2.1864	0.8971	106	53.9343	57.4950
27	0.0628	0.0329	67	2.4336	0.9868	107	60.6069	64.0345
28	0.0663	0.0349	68	2.6992	1.0934	108	68.7444	71.6944
29	0.0701	0.0371	69	2.9994	1.2280	109	78.5555	80.6309
30	0.0743	0.0396	70	3.3389	1.3991	110	99.9999	99.9999
31	0.0790	0.0421	71	3.7484	1.6347	111	100.0000	100.0000
32	0.0842	0.0450	72	4.1062	1.8852	112	100.0000	100.0000
33	0.0899	0.0480	73	4.4493	2.1606	113	100.0000	100.0000
34	0.0961	0.0513	74	4.7990	2.4635	114	100.0000	100.0000
35	0.1031	0.0549	75	5.1805	2.7864	115	100.0000	100.0000
36	0.1106	0.0589	76	5.7018	3.1949	116	100.0000	100.0000
37	0.1190	0.0633	77	6.2577	3.5776	117	100.0000	100.0000
38	0.1283	0.0681	78	6.8909	3.9903	118	100.0000	100.0000
39	0.1386	0.0733	79	7.5646	4.4417	119	100.0000	100.0000
40	0.1500	0.0791	80	8.2992	4.9216	120	100.0000	100.0000

Rates for active members are 75% of the above rates and rates for disabled members are based upon an age 10 years older than the actual age.

## MERIT AND LONGEVITY INCREASES IN SALARIES NEXT YEAR

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<u>Age</u>	<u>% Increase</u>	<u>Age</u>	<u>% Increase</u>
20	3.1	40	1.7
21	2.9	41	1.7
22	2.8	42	1.6
23	2.7	43	1.5
24	2.6	44	1.4
25	2.5	45	1.3
26	2.4	46	1.3
27	2.3	47	1.2
28	2.3	48	1.1
29	2.2	49	1.0
30	2.1	50	0.9
31	2.1	51	0.8
32	2.0	52	0.8
33	2.0	53	0.7
34	1.9	54	0.6
35	1.9	55	0.5
36	1.9	56	0.5
37	1.8	57	0.4
38	1.8	58	0.3
39	1.8	59	0.2
		60	0.1
		Over 60	0.0



## *EXPERIENCE STUDY LIMITATIONS*

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In reviewing the proposed changes presented in this report, the Board should be aware of certain limitations, which may have influenced certain results:

1. There was no census data available as of June 30, 1991. As a result, reasonable judgments (estimates) had to be made regarding System activity between June 30, 1990 and June 30, 1992.
2. Reasonable assumptions were required to deal with certain events such as death in service versus termination in service followed by death, or vested members who terminated at one date and later showed up on the retirement roll.

While these and other limitations may have affected the various tabulations, the actuary believes the overall outcomes fell within reasonable ranges.