

NORTH DAKOTA TEACHERS' FUND
FOR RETIREMENT

Experience Review for the Four-Year Period
July 1, 1985 through July 1, 1989

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Board of Retirement
North Dakota Teachers' Fund
for Retirement
Bismarck, North Dakota

Dear Board Members:

We are pleased to present a report which reviews the Plan's experience during the four-year period running from July 1, 1985 through July 1, 1989. Our report consists of the following sections:

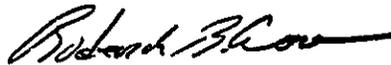
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APPENDIX: PROPOSED ACTUARIAL ASSUMPTIONS

The report was prepared under the supervision of Miguel A. Padro, A.S.A., Enrolled Actuary, in accordance with generally accepted actuarial principles.

We look forward to reviewing this report at your next meeting.

Sincerely,



Roderick B. Crane

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I. INTRODUCTION

The actuarial valuation report as of July 1, 1989 was completed in January, 1990 based on the same assumptions as those used the prior year. In this report, the 1989 actuarial cost results are recalculated based on the set of newly recommended actuarial assumptions.

New assumptions are recommended for:

- o retirement ✓
- o disability ✓
- o mortality ✓
- o withdrawal ✓

These new decrement assumptions are based on the Plan's experience during the four-year period 1985 through 1989. Mortality changes are based primarily on general principles.

The economic assumptions are currently 7.50% investment yield and a 6.00% salary scale. Both include an allowance of 4.50% for inflation. Adjustments in these assumptions are also recommended.

II. ECONOMIC ASSUMPTIONS

Generally, the rate at which employees leave the workforce is affected by the state of the economy. The economic assumptions regarding the level of inflation, the interest assumption, and the salary scale are reviewed in this section.

A. Inflation

Inflation is a component of all the economic assumptions. The rate of increase in the CPI for All U.S. Cities is appropriate to consider as a component of investment yield, because the assets are invested in stocks and bonds all over the nation. The rate of increase in the CPI for All Urban Consumers*, All U.S. Cities for recent fiscal years are shown below:

1989: 5.2%	1984: 4.2%
1988: 4.0	1983: 2.6
1987: 3.7	1982: 7.1
1986: 1.7	1981: 9.6
1985: 3.7	1980: 14.3

The average over these 10 years is 5.5% per year. For longer periods the annual average (compound) increases include:

June, 1969 to June, 1989: 6.3%
June, 1959 to June, 1989: 4.9%
June, 1939 to June, 1989: 4.5%

The current inflation assumption is 4.50% per annum. We recommend no change in this assumption.

B. Interest Assumption

The interest rate used is the single most important actuarial assumption because operates over the period of employment, past retirement, until the participant's death. The assumption utilized is net of investment expenses, on the actuarial value of assets. The actuarial asset valuation method is market-related with appreciation (depreciation), whether realized or not, recognized at the rate of 20% per year. Over the long term it should be similar to a yield on market value, but smoother.

*This is the CPI-U, initiated in 1977. There was only one CPI prior to 1977.

Yields at book and market for the past ten years are as follows:

Year Ending June 30	Net Yield on	
	Book	Market
1989	8.56*	14.29*
1988	7.30	4.96
1987	12.34	9.19
1986	11.80	19.25
1985	10.35	25.68
1984	10.30	*
1983	9.48	*
1982	10.01	*
1981	8.91	*
1980	8.22	*

*Not available.

These rates of return averaged 9.75% at book and 13.34% at market, well in excess of the 7.50% currently assumed. There is \$26.7 million of appreciation as of July 1, 1989 which has not yet been included in the actuarial asset value on the new basis. This will roll into the assets as part of the net investment income over the next few years. The actuarial value of assets was \$386 million as of July 1, 1989.

It is appropriate to review the recent investment performance of the plan. However, selection of an interest assumption should be based on the 30 to 50 year period over which a new employee contributes, and then receives benefits. For this purpose, let us review the average annual increases of the following indices.

Index	1926 to 1989	1957 to 1989
	Period	Period
S & P 500 Stock Index	10.3%	11.7%
Long-Term Government Bonds	4.6	6.5
Long-Term Corporate Bonds	5.2	6.8
Treasury Bills	3.6	6.2
Consumer Price Index	3.1	5.0

The excess of yield over inflation is the real rate of return.

Suppose the plan assets are expected to be:

- o 50% equities (including real property)
- o 45% fixed income investments
- o 5% cash and short-term investments.

Furthermore, assume that expected real rates of return are:

- o 6.0% equities
- o 1.5% fixed income
- o 0.0% cash

Then, the expected real return is:

$$\begin{array}{rcl} .50 \times 6.0\% & = & 3.00\% \\ + .45 \times 1.5\% & = & .68\% \\ + .05 \times 0.0 & = & \underline{0.00\%} \\ \text{Total} & & 3.68\% \end{array}$$

The majority of pension plans in the U.S. use a real rate of return in the range of 2% to 4%.

A final consideration in the selection of an interest assumption is what other plans are doing. A 1986 survey of statewide Retirement Systems showed an average of 7.50% (for 1984 and 1985 valuation dates). A survey of over 900 plans showed a mean of 8.00% for those plans (public and private sectors) with benefits based on final average salaries. A recent State Controller's report shows an average yield assumption of 8.00% for public pension plans in California.

We recommend an interest rate assumption of 8.00% for the future valuations of the Retirement Fund.

C. Salary Scale

The current assumed rate of salary increase is 6.00% per annum irrespective of age or service.

The salary scale includes an allowance for price inflation of 4.50%. Over the long term, salaries in the United States have grown faster than inflation. This growth can be attributed to that share of productivity increases which are passed to labor. For the employees covered by TFFR, the inflation and productivity components are included in the growth in salary for each position. The current assumption for productivity increases is .50% and no change is recommended.

The final component of the salary scale is for merit, longevity, and promotions. Currently, this component is assumed to be 1%. This can mean 10% of the teachers receiving 10% increases in their salaries due to promotions or that 20% of the teachers advance a step each year with a 5% adjustment in salary.

This component was studied in some detail to determine if the assumption should be changed. By removing the effects of inflation and productivity increases over the past four years, it was discovered that salary increases for merit, longevity, and promotions have tended to be considerably in excess of 1%, especially for teachers who are younger and have less service. For example, during the first five years of employment between ages 27 and 32, annual increases due to this component averaged over 3.5%.

As might be expected, the annual increases due to this component decreased as teachers became older and accrued more service. As such, we recommend a salary scale that changes with age. Allowing for inflation of 4.5% and productivity increases of 0.5%, combining the final component which varies over age and service, results in a salary scale that ranges from 8.50% increases at the younger ages to 5.50% at the older ages. As higher salary increases were experienced in the early years of employment, regardless of age, the recommended salary scale assumes 8.50% increases during the first five years of employment. Please refer to the Appendix for a more detailed description of the recommended salary scale.

III. PRE-RETIREMENT DECREMENT ASSUMPTIONS

This section reviews the experience with respect to withdrawal from employment, service retirement, disability retirement, and pre-retirement death. The proposed rates are based on recent experience and reflect a smooth pattern that varies with age.

Withdrawal

The rates of withdrawal reflect voluntary and involuntary cessation of employment other than death, disability, and retirement. They include the retention of vested rights as well as those who elect contribution refunds. Tables 1 and 2 present the experience on withdrawal from employment for the four years, July 1, 1985 to June 30, 1989, for males and females, respectively.

For both males and females, the experience rates are lower than current assumptions for ages below 45. Above that point, withdrawal experience was greater than assumed.

When a review of withdrawal rates is performed by number of employees, account must be taken of relative actuarial liabilities. The same rate of withdrawal is applied to employees of a given age regardless of service. As can be seen in Tables 1 and 2, withdrawal rates generally decrease with increasing service for members of equal age. Hence, the use of the experience rate without adjustment would project the forfeiture of a higher liability even though the right number and ages of withdrawals were forecast.

The experience rates have been adjusted to reflect the liabilities by weighting results by service. This generally results in lower average withdrawal rates than shown in the tables. Those weighted averages have been used to set new assumptions. The proposed withdrawal rates are shown in the Appendix.

Members hired after an actuarial valuation date who terminate before the subsequent actuarial study were excluded from this analysis.

Service Retirement

Members can elect to retire after age 55. Unreduced benefits are paid for retirement when age plus service equals 85, or at age 65.

During the four-year period under review, 185 men and 278 women retired on non-disability pensions. Table 3 shows the experience retirement rates for males and females, separately.

The current assumptions, which vary by age of entry in covered employment, are the same for men and women. The recommended assumptions, which are shown in the Appendix, introduce retirement rates varying by age. The retirement rate represents the likelihood of retirement at a given age.

Disability Retirement

During the four-year 1985 through 1989 period, 16 teachers were granted disability retirements. The current assumptions projected that 68 members would retire on disability. Hence, new assumptions have been selected which would have projected 19 disability retirements over the four years.

Pre-retirement Death

During the four-year review period, the number of deaths expected was 32 for males and 23 for females. The number of deaths reported included only 14 males and 23 females. (There is the possibility of understatement of deaths for which monthly income benefits were not provided.) The proposed rates, as for retired employees, are the 1983 Group Annuity Mortality Tables with an age setback (separate male and female tables). These tables would have projected 14 male and 21 female deaths for the review period.

Table 1

Male Withdrawal Experience, July 1, 1985 to June 30, 1989
(Number Terminating, Exposure, and Rate)

Age	Years of Service					Total	Current Assumed Rate
	Under 5	5 - 9	10 - 14	15 - 19	20 & Over		
Under 25	20	0	-	-	-	20	18.73%
	169	2	-	-	-	171	
	11.83%	0.00%	-	-	-	11.70%	
25 - 29	119	50	0	-	-	169	13.93%
	955	448	4	-	-	1,407	
	12.46%	11.16%	0.00%	-	-	12.01%	
30 - 34	38	102	35	-	-	175	10.13%
	286	1,075	724	-	-	2,085	
	13.29%	9.49%	4.83%	-	-	8.39%	
35 - 39	20	23	78	38	-	159	7.32%
	164	302	1,675	646	-	2,787	
	12.20%	7.62%	4.66%	5.88%	-	5.71%	
40 - 44	7	17	27	50	21	122	5.26%
	73	135	418	1,202	730	2,558	
	9.59%	12.59%	6.46%	4.16%	2.88%	4.77%	
45 - 49	13	7	11	11	31	73	3.36%
	54	63	132	288	1,334	1,871	
	24.07%	11.11%	8.33%	3.82%	2.32%	3.90%	
50 - 54	5	6	5	5	28	49	1.81%
	26	43	66	130	1,192	1,457	
	19.23%	13.95%	7.58%	3.85%	2.35%	3.36%	
55 - 59	3	1	0	2	8	14	0.00%
	18	16	36	64	822	956	
	16.67%	6.25%	0.00%	3.13%	0.97%	1.46%	
60 - 64	4	0	3	1	10	18	0.00%
	8	9	17	30	404	468	
	50.00%	0.00%	17.65%	3.33%	2.48%	3.85%	
Total	229	206	159	107	98	799	5.81%
	1,753	2,093	3,072	2,360	4,482	13,760	
	13.06%	9.84%	5.18%	4.53%	2.19%		

Notes: (1) Exposure is the sum of the number of employees in the age-service cell at beginning of year for all four years under review.

(2) Members hired after a given actuarial valuation and terminating before the next valuation are excluded.

Table 2

Female Withdrawal Experience, July 1, 1985 to June 30, 1989
(Number Terminating, Exposure, and Rate)

Age	Years of Service					Total	Current Assumed Rate
	Under 5	5 - 9	10 - 14	15 - 19	20 & Over		
	88	-	-	-	-	88	
	573	-	-	-	-	573	
Under 25	15.36%	-	-	-	-	15.36%	18.77%
	263	116	1	-	-	380	
	1,843	1,364	3	-	-	3,210	
25 - 29	14.27%	8.50%	33.33%	-	-	11.84%	13.97%
	52	141	87	0	-	280	
	507	2,102	1,788	1	-	4,398	
30 - 34	10.26%	6.71%	4.87%	0.00%	-	6.37%	10.17%
	32	34	130	50	1	247	
	332	665	2,732	1,342	9	5,080	
35 - 39	9.64%	5.11%	4.76%	3.73%	11.11%	4.86%	7.35%
	21	20	19	40	19	119	
	202	391	563	1,319	856	3,331	
40 - 44	10.40%	5.12%	3.37%	3.03%	2.22%	3.57%	5.32%
	14	15	20	7	29	85	
	80	244	345	364	1,253	2,286	
45 - 49	17.50%	6.15%	5.80%	1.92%	2.31%	3.72%	3.48%
	5	6	7	3	25	46	
	41	119	193	215	1,107	1,675	
50 - 54	12.20%	5.04%	3.63%	1.40%	2,26%	2.75%	2.03%
	2	3	3	2	15	25	
	12	47	134	164	1,032	1,389	
55 - 59	16.67%	6.38%	2.24%	1.22%	1.45%	1.80%	0.00%
	1	2	5	4	5	17	
	4	17	51	74	642	788	
60 - 64	25.00%	11.76%	9.80%	5.41%	0.78%	2.16%	0.00%
	478	337	272	106	94	1,287	
	3,594	4,949	5,809	3,479	4,899	22,730	
Total	13.30%	6.81%	4.68%	3.05%	1.92%	5.66%	

Notes: (1) Exposure is the sum of the number of employees in the age-service cell at beginning of year for all four years under review.

(2) Members hired after a given actuarial valuation and terminating before the next valuation are excluded.

Table 3

Analysis of Retirement Rates
July 1, 1985 to June 30, 1989

<u>Age at Retirement</u>	<u>Males</u>		<u>Females</u>	
	<u>Retirements</u>	<u>Rate</u>	<u>Retirements</u>	<u>Rate</u>
55	1	0.42%	4	1.30%
56	2	0.88	9	3.01
57	5	2.59	6	2.07
58	9	5.59	9	3.56
59	11	7.86	10	4.18
60	10	8.62	15	7.35
61	19	16.96	16	8.65
62	36	34.29	49	29.70
63	16	19.75	32	26.45
64	24	44.44	25	22.12
65	30	83.33	54	75.00
66	11	52.38	24	70.59
67	2	16.67	7	35.00
68	5	55.56	6	28.57
69	3	75.00	2	9.09
70	<u>1</u>	100.00	<u>10</u>	55.56
Total	185		278	

IV. POST-RETIREMENT MORTALITY

In this section the rates of mortality among disabled and non-disabled retirees are compared with the assumed rates. Retirements for service and disability are considered separately.

Non-Disabled Lives

Actual deaths and those expected from the assumptions are given in Tables 4 and 5. The 106 male deaths are about 10% lower than expected, while the 322 female deaths were 95% of those expected. This data indicates that mortality assumptions are producing actuarial losses.

Non-disabled mortality has been studied extensively by various actuarial groups. Mortality in the United States is generally improving among both, males and females. Some pension plans have switched to the 1983 GAM Table constructed by the Society of Actuaries. Many of those plans previously used the 1971 GAM with an age setback arrangement. The setback approach results in using a lower mortality rate for a given actual age than without the adjustment. We recommend switching to the 1983 GAM tables with an age setback, as shown in the Appendix.

The recommended assumptions would have forecasted 96 male and 283 female deaths for the 1985 to 1989 period. While mortality was higher than this table forecast, a longer review period would be appropriate before making a more dramatic change.

Disabled Lives

Disabled life mortality experience was inconclusive because of the experience available (total of 3 deaths). Therefore, we recommend that a standard Disabled Life Mortality Table be used. We believe that the Pension Benefit Guaranty Corporation's Disabled Life Mortality Table is appropriate for this purpose.

Beneficiaries

The mortality rates used for beneficiaries have been the same as used for retirees of the same gender. There has been no study of the mortality among beneficiaries. We recommend use of the 1983 GAM tables based on the general principle of using a beneficiary table consistent with the retiree basis.

Table 4

Mortality Among Retired Males
 July 1, 1985 to June 30, 1989
 Non-Disability Retirements Only

<u>Ages</u>	<u>Expected Deaths</u>	<u>Actual Deaths</u>
55 - 59	0	0
60 - 64	4	4
65 - 69	17	7
70 - 74	18	20
75 - 79	26	19
80 - 84	28	26
85 - 89	17	20
90 & Over	<u>8</u>	<u>10</u>
Total	118	106

Table 5

Mortality Among Retired Females
 July 1, 1985 to June 30, 1989
 Non-Disability Retirements Only

<u>Ages</u>	<u>Expected Deaths</u>	<u>Actual Deaths</u>
55 - 59	0	0
60 - 64	3	5
65 - 69	17	16
70 - 74	38	30
75 - 79	77	62
80 - 84	100	96
85 - 89	62	67
90 & Over	<u>42</u>	<u>46</u>
Total	339	322

V. SUMMARY OF RESULTS

As shown in the actuarial valuation report as of July 1, 1989, the actuarial employer contribution requirement based on current assumptions was 5.93% of payroll. The effects of the recommended changes in actuarial assumptions follows:

<u>Factor</u>	<u>Change in Contribution Requirement</u>
Interest	-1.60%
Salary Scale	+ .37
Post-Retirement Mortality	+ .71
Pre-Retirement Mortality, Retirement Rates and Withdrawal	<u>-1.18</u>
Total Changes	-1.70%

Hence, the change in actuarial assumptions lowers the cost of the Plan from 5.93% to 4.23% of payroll.

APPENDIX

PROPOSED ACTUARIAL ASSUMPTIONS

Mortality:

Healthy Lives: 1983 Group Annuity Mortality Tables (with margins) set back 4 years for males and 3 years for females

Disabled Lives: The Pension Benefit Guaranty Corporation's Disabled Life Mortality Table.

Pre-retirement Decrement Rates:

<u>Age</u>	<u>Rate</u>			
	<u>Death</u>	<u>Disability</u>	<u>Withdrawal</u>	
			<u>Male</u>	<u>Female</u>
25	.02%	.01%	11.00%	11.10%
30	.03	.01	8.70	7.00
35	.04	.01	5.40	4.30
40	.06	.03	4.15	3.20
45	.09	.05	2.95	2.20
50	.14	.08	2.15	1.70
55	.22	.14	1.35	1.20
60	.34	.27	.15	.60

Rates of Retirement:

<u>Age</u>	<u>Rate of Retirement</u>		<u>Age</u>	<u>Rate of Retirement</u>	
	<u>Male</u>	<u>Female</u>		<u>Male</u>	<u>Female</u>
55	1.00%	2.00%	63	20.50%	22.50%
56	1.50	2.50	64	44.50	26.50
57	3.00	3.25	65	80.50	75.50
58	6.00	4.00	66	50.50	70.50
59	8.50	4.50	67	30.50	35.50
60	9.50	7.50	68	50.50	40.50
61	17.50	9.00	69	75.50	55.50
62	34.50	30.50	70	100.00	100.00

Interest: 8% per year.

APPENDIX (continued)

Salary Increases: 8.50% for the first 5 years of service and the following rates, varying by attained age, thereafter. (Rates include a 4.50% allowance for inflation.)

<u>Attained Age</u>	<u>Salary Rate</u>	<u>Attained Age</u>	<u>Salary Rate</u>
25	8.50% ✓	45	6.50%
30	8.00	50	6.25
35	7.50	55	6.00
40	7.00	60	5.75