

State of Alaska

Teachers' Retirement System

Study of Actuarial Assumptions

October, 1991

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Section 1

Introduction and Summary

Role of Assumptions in Funding the Retirement Plans

The ultimate cost of a pension plan cannot be determined in advance as it depends upon three factors, the precise effects of which can only be known once the last member has left the plan. These factors are:

- the investment returns generated by the fund's assets;
- the costs of administration, actuarial and advisory services, and
- the actual experience over the duration of the plan with respect to retirement, termination from service, mortality, disability, salary increases and health inflation.

One of the primary functions of an actuarial valuation is to determine an annual contribution amount that is expected to adequately provide for future benefit payouts and that is expected to remain relatively stable from year to year. To determine the annual contribution amount, assumptions must first be made that estimate the amount and incidence of future benefit payouts and the economic value of those payouts as of the valuation date. Assumptions with respect to rates of mortality, retirement, disability, turnover, health trends and salary increases are used to estimate the amount and incidence of future benefit payouts. An investment return assumption is used to estimate the value of those payouts at the valuation date. The annual contribution amount is arrived at by allocating a portion of the value of the expected benefit payouts to the current year according to an actuarial funding method.

The assumptions chosen for the actuarial valuation are central to funding the plan in an orderly way and with assurance that the funds accumulated through annual contributions and investment returns will provide participants with promised benefit payouts. Since economic and demographic factors change over time, periodic studies of the assumptions and their relation to past and expected future experience are undertaken to determine whether they continue to be valid or if changes should be made. These studies are usually done every four or five years.

The current assumptions have been used since their approval by the Teachers' Retirement System Board in 1986. The previous change in actuarial assumptions was adopted by the Board in 1982.

Summary of Recommended Changes

The following chart summarizes the recommended changes in actuarial assumptions for the June 30, 1991 valuation of the System and their effect on the financial status of the System had the revised assumptions been in place June 30, 1990.

	Current Assumption	Proposed Assumption	Change in:	
			Funding Ratio	Contribution Rates
Investment Return	9%	8.75%	(2.0%)	+1.68%
Salary Increase - Inflation Productivity Merit (first 5 years)	5.0% 0.5% 1.0%	5.0% 0.5% 1.0%	No change	No change
CPI	5%	5%	No change	No change
Health Inflation	9%	1992 - 12.5% 1993 - 11.5% 1994 - 10.5% 1995 - 9.5% 1996 - 8.5% 1997 & after - 7.5%	+3.0%	(2.25%)
Total Turnover	See Table 4 on page 25.	See Table 1 on page 19. Patterns vary by age and service, but proposed rates are generally higher than the current rates.	No change	(.18%)
Disability	See Table 5 on page 26.	See Table 2 on page 20. Proposed rates are generally higher than the current rates.	(.2%)	+.09%
Retirement	See Table 6 on page 27.	See Table 3 on page 21. The pattern of retirement rates has not changed significantly. There has been some shift to retirement at younger ages.	+.4%	(.19%)

	Current Assumption	Proposed Assumption	Change in:	
			Funding Ratio	Contribution Rates
Mortality	1984 Unisex Pension Mortality Table, set backward 1½ years.	Same table, but using distinct male/female rates.	No change	(.13%)
COLA	54% of retirees receive COLA.	66% of retirees receive COLA.	(.5%)	+.15%
Total Change Due to Proposed Assumptions:			+.7%	(.83%)

This analysis is based on employee census information provided annually by the State of Alaska to perform the actuarial valuation of the System. Generally acceptable actuarial methods and techniques were used to analyze the data, derive the proposed assumptions and evaluate the financial effect on the system. The undersigned are available to answer any questions with respect to this report.

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Section 2

Analysis of Economic Assumptions

The actuarial assumptions fall naturally into two categories: economic and demographic assumptions. The economic assumptions are:

- Annual Investment Return
- Annual Salary Increase
- Total Inflation (as measured by the CPI)
- Inflation in post-retirement medical rates

Annual Investment Return

Annual investment return is an assumption of the expected total investment return from the TRS fund. It is a long-term assumption, since all future liabilities of the System will be discounted at this rate to determine current plan liabilities and contribution rates. The annual investment return is made up of three primary components:

- (1) Estimated increase in overall productivity.
- (2) Estimated inflation rate.
- (3) Risk premium associated with each investment class.

The decade of the 1980's produced relatively large investment returns compared to longer-term historical experience. The current 9% assumption was generally met or exceeded in actual returns during the 1980's. Looking forward into the 1990's, however, it would be prudent to establish an assumption based on longer term experience due to the cyclical nature of the capital markets.

A 1990 Report on Funding Levels for State Retirement Systems prepared by Wilshire Associates Incorporated showed that the average investment return assumption used by State systems is 7.85%. 9.00% was the highest reported rate and 5.50% was the lowest. Care should be taken when reviewing these results, since there are many other actuarial assumptions which should be considered in total when selecting a single assumption. The data indicates, however, that the State's current 9% assumption is relatively high compared to assumptions used by other State systems.

During the coming year, the Department of Revenue intends to make a detailed study of expected investment returns, in order to recommend to the Board an investment return assumption. In the meantime, they recommend reducing the investment return assumption from 9.00% to 8.50%. This reflects the lower investment return expectation, and has the effect of increasing system liabilities and contribution rates.

The Department of Administration also recognizes that a reduction in the investment return assumption may be needed, however, feels a more prudent reduction at this time, absent a detailed study, would be 8.75%. Until the more detailed study is completed, this assumption, when combined with the other assumption changes, will have a more neutral effect on the financial condition of the fund, as measured by the Funding Ratio, and the contribution rate than the 8.50% assumption. The Summary on page 2 shows the effect of an 8.75% assumption. An 8.50% assumption would double the changes in Funding Ratio and contribution rates shown.

Annual Salary Increase

The expected increase in salaries for participants in TRS has been 6½% for the first five years of service and 5½% thereafter actual salary increases have been slightly less than those assumed over the last five years producing small gains to the System.

The Wilshire Report noted above also contained data on salary increase assumptions used by State systems. Based on this information, the State of Alaska assumption is about ½% lower than the average of other State systems. It is important not to underestimate the salary increase assumption. If salary increases exceed the assumption, the System's liabilities would be understated. However, salary increases in the State of Alaska will be heavily dependent upon the health of the Alaskan economy. Given the continued uncertain economic outlook in Alaska, we recommend the assumption be unchanged.

Total Inflation

During the last ten years, general inflation in the U.S. economy has been at longer historical levels. Increases in the CPI have averaged about 5% annually. We recommend that the annual CPI assumption remain at the current 5% level.

Health Premium Trend

The post-retirement health insurance rates over the last five years have been very volatile, producing large gains and losses on an annual basis. This has been and will likely continue to be a major contributing factor with respect to the funding status of the System and contribution levels.

Based on an exponential regression analysis, the increase in health care premiums has averaged 12.4% over the last 16 years and 7.4% over the last 10 years (see Section 4, page 11). Using this information, we recommend that the health care trend assumption be revised as shown below.

Year	Current Rate	Proposed Rate
1992	9%	12.5%
1993	9%	11.5%
1994	9%	10.5%
1995	9%	9.5%
1996	9%	8.5%
1997 and later	9%	7.5%

This proposed pattern of assumptions is based on the following reasoning:

- Current trend rates should be related to past experience and representative of trend rates currently being experienced in the market.
- As we project further into the future, we have less certainty about the outcome. Thus, the long-term rate should be more conservative than current rates.
- In general, trend rates are expected to decline over time as society's tolerance for expanding health care costs diminishes, as employers take more aggressive steps to control health care costs and as health care expenditures consume a larger and larger percentage of GNP.

Beginning in 1992, we recommend a trend rate of 12.5%. This rate is representative of the increases experienced by the System over the last 16 years and is slightly lower than the increases other employers are experiencing. In addition, we recommend a long-term trend rate which is representative of underlying medical inflation. Over the last 10 years, medical inflation has averaged about 7.5% per year. Between 1992 and 1997, we recommend a simple pattern of decreasing rates. This change will have the effect of lowering plan liabilities and contribution rates.

Section 3

Analysis of Demographic Assumptions

Total Turnover

Using data collected for the annual actuarial valuations for the years 1986 through 1990, we have determined the rates of total turnover by age and service for the five-year period. By total turnover, we mean retirement, termination, disability and mortality combined. We have plotted the results against the rates of total turnover as currently assumed in the valuation (old rate) and the proposed change (new rate) on the graphs in Section 4 on pages 12 and 13. The observed rates of total turnover for TRS are somewhat higher than the current rates. However, patterns vary significantly by age and service.

We continue to see a pattern of turnover during the first ten years of service which is independent of attained age. This graph is shown separately and is identified as select turnover rates in the first ten years.

"Ultimate" turnover rates, those for employees with ten or more years of service, are quite low. These rates vary by age, and are shown separately as ultimate turnover rates after ten years.

The proposed turnover assumptions are presented in Section 5, Table 1 on page 19. The actual proposed rates of termination will be determined by taking the proposed total turnover rate and subtracting the sum of the other rates of decrement. This change in total turnover rates will generally lower plan liabilities and contribution rates.

Disability

Observed disability rates for TRS members were lower than assumed at younger ages, but higher than assumed at older ages. The graph in Section 4 on page 14 illustrates this. We propose new rates of disability, consistent with this experience, which can be found in Section 5, Table 2 on page 20. The new rates are as much as 100% higher than the old rates, especially at ages 40 to 55. However, liabilities from disability are relatively small, and this change in assumptions will produce a small increase plan liabilities and contribution rates.

Retirement

Retirement experience was reviewed by excluding years during which the RIP was in effect. Observed rates were slightly higher at younger ages, and lower at older ages. This is illustrated on the graph in Section 4 on page 15. We propose new rates of retirement consistent with this experience, which can be found in Section 5, Table 3 on page 21. The change in this assumption produces a small decrease in liabilities and contribution rates.

Mortality

Mortality patterns were generally consistent with the expectations from the current mortality assumption. However, there are different patterns of mortality for male and female employees. We propose using the same mortality table, but applying the male mortality table and female mortality table separately to males and females. This change would have a negligible effect on the liabilities and costs of the System.

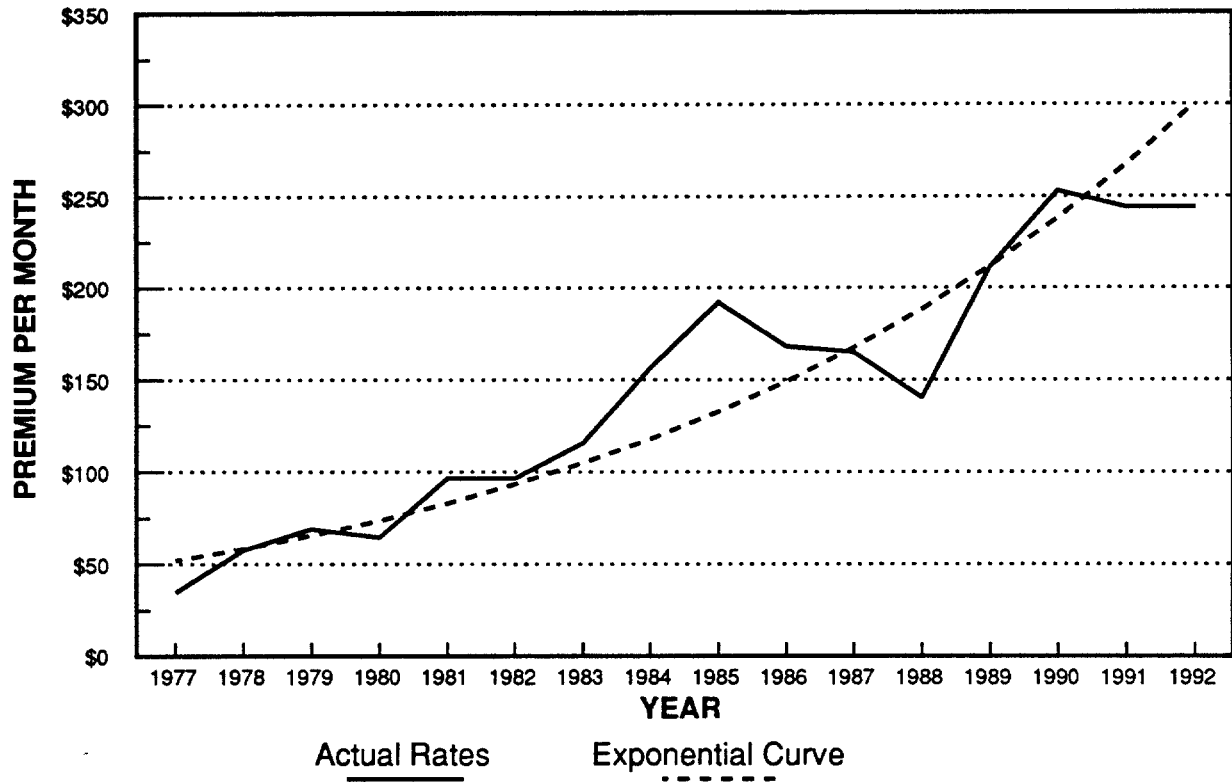
COLA (Cost of Living Adjustment)

In the past, we assumed that 54% of all retirees would receive COLA. The current data shows that 66% of the dollar-weighted average benefit is increased with COLA. Thus, we propose to increase our assumption from 54% to 66%. This has the effect of slightly increasing plan liabilities and contribution rates.

Section 4

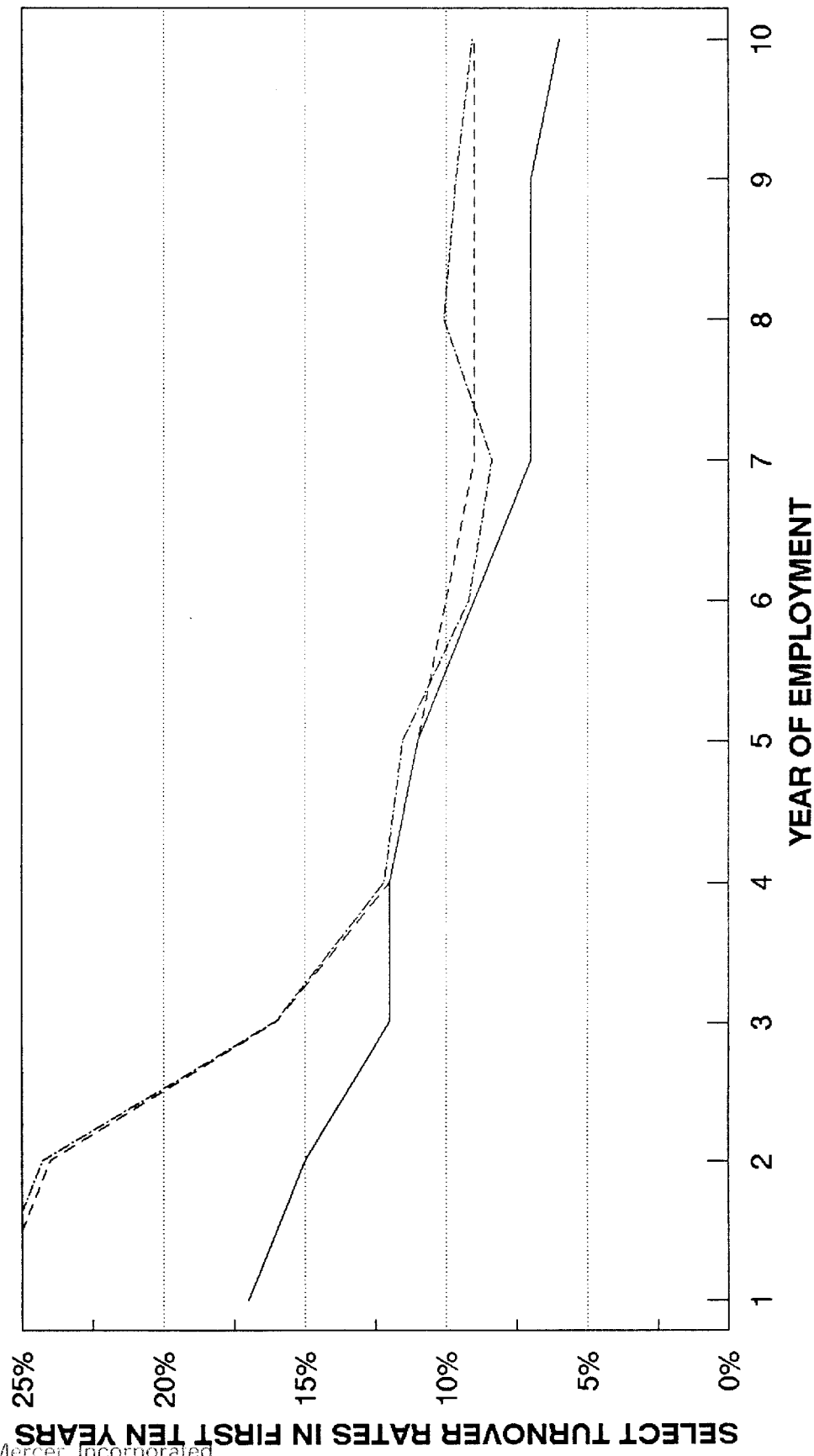
Statistical Analysis

HEALTH PREMIUM RATES & EXPONENTIAL REGRESSION ANALYSIS



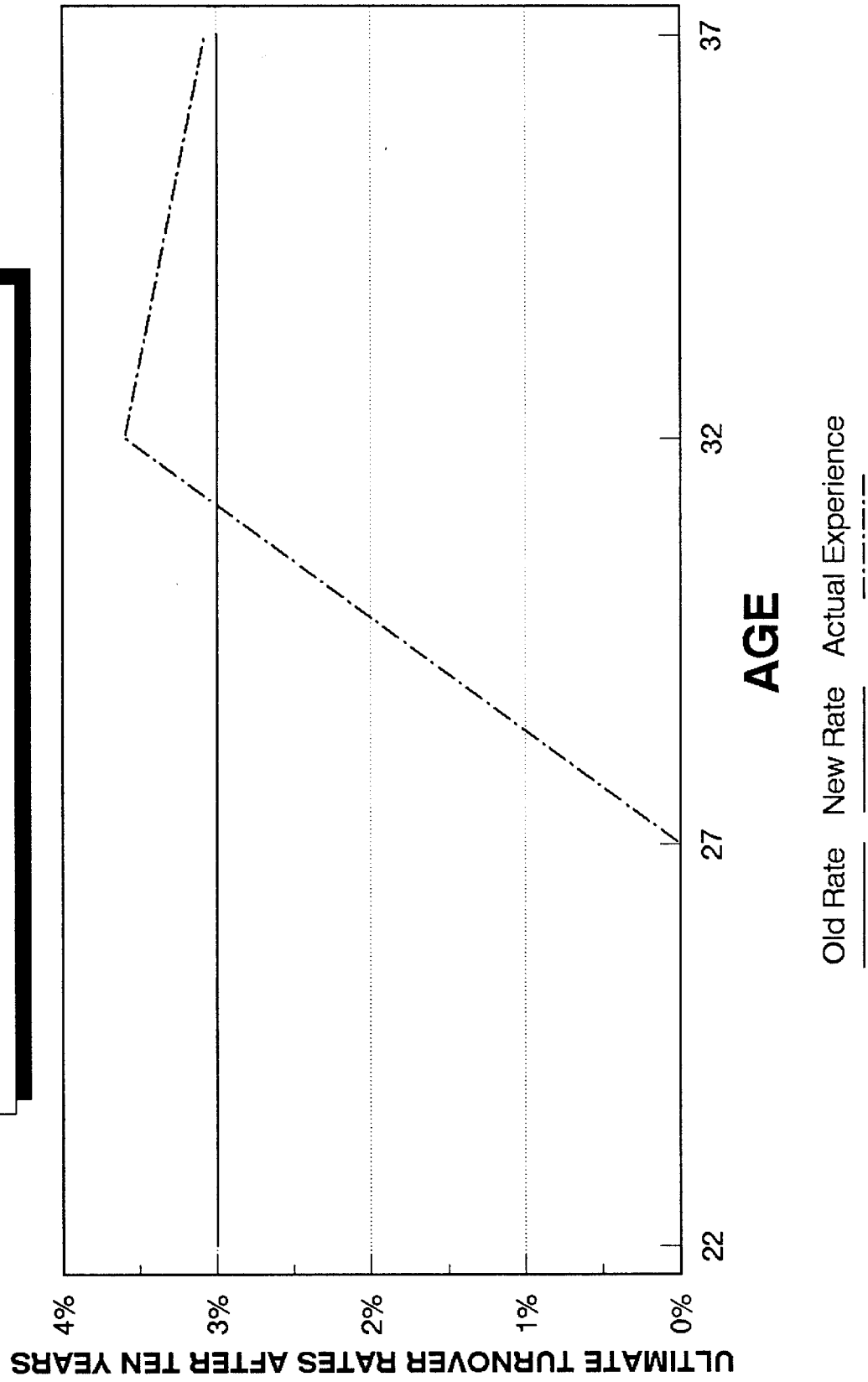
Health Premium		16-Year Exponential Regression	10-Year Exponential Regression
Year	Per Retiree		
1977	34.75	51.98	
1978	57.64	58.44	
1979	69.10	65.69	
1980	64.70	73.84	
1981	96.34	83.01	
1982	96.34	93.31	
1983	115.61	104.89	133.05
1984	156.07	117.91	142.87
1985	191.85	132.55	153.42
1986	168.25	149.00	164.74
1987	165.00	167.49	176.90
1988	140.25	188.28	189.95
1989	211.22	211.65	203.97
1990	252.83	237.92	219.03
1991	243.98	267.45	235.19
1992	243.98	300.65	252.55
Average Annual Growth		12.4%	7.4%

TOTAL TURNOVER ASSUMPTION TRS

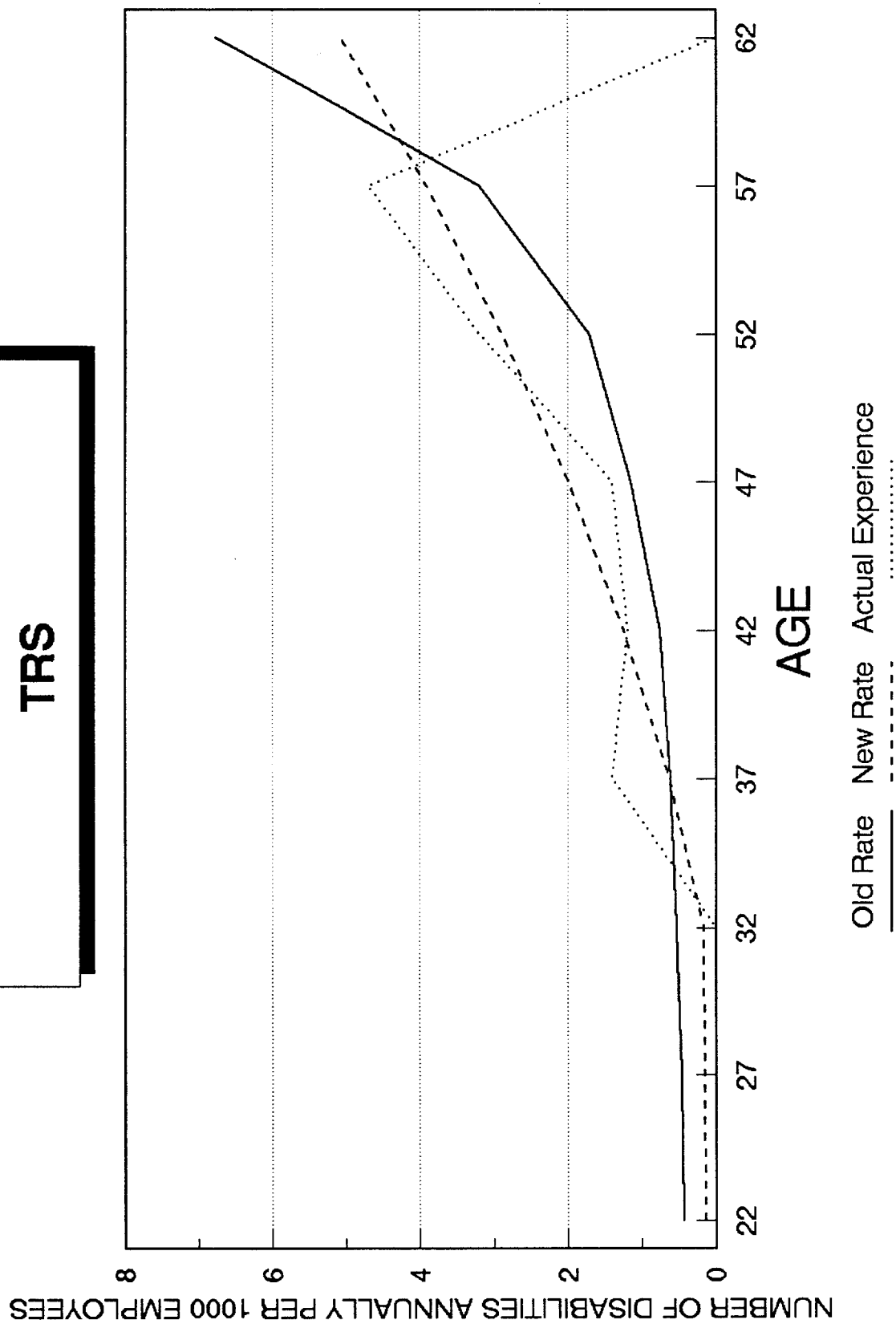


Old Rate New Rate Actual Experience

TOTAL TURNOVER ASSUMPTION TRS

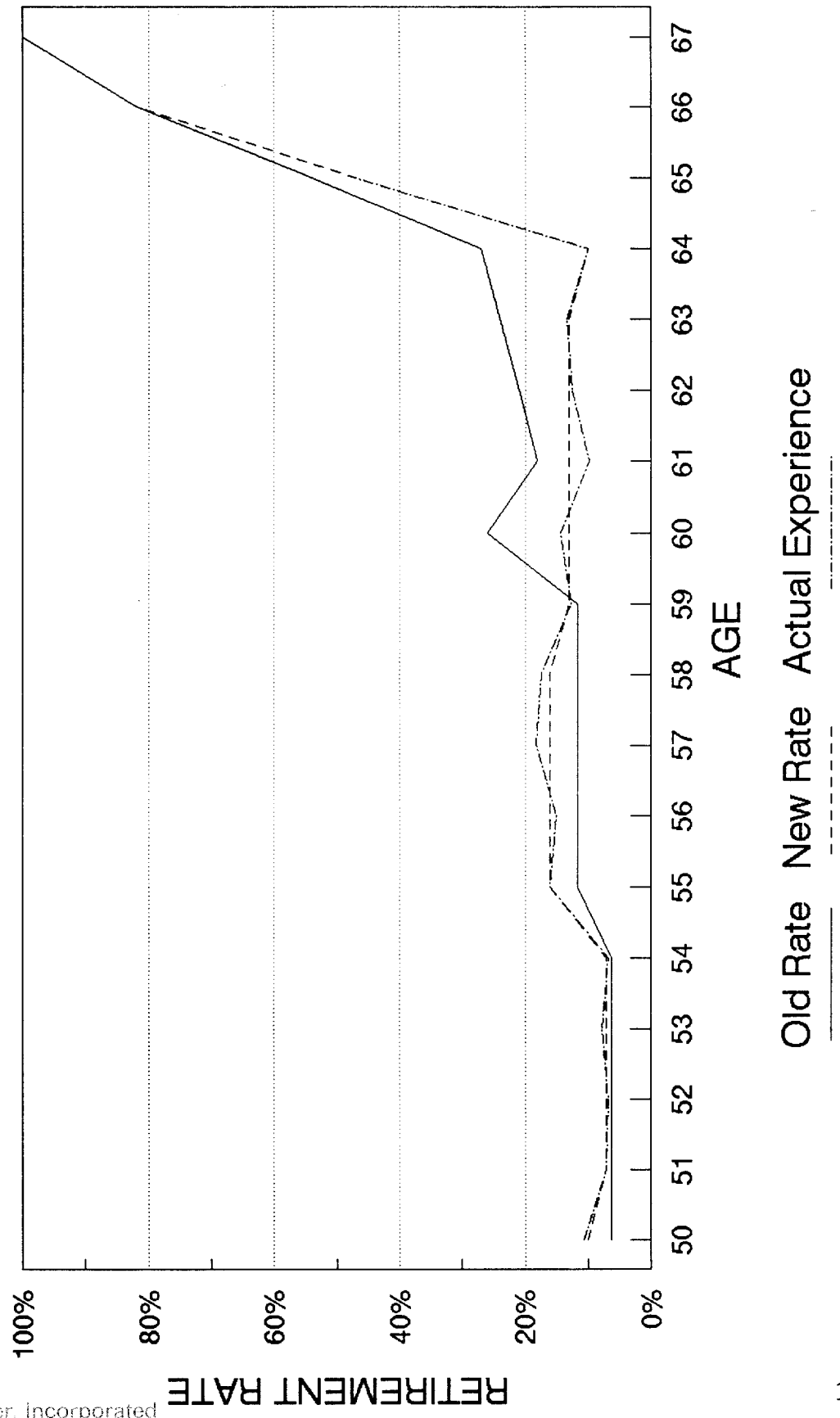


DISABILITY ASSUMPTION TRS



RETIREMENT ASSUMPTION

TRS



Section 5

Statement of Proposed Actuarial Assumptions and Methods

Valuation of Liabilities

- A. **Actuarial Method** - Projected Unit Credit (no change). Liabilities and contributions shown in the report are computed using the Projected Unit Credit method of funding. The unfunded accrued liability is amortized over 25 years. Any funded surpluses are amortized over five years.

The objective under this method is to fund each participant's benefits under the plan as they accrue. Thus, each participant's total pension projected to retirement with salary scale is broken down into units, each associated with a year of past or future service. The principle underlying the method is that each unit is funded in the year for which it is credited. Typically, when the method is introduced there will be an initial liability for benefits credited for service prior to that date, and to the extent that this liability is not covered by Assets of the Plan there is an Unfunded Liability to be funded over a chosen period in accordance with an amortization schedule.

An Accrued Liability is calculated at the valuation date as the present value of benefits credited with respect to service to that date.

The Unfunded Liability at the valuation date is the excess of the Accrued Liability over the Assets of the Plan. The level annual payment to be made over a stipulated number of years to amortize the Unfunded Liability is the Past Service Cost.

The Normal Cost is the present value of those benefits which are expected to be credited with respect to service during the year beginning on the valuation date.

Under this method, differences between the actual experience and that assumed in the determination of costs and liabilities will emerge as adjustments in the Unfunded Liability, subject to amortization.

B. **Actuarial Assumptions** -

- | | |
|-----------------|--|
| 1. Interest | 8.75% per year, compounded annually, net of expenses. |
| 2. Salary Scale | 6.5% per year for the first five years of employment and 5.5% per year thereafter. |

3. Total Inflation Total inflation as measured by the Consumer Price Index for urban and clerical workers for Anchorage is assumed to increase 5% annually.
4. Health Cost Trend
- | | |
|----------------|-------|
| 1992 - | 12.5% |
| 1993 - | 11.5% |
| 1994 - | 10.5% |
| 1995 - | 9.5% |
| 1996 - | 8.5% |
| 1997 and later | -7.5% |
5. Mortality 1984 Unisex Pension Mortality Table, set forward one year for male members and set backward four years for female members. All deaths are assumed to result from nonoccupational causes.
6. Turnover Based upon the 1986-90 actual total turnover experience. (See Table 1).
7. Disability Incidence rates based upon the 1986-90 actual experience, in accordance with Table 2. Post-disability mortality in accordance with rates published by the Pension Benefit Guaranty Corporation to reflect mortality of those receiving disability benefits under Social Security.
8. Retirement Age Retirement rates based upon the 1986-90 actual experience in accordance with Table 3.
9. Spouse's Age Wives are assumed to be four years younger than husbands.
10. Dependent Children Benefits to dependent children have been valued assuming members who are not single have one dependent child.
11. Contribution Refunds 100% of those terminating after age 35 with eight or more years of membership service, or with at least five years of membership service and at least three years of B.I.A. service will leave their contributions in the fund and thereby retain their deferred vested benefit. All others who terminate are assumed to have their contributions refunded.

- | | | |
|-----|------------|---|
| 12. | C.O.L.A. | Of those benefit recipients who are eligible for the C.O.L.A., 66% are assumed to remain in Alaska and receive the C.O.L.A. |
| 13. | Sick Leave | 4.7 days of unused sick leave for each year of service will be available to be credited once the member is retired. |
| 14. | Expenses | Expenses are covered in the interest assumption. |

Valuation of Assets

Based upon the five-year average ratio between actuarial and book values of the System's assets. The actuarial value of assets equals the market value, except that fixed income investments are carried at book value. Assets are accounted for on an accrued basis and are taken directly from audited financial statements provided by Coopers & Lybrand. Valuation assets cannot be outside the range of book and actuarial values.

Valuation of Medical Benefits

Medical benefits for retirees are provided by the payment of premiums from the fund. A pre-65 cost and lower post-65 cost (due to Medicare) were assumed such that the total rate for all retirees equals the present premium rate. These medical premiums are then increased with the health inflation assumption. The actuarial cost method used for funding retirement benefits is also used to fund health benefits.

For FY91 and FY92, the pre-65 monthly premium is \$318.94 and the post-65 premium is \$121.50, based on a total blended premium of \$243.98. These rates and the pre-65/post-65 split were provided by Deloitte & Touche.

Table 1

Alaska TRS

Total Turnover Assumptions

Select Rates of Turnover During the First 10 Years of Employment		Ultimate Rates of Turnover After the First 10 Years of Employment	
<u>Year of Employment</u>	<u>Rate</u>	<u>Ages</u>	<u>Rate</u>
1	.26	20-39	.03
2	.24	40+	.02
3	.16		
4	.12		
5	.11		
6	.10		
7	.09		
8	.09		
9	.09		
10	.09		

Table 2
Alaska TRS
Disability Rates
Annual Rates Per 1,000 Employees

<u>Age</u>	<u>Rate</u>
20	.14
21	.14
22	.14
23	.15
24	.15
25	.15
26	.15
27	.15
28	.16
29	.16
30	.16
31	.17
32	.17
33	.25
34	.34
35	.44
36	.53
37	.64
38	.75
39	.87
40	.99
41	1.12
42	1.25
43	1.39
44	1.53
45	1.68
46	1.84
47	2.00
48	2.17
49	2.34
50	2.52
51	2.70
52	2.89
53	3.08
54	3.29
55	3.49
56	3.70
57	3.92
58	4.14
59	4.37
60	4.61
61	4.84
62	5.09
63	5.34
64	5.60

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Table 3
Alaska TRS
Retirement Rates

<u>Age at Retirement</u>	<u>Retirement Rate</u>
50	.10
51	.07
52	.07
53	.07
54	.07
55	.16
56	.16
57	.16
58	.16
59	.13
60	.13
61	.13
62	.13
63	.13
64	.10
65	.47
66	.82
67	1.00

For ages less than 50, teachers are assumed to retire two years after the earliest age they are eligible to retire.

Section 6

Statement of Current Actuarial Assumptions and Methods

Valuation of Liabilities

- A. **Actuarial Method - Projected Unit Credit.** Liabilities and contributions shown in the report are computed using the Projected Unit Credit method of funding. The unfunded accrued liability is amortized over 25 years. Any funded surpluses are amortized over five years.

The objective under this method is to fund each participant's benefits under the plan as they accrue. Thus, each participant's total pension projected to retirement with salary scale is broken down into units, each associated with a year of past or future service. The principle underlying the method is that each unit is funded in the year for which it is credited. Typically, when the method is introduced there will be an initial liability for benefits credited for service prior to that date, and to the extent that this liability is not covered by Assets of the Plan there is an Unfunded Liability to be funded over a chosen period in accordance with an amortization schedule.

An Accrued Liability is calculated at the valuation date as the present value of benefits credited with respect to service to that date.

The Unfunded Liability at the valuation date is the excess of the Accrued Liability over the Assets of the Plan. The level annual payment to be made over a stipulated number of years to amortize the Unfunded Liability is the Past Service Cost.

The Normal Cost is the present value of those benefits which are expected to be credited with respect to service during the year beginning on the valuation date.

Under this method, differences between the actual experience and that assumed in the determination of costs and liabilities will emerge as adjustments in the Unfunded Liability, subject to amortization.

B. Actuarial Assumptions -

- | | |
|-----------------|--|
| 1. Interest | 9% per year, compounded annually, net of expenses. |
| 2. Salary Scale | 6.5% per year for the first five years of employment and 5.5% per year thereafter. |

- | | | |
|-----|----------------------|---|
| 3. | Total Inflation | Total inflation as measured by the Consumer Price Index for urban and clerical workers for Anchorage is assumed to increase 5% annually. |
| 4. | Health Cost Trend | 9% per year. |
| 5. | Mortality | 1984 Unisex Pension Mortality Table set back 1-1/2 years. All deaths are assumed to result from nonoccupational causes. |
| 6. | Turnover | Based upon the 1981-85 actual total turnover experience. (See Table 4). |
| 7. | Disability | Incidence rates in accordance with Table 5. Post-disability mortality in accordance with rates published by the Pension Benefit Guaranty Corporation to reflect mortality of those receiving disability benefits under Social Security. |
| 8. | Retirement Age | Retirement rates based on actual experience in accordance with Table 6. |
| 9. | Spouse's Age | Wives are assumed to be four years younger than husbands. |
| 10. | Dependent Children | Benefits to dependent children have been valued assuming members who are not single have one dependent child. |
| 11. | Contribution Refunds | 100% of those terminating after age 35 with eight or more years of membership service, or with at least five years of membership service and at least three years of B.I.A. service will leave their contributions in the fund and thereby retain their deferred vested benefit. All others who terminate are assumed to have their contributions refunded. |
| 12. | C.O.L.A. | Of those benefit recipients who are eligible for the C.O.L.A., 54% are assumed to remain in Alaska and receive the C.O.L.A. |

13. Sick Leave

4.7 days of unused sick leave for each year of service will be available to be credited once the member is retired.

14. Expenses

Expenses are covered in the interest assumption.

Valuation of Assets

Based upon the five-year average ratio between actuarial and book values of the System's assets. The actuarial value of assets equals the market value, except that fixed income investments are carried at book value. Assets are accounted for on an accrued basis and are taken directly from audited financial statements provided by Coopers & Lybrand. Valuation assets cannot be outside the range of book and actuarial values.

Valuation of Medical Benefits

Medical benefits for retirees are provided by the payment of premiums from the fund. A pre-65 cost and lower post-65 cost (due to Medicare) were assumed such that the total rate for all retirees equals the present premium rate. These medical premiums are then increased with the health inflation assumption. The actuarial cost method used for funding retirement benefits is also used to fund health benefits.

For FY91 and FY92, the pre-65 monthly premium is \$318.94 and the post-65 premium is \$121.50, based on a total blended premium of \$243.98. These rates and the pre-65/post-65 split were provided by Deloitte & Touche.

Table 4

Alaska TRS

Total Turnover Assumptions

Select Rates of Turnover During the First 10 Years of Employment

<u>Year of Employment</u>	<u>Rate</u>
1	.17
2	.15
3	.12
4	.12
5	.11
6	.09
7	.07
8	.07
9	.07
10	.06

Ultimate Rates of Turnover After the First 10 Years of Employment

<u>Ages</u>	<u>Rate</u>
20-39	.03
40+	.02

Table 5
Alaska TRS
Disability Rates
Annual Rates Per 1,000 Employees

<u>Age</u>	<u>Rate</u>
20	.42
21	.43
22	.43
23	.44
24	.44
25	.45
26	.46
27	.47
28	.48
29	.49
30	.50
31	.52
32	.53
33	.54
34	.56
35	.58
36	.59
37	.62
38	.64
39	.67
40	.69
41	.72
42	.76
43	.82
44	.89
45	.97
46	1.06
47	1.15
48	1.24
49	1.34
50	1.44
51	1.56
52	1.72
53	1.91
54	2.13
55	2.40
56	2.75
57	3.20
58	3.66
59	4.32
60	5.06
61	5.85
62	6.78
63	7.83
64	8.94

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Table 6

Alaska TRS

Retirement Rates

<u>Age at Retirement</u>	<u>Retirement Rate</u>
50	.063
51	.063
52	.063
53	.063
54	.063
55	.117
56	.117
57	.117
58	.117
59	.117
60	.260
61	.180
62	.210
63	.240
64	.270
65	.540
66	.820
67	1.000

For ages less than 50, teachers are assumed to retire two years after the earliest age they are eligible to retire.