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TEACHERS RETIREMENT ASSOCIATION
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REPORT OF ACTUARIAL VALUATION

JUNE 30, 1977

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STATE OF MINNESOTA

Teachers Retirement Association
State of Minnesota

As requested by the Board of Trustees of the Fund, we have made an actuarial valuation of the Fund as of June 30, 1977, in accordance with the provisions of Minnesota Statutes, Sections 356.20 to 356.23. The results of our analysis are presented in the following report.

Liability for Annuities. Table 1 summarizes the census of annuities in force showing for each type of annuitant the number, annual amount and the present value of annuities. The present value was calculated using the 1971 Group Annuity Mortality Table for males set back 6 years with an interest assumption of 5%.

The liability for annuities shown in Table 1 are as follows:

Summary of Liability for Annuities

Adjustable Fixed Benefit Fund	\$ 285,138,743.35
Variable Annuity Fund	71,567.66
Disability Benefits	7,101,515.91
1915 Law Annuities	150,230.36
Survivor Benefits	1,993,990.97
Total	<u>\$ 294,456,048.25</u>

Liability for Prior Service. Table 2 summarizes the census of active members and Table 3 the census of inactive members. These are shown separately for the Basic and Coordinated Group with each of these groups separated according to the benefit plan election in effect as of the date of this valuation. The accrued liability for prior service for each of these groups, exclusive of any participation in the Variable Annuity Fund, has been determined as follows:

Summary of Liability for Prior Service

	<u>Basic</u>	<u>Coordinated</u>
<u>Active Members</u>		
Full Formula	\$284,241,531	\$ 562,244,586
Partial Formula	49,745,374	162,129,751
Full Variable	<u>-0-</u>	<u>9,018</u>
Total	\$333,986,905	\$ 724,383,355
<u>Inactive Members</u>		
Full Formula	\$ 22,588,352	\$ 30,777,503
Partial Formula	912,367	2,633,160
Full Variable	<u>-0-</u>	<u>211,911</u>
Total	\$ 23,500,719	\$ 33,622,574
Total accrued prior service liability		\$1,115,493,553

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For members under a formula plan the accrued prior service liability has been determined using the entry age normal cost method. The assumed rates of death disability and withdrawal are shown in Table 4. It was assumed that individual salaries would increase at the rate of 3.5% each year. An interest assumption of 5% was used.

For members under the full variable money purchase plan the accrued prior service liability has been determined to be represented by 180% of the members accumulation at June 30, 1957 plus 220% of the members accumulated fixed deposits with interest to the valuation date plus 300% of any unpaid arrears.

Liability for Annuity Increases. As required by Section 11.25 Subd. 12, as of January 1, 1978 annuities payable from the Adjustable Fixed Benefit Fund and which began before July 1, 1976 will be increased by 4%. The value of this increase as of June 30, 1977 is \$9,373,689. This amount, when added to the \$285,138,743 liability shown in Table 1, represents the total reserve requirement for this fund of \$294,512,432.

Assets of the Fund. Table 5 summarizes the assets and current liabilities of the Fund. As required by Section 356.20 Subd. 5 the deferred yield adjustment account, amounting to \$5,458,535 is shown as an asset. This account represents realized losses incurred in the disposition of debt securities. Bonds are shown at amortized cost. The market value of stocks exceeded cost by \$6,691,283 of which \$1,515,041 has been recognized as an asset. As required by Section 11.25 Subd. 12(e), the Adjustable Fixed Benefit Participation is adjusted to equal the required reserve for annuities being paid from that Fund. This is accomplished by establishing a pseudo-asset referred to as an annuity stabilization account amounting to \$19,130,809.

Unfunded Liability. The difference between the actuarial liabilities and the assets available for funding these liabilities is the actuarial deficit or unfunded liability. The following table compares these amounts as of June 30, last year and this year. The liability for benefits payable from the Variable Annuity Fund is assumed to be equal to the participation in such fund included with the assets.

	<u>6-30-76</u>	<u>6-30-77</u>
Required Reserves For:		
Adjustable Fixed Benefit Fund	\$ 239,670,297	\$ 294,512,432
Variable Annuity Fund	28,756,819	43,751,951
Other Annuities	7,614,385	9,224,677
Accrued Prior Service	<u>1,017,722,670</u>	<u>1,115,493,553</u>
Total Actuarial Liabilities	\$1,293,764,171	\$1,462,982,613
Assets in Excess of Current Liabilities	695,640,890	822,410,185
Unfunded Liability	\$ 598,123,281	\$ 640,572,428
Funding Ratio	53.8%	56.2%

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During the year unfunded liabilities increased by \$42,449,147. An analysis of the causes of this increase is presented in the appendix to this report.

Normal Support Rate. Current statutes provide for equal employer and employee contributions of 8% of salary for the Basic Group and 4% for the Coordinated Group. For members under a formula plan the aggregate entry age normal cost to provide retirement benefits and ancillary benefits was determined as follows:

	<u>Employer</u>	<u>Employee</u>	<u>Total</u>
Basic - Full Formula	8.75%	8.00%	16.75%
Partial Formula	8.36	8.00	16.36
Coordinated - Full Formula	4.21	4.00	8.21
Partial Formula	3.98	4.00	7.98

These entry age normal cost rates were used in the determination of the accrued liability for members under a formula plan.

Administrative Expense. The cost of administration of the Fund during the year amounted to \$834,211. This represents 0.10% of the current annual payroll.

Additional Support Rate. An additional contribution of 3% of salary is provided by statute to amortize the actuarial deficit. The following table shows for this year and last year the computations of the additional support rate required to amortize the actuarial deficit by June 30, 1997.

	<u>6-30-76</u>	<u>6-30-77</u>
(a) Unfunded Liability	\$ 598,123,281	\$ 640,572,428
(b) Annual Cost to Amortize by 1997	46,651,287	51,401,189
(c) Current Annual Payroll	752,040,857	802,761,084
(d) Additional Support Rate (b) / (c)	6.20%	6.40%

Interest at the rate of 5% on the current unfunded liability amounts to \$32,028,621 or 3.99% of the current annual payroll.

It is apparent that the additional support rate now provided by statute is inadequate. Legislative action should be sought to increase this rate to at least 6.5%.

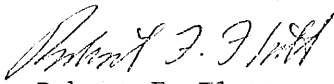
Income From Investments. Income from investments earned during the year, and not allocated to the Adjustable Fixed Benefit Fund or Variable Annuity Fund, amounted

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to \$23,797,358. This represents a return of 5.36% on the mean assets in excess of current liabilities excluding participation in the Variable Fund and the Adjustable Fixed Benefit Fund. This includes a decrease in the recognized unrealized appreciation on stocks in the amount of \$1,976,748 and realized gains of \$45,630 on sale of stocks. Interest at the rate of 6.00% was credited to members accumulated deposits.

Respectfully submitted,

BROWN AND FLOTT


Robert F. Flott

Teachers Retirement Association
State of Minnesota

TABLE 1

SUMMARY OF CENSUS OF ANNUITANTS

Type of Annuity		Annual Amount	Present Value
<u>Annuities Payable from Adjustable Fixed Benefit Fund</u>			
1. <u>Service Retirement Annuitants</u>			
as of 6-30-76	7044	\$20,729,986.02	\$227,436,957.14
net adjustments made in 6-30-76 bal.	--	+ 4,843.80	
1976 benefit increases (MS 356.36)		557,200.56	
granted during year	780	3,912,745.00	
terminated by death	141	436,561.32	
expired	1	2,098.08	
as of 6-30-77	7682	\$24,766,115.98	\$271,530,489.25
2. <u>Beneficiaries of Deceased Members</u>			
as of 6-30-76	106	\$ 291,955.08	\$ 2,601,650.68
net adjustments made in 6-30-76 bal.		+ 19.80	
1976 benefit increases (MS 356.36)		8,818.56	
granted during year	7	30,874.92	
expired	3	8,630.52	
as of 6-30-77	110	\$ 323,037.84	\$ 2,872,801.16
3. <u>Beneficiaries of Deceased Annuitants</u>			
as of 6-30-76	273	\$ 556,259.88	\$ 3,316,491.65
net adjustments made in 6-30-76 bal.		- 1,152.36	
1976 benefit increases (MS 356.36)		14,743.08	
transfer from type 1	57	212,521.92	
expired	21	41,669.88	
as of 6-30-77	309	\$ 740,702.64	\$ 4,661,068.24
4. <u>Section 136.82 Supplemental Annuities</u>			
as of 6-30-76	83	\$ 32,455.20	\$ 364,098.01
1976 benefit increases (MS 356.36)		1,447.32	
terminated by death	2	774.84	
granted during year	24	16,428.12	
as of 6-30-77	105	\$ 49,555.80	\$ 553,064.46
5. <u>Section 354.59 Allowances and 354.581 Increases</u>			
as of 6-30-76		\$ 794,787.84	\$ 5,951,099.71
expirations		33,401.76	
as of 6-30-77		\$ 761,386.08	\$ 5,521,320.23
6. <u>Section 356.36 1976 Benefit Increases</u>			
as of 6-30-76		\$ 582,209.52	\$ 4,975,050.51
transfer to types 1-5		582,209.52	4,975,050.51
as of 6-30-77		-0-	-0-
Total 6-30-76 MAFBF	7506	\$22,987,653.54	\$244,645,347.70
Total 6-30-77 MAFBF	8206	\$26,640,798.34	\$285,138,743.35

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<u>Type of Annuity</u>	<u>Number</u>	<u>Annual Amount</u>	<u>Present Value</u>
<u>Annuities Payable from Variable Annuity Fund</u>			
7. <u>Service Retirement Annuitants</u>			
as of 6-30-76	21	\$ 2,552.28	\$ 33,722.58
less adjustment for variable loss		- 233.04	
granted during year	13	3,079.20	
as of 6-30-77	34	\$ 5,398.44	\$ 71,567.66
<u>Other Annuities and Benefits</u>			
8. <u>Disability Annuitants</u>			
as of 6-30-76	120	\$ 413,616.12	\$ 5,755,822.00
1976 benefit increases (MS 356.37)		3,481.08	
net adjustments made in 6-30-76 bal.		+ 9.12	
returned to teaching	3	25,069.32	
granted during year	47	226,071.60	
terminated by death	12	65,020.56	
transfers to type 1	15	45,491.88	
as of 6-30-77	137	\$ 507,596.16	\$ 7,101,515.91
9. <u>Survivors Benefits</u>			
as of 6-30-76	150	\$ 174,064.20	\$ 1,740,812.53
1976 benefit increases (MS 356.37)		5,716.20	
granted during year	9	27,329.16	
terminated	16	13,242.60	
as of 6-30-77	143	\$ 193,866.96	\$ 1,993,990.97
10. <u>1915 Law Retirement Annuitants</u>			
as of 6-30-76	28	\$ 26,614.08	\$ 117,750.52
1976 benefit increases (MS 356.36)		14,684.40	
terminated by death	7	10,044.12	
as of 6-30-77	21	\$ 31,254.36	\$ 129,169.64
11. <u>Section 354.44 Subd. 5 Increases</u>			
as of 6-30-76	--	\$ 6,720.00	\$ 30,006.24
terminated by death		1,680.00	
as of 6-30-77	--	\$ 5,040.00	\$ 21,060.72
12. <u>Section 356.36 and 356.37 1976 Benefit Increases</u>			
as of 6-30-76		\$ 23,881.68	\$ 167,319.11
transfer to types 8-10		23,881.68	167,319.11
as of 6-30-77		-0-	-0-

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TABLE 2

SUMMARY OF CENSUS OF ACTIVE MEMBERS

	<u>BASIC GROUP</u>		<u>COORDINATED GROUP</u>	
	<u>Number</u>	<u>Annual Payroll</u>	<u>Number</u>	<u>Annual Payroll</u>
	<u>Money Purchase - Full Variable</u>			
At 6-30-76			35	\$174,535
*Less than 20 days of resumed service			(6)	
At 6-30-77			29	\$104,837
	<u>Full Formula</u>			
At 6-30-76	3,351	\$54,259,271	47,134	\$491,573,615
New Entrants	130		6,638	
To Inactive	33		1,376	
Separation with Refund	109		3,972	
Deaths	9		60	
Disability Retirement	9		39	
Service Retirement	<u>243</u>		<u>455</u>	
At 6-30-77	3,078	\$53,638,745	47,870	\$535,037,513
	<u>Partial Formula</u>			
At 6-30-76	723	\$13,601,702	12,845	\$192,431,734
New Entrants				
To Inactive	10		194	
Separation with Refund	2		349	
Deaths	2		5	
Disability Retirement	1		2	
Service Retirement	<u>3</u>		<u>10</u>	
At 6-30-77	705	\$13,980,210	12,285	\$199,999,779
Total at 6-30-76	4,074	\$67,860,973	60,014	\$684,179,884
Total at 6-30-77	3,783	\$67,618,955	60,184	\$735,142,129

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TABLE 3

SUMMARY OF CENSUS OF INACTIVE MEMBERS

	<u>Basic Group</u>	<u>Coordinated Group</u>
<hr/> Money Purchase - Full Variable <hr/>		
At 6-30-76		166
Separation with Refund		<u>32</u>
At 6-30-77		134
<hr/> Full Formula <hr/>		
At 6-30-76	949	14,262
From Active	33	1,376
Separation with Refund	45	206
Write-Offs	0	0
Deaths	0	11
Service Retirement	<u>43</u>	<u>32</u>
At 6-30-77	894	15,389
<hr/> Partial Formula <hr/>		
At 6-30-76	8	509
From Active	10	194
Separation with Refund	0	9
Deaths	0	0
Service Retirement	<u>0</u>	<u>0</u>
At 6-30-77	18	694
<hr/>		
Total at 6-30-76	957	14,937
Total at 6-30-77	912	16,217

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TABLE 4

ASSUMED RATES OF DECREMENT USED IN
VALUATION OF FORMULA PLAN BENEFITS

<u>Age</u>	<u>Death</u>	<u>Disability</u>	<u>Withdrawal</u>
20	.000530	.00076	.203
25	.000616	.00100	.168
30	.000758	.00112	.133
35	.000991	.00129	.098
40	.001374	.00164	.063
45	.002000	.00221	.028
50	.003580	.00347	.000
55	.006475	.00712	.000
60	.010436	.01264	.000

Assumed age at retirement - 62

Post Retirement Mortality - 1971 Group Annuity Mortality Table for
 males set back 6 years.

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TABLE 5

ASSETS AND CURRENT LIABILITIES

A. Assets

Deposits in banks	\$ 636,476.11
Accounts Receivable:	
Accrued members' contributions	4,464,289.61
Accrued employer's contributions	12,512,223.14
Minnesota Variable Annuity Fund	122,593.89
Minnesota Adjustable Fixed Benefit Fund	584,761.86
Social Security Retirement Division	827.85
Interest charges on late remittance	3,015.76
Other	52.75
Accrued interest on investments	4,650,858.97
Dividends on stock, declared but not yet received	63,359.95
Investment in bonds at amortized cost	218,894,049.23
Investment in common stocks at cost	219,692,474.16
Short term investments	17,668,681.13
Deferred Yield Adjustment Account	5,458,534.59
Recognized unrealized appreciation in stocks	1,515,040.95
Participation in MAFB Fund-Admitted Value	275,381,623.33
Participation in MAFB Fund-Annuity Stabilization A/C	19,130,808.54
Participation in Minnesota Variable Annuity Fund	43,751,951.27
Equipment at cost, less depreciation	24,631.44
Total Assets	<u>\$ 824,556,254.53</u>

B. Current Liabilities

Accounts Payable:	
Annuity payments	\$ 2,097,832.25
Accrued expenses	48,236.72
Total Current Liabilities	<u>\$ 2,146,068.97</u>

C. Assets in Excess of Current Liabilities \$ 822,410,185.56

Teachers Retirement Association
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APPENDIX TO VALUATION REPORT

1. ACTUARIAL ANALYSIS OF CHANGE IN UNFUNDED LIABILITIES

As indicated in the report of actuarial valuation, during the current year the unfunded liability increased by \$42,449,147. The causes of this increase may be summarized as follows:

Increases:

Actuarial loss - salary increases	\$60,484,363
Contribution deficiency	9,876,119
AFBF mortality loss (Sec. 11.25)	139,455

Decreases:

Sec. 11.25 - Prior year adjustment	5,561,187
Actuarial gain - Terminations	19,389,356
Actuarial gain - Investment income	2,305,658
Actuarial gain - Ancillary benefits	324,687
Sec. 356.36 transfer gain	<u>469,902</u>

Net Increase	\$42,449,147
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As required by Section 356.215 Subd. 4, in calculating the accrued prior service liability it is assumed that salaries increase each year at a rate of 3.5%. In the past year salaries actually increase at a rate of 9.6%. This departure from the assumed rate increased the deficit by \$60,484,363.

For purposes of this report it is assumed that minimum contributions are the sum of the entry age normal cost, 5% interest on the unfunded liability at the beginning of the year, and administrative expenses. Actual employee and employer contributions were \$9,876,119 less than this required amount.

Section 11.25 Subdivision 12 required a transfer to the basic fund from the Adjustable Fixed Benefit Fund for the current year in the amount of \$5,421,732. This transfer is intended to reflect the mortality loss for retired members which amounted to \$139,455 for the current year, offset by a \$5,561,187 adjustment for amounts transferred in prior years.

During the past year members terminated employment at a rate greater than assumed in calculating the accrued prior service liability. The reserves released by these terminations were \$19,389,356 more than expected.

In computing required reserves it is assumed that investment income would be earned at the rate of 5% per annum. The actual income from investments exceeded the income required to maintain reserves on this basis by \$2,305,658.

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APPENDIX TO VALUATION REPORT

Ancillary benefits include disability, surviving spouse, surviving children and 1915 law annuities in force. The cost of these benefits in the current year was \$324,687 less than the assumed normal cost of such benefits.

The amount received from the general fund for annuity increase which became effective June 30, 1976 pursuant to Sec. 356.36 exceeded the actual cost of such increases by \$469,902.

2. POST-RETIREMENT MORTALITY IN ADJUSTABLE FIXED BENEFIT FUND

During the current year the difference between tabular and actual reserves released due to the death of annuitants amounted to \$134,092. This is the third consecutive year in which fewer annuitants died than were expected. The following is a comparison of the actual and expected deaths in each of these years:

<u>Year</u>	<u>Actual</u>	<u>Expected</u>	<u>Ratio Actual to Expected</u>
1975	123	145	85%
1976	146	161	91
1977	<u>141</u>	<u>177</u>	<u>80</u>
Total	410	483	85%

In view of this experience we anticipate changing the current mortality assumption effective June 30, 1978.

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SCHEDULE OF TOTAL RESERVES REQUIRED JUNE 30, 1977

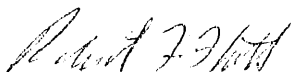
1. <u>For Adjustable Fixed Benefit Fund Participation</u>	\$ 294,512,431.87
2. <u>For Variable Annuity Fund Participants</u>	43,751,951.27
3. <u>For Active Members</u>	1,058,370,260.00
4. <u>For Inactive Members</u>	57,123,293.00
5. <u>For Other Annuitants</u>	
a. 1915 Law Retirement Annuities	129,170.12
b. Disability Annuities	7,101,515.91
c. Widow's Annuities	1,826,269.77
d. Surviving Children's Annuities	<u>167,721.20</u>
Total	<u>\$ 9,224,677.00</u>
Total Required Reserves	\$ 1,462,982,613.14

Certification

The above exhibit has been prepared in accordance with the provisions of Section 356.20. The required reserves for formula benefits have been computed in accordance with the entry age normal cost method.

Respectfully submitted,

BROWN AND FLOTT


Robert F. Flott

November 28, 1977