ACTUARIAL VALUATION REPORT
OF THE
MINNESOTA HIGHWAY PATROL OFFICERS' RETIREMENT ASSOCIATION
AS OF
JUNE 30, 1975

Prepared and submitted by

George V. Stennes and Associates

Consulting Actuaries

November 7, 1975

INTRODUCTION

Minnesota Highway Patrol Officers' Retirement Association

In accordance with the pertinent chapters of Minnesota Laws, an actuarial valuation as of June 30, 1975, has been made of this Retirement Association. The valuation covers the membership of the fund as shown in the census of members and survivors of deceased members, which is included in this report. The details of the benefits under the Plan, assets in the fund, income of the fund, and membership data were furnished by the Administrator of this Plan.

The report covers the following items:

A. Benefits of the Plan and Contributions

B. Assumptions in Actuarial Valuation

C. Results of Valuation

D. Discussion of Results

E. Unfunded Cost of Vested Benefits

F. Analysis of Change in the Unfunded Accrued Liability

G. Census of Membership and Benefits as of June 30, 1975

H. Analysis of Changes in Membership

I. Average Ages at Entry and Retirement

J. Certification by Actuary

MINNESOTA HIGHWAY PATROL OFFICERS' RETIREMENT FUND

A. BENEFITS OF PLAN AND CONTRIBUTIONS

This Plan provides the following major benefits:

1. Retirement Benefit

   a. Requirements for retirement:

      (1) Age 55 and 10 years of service required for full service benefit.

      (2) 10 years of service required for vesting of deferred annuity benefit with payments to start at age 55.

   b. Monthly Annuity:

      2 1/2% of average monthly salary for each year up to and including 20 years; 2% for each year of service in excess of 20.

   c. Average Monthly Salary:

      Average of highest 5 years.

2. Disability Benefit

   a. Requirements:

In Line of Duty:	None.
Not in Line of Duty:	5 years of service and age less than 55.

   b. Monthly Annuity:

In Line of Duty:	50% of average monthly salary plus 2% for each year of service in excess of 20.
Not in Line of Duty:	2 1/2% of average monthly salary for each year up to and including 20 years plus 2% for each year in excess of 20; a minimum of 25%.

3. Widow's and Orphan's Benefits

a. Active Members:

(1) Death benefit before retirement:

Widow:	20% of average covered monthly salary.
Orphans:	10% of average covered monthly salary to age 18 or 22 for each child plus $20 per month prorated equally to such children.

(Maximum total orphan benefit $400 per month.)

(2) Death benefit after retirement:

None (actuarial equivalent of life annuity may be chosen under an option to provide a widow's benefit). However, the widows of those members who retired or separated from the fund with vested benefits prior to July 1, 1965 will receive $156.25 per month.

b. Retired Members: None.

4. Other Death Benefit

(Lump Sum): None.

5. Termination of Employment Benefit

Refund of Participant's contributions without interest may be applied for upon termination with less than 20 years of service. If refund is not applied for and Participant has completed 10 years of service, a vested deferred annuity may be payable commencing at age 55.

6. Contributions

Members:	8.0% of salary
Employer Regular:	12.0% of salary
Employer Additional:	10.0% of salary
Total	30.0% of salary

B. ASSUMPTIONS IN ACTUARIAL VALUATION

1.	Mortality:	United States Life Tables, 1959-61 (White Males and White Females). These tables were used for both active and retired members, and for survivors.
2.	Disability:	The rates of disability were adapted from experience of the New York State Employees' Retirement System, graduated and extrapolated as required for this valuation.
3.	Withdrawal:	A rate of withdrawal of .030 at age 20 decreasing uniformly to zero at age 50 with no withdrawals after that age.
4.	Salary Scale:	Salaries were assumed to increase 3 1/2% each year.
5.	Retirement Age:	The assumed average ages at retirement for this fund were 57.0 for the Highway Patrol group and for the State Police Officers group hired after 6-30-61, and 62.5 for the State Police Officers group hired before 7-1-61.
6.	Interest:	5%, compounded annually.

It is felt that these assumptions are appropriate for the valuation of this fund on a realistic basis.

C. RESULTS OF VALUATION

1. Valuation

Normal Cost of Benefits	$1,661,999
Administrative Expense	30,000
Accrued Liability	43,346,873

2. Current Deficit from Full Funding

Accrued Liability	$43,346,873
Assets in Fund *	22,910,417
Unfunded Accrued Liability	$20,436,456

3. Annual Payment to Achieve Full Funding by 1997

Annual Deposit to Retire Deficit by 1997	$ 1,478,578
Total Normal Cost	1,661,999
Administrative Cost	30,000
Total Annual Payment	$ 3,170,577

4. Minimum Contribution to Prevent Increase in Deficit

Interest on Deficit at 5%	$ 1,021,823
Total Normal Cost	1,661,999
Administrative Expense	30,000
Minimum Contribution	$ 2,713,822

5. Income of Fund during Fiscal Year Ending June 30, 1975*

Members' Contributions	$ 841,956
Taxes or Public Funds	2,314,847
Total Contributions	$ 3,156,803
Investment Income	$ 751,486

6. Annual Payroll*

Total Projected Payroll, 1975-1976	$11,214,526

* Data furnished by Administrator. For valuation purposes, assets from Minnesota Adjustable Fixed Benefit Fund taken equal to reserves for benefits payable from this Fund.

D. DISCUSSION OF RESULTS

The valuation was made by a method known as the entry age normal cost method. Under this method, the normal cost is determined based on the age at hire of each member. This normal cost is the annual deposit required (using the assumptions outlined in Section B above) to pay for the cost of each member's prospective benefits over a period from his date of hire to his date of retirement. This normal cost is determined as a level percentage of payroll; therefore, future increases in payroll will produce increases in the number of dollars of normal cost.

The elements of normal cost for this plan are:

Type of Benefit	Normal Cost
Service Retirement Benefit	$1,060,473
Disability Benefit	313,368
Withdrawal Benefit	4,667
Survivor's Benefit	207,870
Vesting	75,621
Total Normal Cost	$1,661,999

This total normal cost and the administrative expense equal 14.82% of the total payroll as of June 30, 1975.

When a retirement plan is fully funded, the fund contains an amount equal to the accumulation (under the actuarial assumptions made) of the normal cost for each member from his date of hire to the date of the valuation. This accumulation is called the accrued liability or the required reserve.

The elements of accrued liability for this plan are:

Type of Benefit	Accrued Liability
1. Active Members	
Retirement Benefit	$29,767,888
Disability Benefit	2,481,736
Withdrawal Benefit	29,484
Survivor's Benefit	1,915,984
Vesting	905,469
Total for Active Members	$35,100,561
2. Inactive Members	
Retired	$ 5,031,584
Disabled	264,820
Deferred Retired	415,978
Widows	1,566,955
Orphans	154,502
Survivor's Benefit	812,473
Total for Inactive Members	$ 8,246,312
Total Accrued Liability	$43,346,873

A retirement plan which is fully funded requires future contributions no larger than the sum of the administrative expense and the normal costs for all active members to pay for the prospective benefits (if the assumptions made are realized exactly). To the extent that normal costs and administrative expenses have not been paid in the past, a plan is not fully funded. The amount by which the plan is short of full funding is called the unfunded accrued liability of the fund. In other words, the unfunded accrued liability is the excess of the accrued liability over the actual assets of the fund.

The amount of annual contribution which would be required to pay each year's normal cost, to pay the administrative expense and to eliminate the deficit by 1997 is the "total annual payment" shown in Section C of this report.

The deficit in the fund will increase unless at least 5% interest on the deficit is paid each year in addition to the normal cost and the administrative expenses. The sum of these three amounts should be regarded as the minimum annual contribution to the fund in order to keep the deficit at its present size. This "minimum contribution" is shown in Section C of this report.

E. UNFUNDED COST OF VESTED BENEFITS

The Legislative Commission on Pensions and Retirement has requested that the actuarial valuation report also contain a statement of the unfunded cost of vested benefits. Such a statement shows the relationship between the assets and the present value of benefits earned to the date of the valuation, and this indicates the degree of funding if the plan were to be terminated.

If the plan were to be terminated, the following liabilities would be incurred:

1. For active members with less than 10 years of service, a refund of such members' contributions;

2. For active members with 10 or more years of service, the present value with interest and mortality (and without withdrawals) of a retirement benefit deferred to the earliest possible date of retirement with the amount equal to the retirement benefit credits accrued to date augmented at 5%, compounded annually to the assumed retirement date;

3. For each member in No. 2, a pre-retirement death benefit equal to the member's contributions.

4. For inactive members, the present value of future benefits.

The amount of each of these liabilities turned out to be the following:

1.	$ 1,387,433
2.	28,372,511
3.	173,628
4.	8,246,312
	$ 38,179,884

The assets of $22,910,417 are $15,269,467 less than this total cost of vested benefits, and the ratio of assets to cost is 60.0%.

F. ANALYSIS OF CHANGE IN THE UNFUNDED ACCRUED LIABILITY

As of 6-30-74

Accrued Liability	$40,779,112	
Assets	19,650,535	
Unfunded Accrued Liability		$21,128,577

As of 6-30-75

Accrued Liability	$43,346,873	
Assets	22,910,417	
Unfunded Accrued Liability		20,436,456

Decrease in Unfunded Accrued Liability		$ 692,121

Decreases:

Amortization Contribution	$ 435,680	
Excess Interest	61,542	
Salary Scale Gain	960,148	
Total Decreases		$ 1,457,370

Increases:

Change in Assumed Benefit Period - Children	$ 50,080	
Mortality and Termination Loss - Actives	591,171	
Mortality Loss - MAFBF	123,998	
Total Increases		765,249
Net Decrease		$ 692,121

G. CENSUS OF MEMBERSHIP AND BENEFITS AS OF JUNE 30, 1975

Status	Number	Annual Payroll
Active Members	759	$11,214,526

Status	Number	Annual Payroll
Service Retirements	133	$ 602,245
Disability Retirements	4	20,298
Widow Annuitants	69	156,131
Orphan Annuitants	33	27,959

Status	Number	Annual Payroll
Deferred Annuitants	13	$ 56,470

H. ANALYSIS OF CHANGES IN MEMBERSHIP

Active Members

Number as of 6-30-74	738
New Entrants	40
Transfers from Deferred	0
Total	778
Deaths	1
Withdrawals with Vested Benefits	0
Withdrawals without Vested Benefits	7
Retired	10
Disabled	1
Total Terminations	19
Number as of 6-30-75	759

Service Retirements

Number as of 6-30-74	133
Newly Retired	10
Transfer from Deferred Status	0
Transfer from Disabled Status	0
Total	143
Deaths	10
Number as of 6-30-75	133

Disabled Annuitants

Number as of 6-30-74	3
Newly Disabled	1
Total	4
Transfer to Retired Status	0
Number as of 6-30-75	4

Widow Annuitants

Number as of 6-30-74	61
Newly Widowed	9
Total	70
Deaths	1
Remarried	0
Number as of 6-30-75	69

Orphan Annuitants

Number as of 6-30-74	34
Newly Orphaned	0
Total	34
Orphans Attaining Maximum Age	1
Number as of 6-30-75	33

Deferred Annuitants

Number as of 6-30-74	13
New Deferred Annuitants	0
Total	13
Transfer to Retired Status	0
Transfer to Active Status	0
Deaths	0
Total Terminations	0
Number as of 6-30-75	13

I. AVERAGE AGES AT ENTRY AND RETIREMENT

		Highway Patrol	State Police Officers
The average age at which employment commences is as follows:			
All Current Active Members:		27.7 (Including State Police Officers hired after June 30, 1961)	31.0 (Those hired prior to July 1, 1961)
New Entrants:	Fiscal Year		
	1970-1971	25.4	30.9
	1971-1972	25.0	27.6
	1972-1973	24.1	30.8
	1973-1974	33.9	26.7
	1974-1975	27.7 (Highway Patrol and State Police Officers combined)	
The average age at which service retirements have taken place is as follows:			
All Current Service Retirements:		59.9 (Highway Patrol and State Police Officers combined)	
New Retireds:	Fiscal Year		
	1970-1971	58.9	59.0
	1971-1972	57.9	63.5
	1972-1973	57.2	62.7
	1973-1974	59.5	64.3
	1974-1975	59.6 (Highway Patrol and State Police Officers combined)	

J. CERTIFICATION BY ACTUARY

Name of Association: Minnesota Highway Patrol Officers' Retirement Association

We hereby certify that this actuarial valuation of the above named Association was made as of June 30, 1975, on the basis of accepted actuarial methods and procedures. The valuation was completed in accordance with the requirements of the pertinent chapters of Minnesota Laws.

Franklin C. Smith

Franklin C. Smith
Associate, Society of Actuaries
GEORGE V. STENNES & ASSOCIATES
Consulting Actuaries

GVS Minnesota Memorandum No. 75-10
January 15, 1976

HIGHWAY PATROLMEN VALUATION AS OF JUNE 30, 1975

The purpose of this memorandum is to discuss the valuation report of the Minnesota Highway Patrol Officers Retirement Association which was submitted to the Commission in accordance with Chapter 356 of Minnesota Laws 1974. The valuation was made by our office using the entry age normal cost method and assuming 5% interest. The Plan includes the State Police Officers as well as the members of the Highway Patrol.

This memorandum contains the following:

1. Statistical and Valuation Data;
2. Discussion of Valuation Results;
3. Unfunded Cost of Vested Benefits;
4. Supplemental Experience Study;
5. Conclusion.

1. Statistical and Valuation Data

Results of the valuation reports as of June 30, 1974 and June 30, 1975 are shown for comparative purposes. Figures are rounded where necessary for simplicity of presentation.

	June 30, 1974	June 30, 1975
(1) Membership		
Active Members	738	778
Deferred Annuitants	13	13
Retired Members	133	133
Disabled Members	3	4
Widows of Deceased Members	61	69
Children of Deceased Members	34	33
(2) Payroll and Annuities Payable	(Thousands of Dollars)	
Total Payroll	$11,052	$11,214
Annuities (annual)	746	806
(3) Valuation Balance Sheet	(Thousands of Dollars)	
Accrued Liability	$40,779	$43,347
Assets	19,651	22,910
Unfunded Accrued Liability (Deficit)	$21,128	$20,437
Funding Ratio (Assets/Accrued Liability)	48.2%	52.8%

	June 30, 1974	June 30, 1975
(4) Normal Cost and Funding Costs	% of Payroll	% of Payroll
Normal Cost	14.68%	14.82%
Administrative Expense	0.28	0.27
Normal Cost plus Expense	14.96%	15.09%
Normal Cost plus Expense	14.96%	15.09%
Interest on Deficit	9.56	9.11
Total (Minimum Contribution)	24.52%	24.20%
Normal Cost plus Expense	14.96%	15.09%
Amortization by 1997	13.50	13.18
Total (Required Contribution)	28.46%	28.27%
(5) Statutory Contributions		
Employee	8.0%	8.0%
Employer Regular	12.0	12.0
Employer Additional	10.0	10.0
Total Contributions	30.0%	30.0%
(6) Investment Yield *	5.85%	5.46%

* Rate of return on mean assets excluding Minnesota Adjustable Fixed Benefit Fund.

2. Discussion of Valuation Results

The normal cost figures for the two years are roughly the same, and the difference is within the limits of reasonable fluctuation. The decrease in the amortization contribution as a percentage of payroll results from adequate financing, actuarial gains and a larger payroll base.

This decrease in the amortization contribution as a percentage of payroll is partially a correction of an overstated increase last year. After the 1974 valuation report had been completed, it was discovered that compensation figures had been overstated, and this produced a deficit and an amortization contribution which were too large. We estimated at the time that a revaluation would have reduced the amortization contribution by 0.25% to 0.50%. (See GVS Minnesota Memorandum No. 74-2, December 2, 1974, page 3.) Had a revaluation been made, the two amortization contribution percentages would have been about equal.

The unfunded accrued liability decreased from $21,128,577 to $20,436,456 during the year, a decrease of $692,121. The following is an approximate analysis of this change:

Decreases:		
Amortization Contribution	$435,680	
Excess Interest	61,542	
Salary Scale Gain	960,148	
		$1,457,370
Increases:		
Change in Assumed Benefit Period - Children	$ 50,080	
Mortality and Termination Loss - Actives	591,171	
Mortality Loss - MAFBF	123,998	
		765,249
		$ 692,121

The salary scale gain is partly a correction of an overstated salary scale loss reported in 1974. The reason for this has already been covered in the discussion of the amortization contribution.

The benefit payable to children of deceased members ceases at age 18 unless the child continues to be a full-time student in which case it continues on to age 22. In prior years, we have set up the reserve for a benefit payable to age 18 and then put up the additional reserve when the child was reported as continuing. Since most children are now continuing, we decided this year to start taking the more conservative approach, set up the reserve for a benefit payable to age 22 and then release the reserve if the child's benefit actually ceased prior to age 22. This change in practice produced the one-time item of $50,080 shown above.

3. Unfunded Cost of Vested Benefits

The Commission requested the actuaries for the various funds to present an additional item of information consisting of the present value of benefits earned to the date of valuation and to compare this present value with the assets. For the Highway Patrol, the following results were obtained:

Active Members with Less Than 10 Years of Service - Refund of Contributions	$ 1,387,433
Vested Active Members:	
Present Value of Deferred Benefits	28,372,511
Death Benefit - Refund of Contributions	173,628
Inactive Members	8,246,312
Total	$38,179,884
Assets at Cost	22,910,417
Unfunded Cost of Vested Benefits	$15,269,467
Ratio of Assets to Total	60.0%

Funding ratio for vested benefits

The Commission also asked for a determination of the rate of return on investments which would make the present value of benefits equal to the assets. For this purpose, we feel that the assets should be valued at market. Furthermore, for benefits payable from the Adjustable Fund, we are of the opinion that the reserves should continue to be based on a 5% interest assumption and the higher rate be used only for the period prior to retirement.

A trial rate of 25% produced the following reserves:

Active Members with Less Than 10 Years of Service - Refund of Contributions	$ 1,387,433
Vested Active Members:	
Present Value of Deferred Benefits	12,693,866
Death Benefit - Refund of Contributions	77,662
Inactive Members	7,710,124
Total	$21,869,085
Assets at Market	$22,295,255

Therefore, a rate of return close to 25% would be required.

The above results include a 5% annual augmentation in the benefits of the vested active members from the valuation date to the date of retirement. If the augmentation is eliminated, then the reserves at 5% and at 18% turn out as follows:

	Interest Assumption	
	5%	18%
Active Members with Less Than 10 Years of Service	$ 1,387,433	$ 1,387,433
Vested Active Members:		
Present Value of Deferred Benefits	21,170,869	13,042,844
Death Benefit	173,628	97,595
Inactive Members	8,128,387	7,761,978
Total	$30,860,317	$22,289,850
Assets, Cost and Market	22,910,417	$22,295,255
Unfunded Cost of Vested Benefits	$ 7,949,900	
Ratio of Assets to Total	74.2%	

With the removal of the augmentation, the ratio of assets to present value of vested benefits increases from 60.0% to 74.2%, and the required rate is reduced from 25% to 18%.

4. Supplemental Experience Study

As required by statute, a Supplemental Experience Study for the period July 1, 1971 to June 30, 1975 was submitted in addition to the valuation report.

For all participants except a small number from the State Police Officers group, an average retirement age of 57.0 is assumed. The average age of new retirees has ranged from 58.9 to 59.6 during the 4-year period which indicates some margin in the assumed average age.

The data for the active lives showed a total of 2,915.5 years of life exposed to the risk of death, withdrawal and disablement during the 4-year period. We remark that this is a small exposure to use as the basis for an experience study. The following summary compares the number of deaths, withdrawals and disablements with the number predicted by the actuarial assumptions:

	Expected	Actual	A/E
Deaths	15.70	6	38.2%
Withdrawals	33.13	35	105.6%
Deaths and Withdrawals	48.83	41	84.0%
Disablements	8.65	4	46.2%

(For deaths and withdrawals, a ratio below 100% is unfavorable. For disablements, a ratio below 100% is favorable.)

For inactive lives, the comparison between the predicted number of deaths and the actual follows:

Class	Expected	Actual	A/E
Retired	25.54	28	109.6%
Widows	6.49	7	107.9%
Disabled	0.07	0	0.0%
Deferred	0.44	1	227.3%

The unfavorable mortality ratio for active lives plus ratios close to 100% for retired members and widows suggests the consideration of a more conservative mortality table.

5. Conclusion

In our opinion, the statutory contributions for this plan are sufficient to pay the normal cost each year and to retire the deficit by 1997. This opinion is based upon cost figures obtained by the entry age normal cost method and upon the valuation assumptions. However, a more conservative mortality assumption should be considered, especially for ages below age 55.

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Commission Actuaries

In accordance with Chapter 356 of Minnesota Laws 1974 as amended in 1975, this supplemental experience study covering the period July 1, 1971 to June 30, 1975 is submitted for the Minnesota Highway Patrol Officers' Retirement Association.

The annual valuation reports show the rate of return on investments and the changes in the salary picture, and they follow the average retirement age year by year. Therefore, additional study of these items is not needed, but the following summary from the annual reports is presented:

July 1	Average Salary	Average Inv. Rate	Average Retirement Age*	
			All Lives	New Retirements
1971	$10,283	6.75%	57.7;65.4	55.0; 59.0
1972	10,541	4.80	57.2;65.3	58.9; 63.5
1973	12,294	5.42	57.6;64.9	57.2; 62.7
1974	14,975	5.85	57.5;64.7	59.5; 64.3
1975	14,775	5.46	59.9	59.6

* Prior to 1975, separate information is given for the Highway Patrol and State Police Officers.

The law specifies that a 3 1/2% salary increase assumption be used, and the above summary shows increases at the rate of about 9 1/2% for the past four years. However, since costs as a percentage of payroll have not increased in years when benefits were not improved, the salary increases in excess of the assumed rate must have been inflationary in nature with a rise in the level of the entire payroll including those newly hired.

The rate of return on investments compares favorably with the assumed rate required by law, namely 3 1/2% for the plan years ending in 1972 and 1973 and 5% for those ending in 1974 and 1975.

We based the valuations on the following assumed average retirement ages for the various years.

July 1	Highway Patrol	State Police
1972	57.0	62.5 (All SPO)
1973	57.0	62.5 (All SPO)
1974	57.0	62.5 (Only SPO hired before 7-1-61)
1975	57.0	62.5 (Only SPO hired before 7-1-61)

Thus, we have a margin in the assumed average retirement age.

The data for the active lives showed a total of 2,915.5 years of life exposed to the risk of death, disablement and withdrawal during the 4-year period. This is a small exposure to use as the basis for an experience study. Inactive lives are exposed only to the risk of death, and the following shows the years of exposure by class of inactive life:

Class	Years
Retired	530.0
Widows	234.5
Disabled	9.5
Deferred	54.5
Total	828.5

Again, even the total is a small exposure, and some of the classes have exposures too tiny to produce meaningful results.

The following summary for the active lives compares the actual number of deaths, terminations and disablements with the number predicted by the actuarial assumptions:

Active Lives

	Expected	Actual	A/E
Deaths	15.70	6	38.2%
Terminations	33.13	35	105.6
Deaths and Terminations	48.83	41	84.0
Disablements	8.65	4	46.2

We comment that for deaths and terminations, a ratio below 100% is unfavorable and a ratio above 100% is favorable. For disablements, the reverse is true. It appears that the mortality assumption is not conservative, but this is offset by favorable experience on terminations and disablements.

The following summary for inactive lives compares the actual number of deaths with the predicted number for each class:

Inactive Lives

Class	Expected	Actual	A/E
Retired	25.54	28	109.6%
Widows	6.49	7	107.9
Disabled	0.07	0	0.0
Deferred	0.44	1	227.3
	32.54	36	110.6%

Although the experience among inactive lives appears to be favorable, it should be pointed out that a favorable ratio for retired lives does not necessarily tell the whole story. If the deceased member has elected an option, his death does not produce as large an actuarial gain as the death of a retiree who has not elected an option.

This fact plus the unfavorable mortality ratio for active lives suggests that a more conservative mortality assumption be used in future valuations. This possibility will be given serious consideration.

Franklin C. Smith

Franklin C. Smith