MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

ACTUARIAL VALUATION AND
EXPERIENCE STUDY AS OF
JUNE 30, 1979

May 2, 1980

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May 2, 1980

Board of Directors
Minnesota State Retirement System
529 Jackson at 10th Street
St. Paul, Minnesota 55101

Gentlemen:

Enclosed herewith is our report setting forth the results of our June 30, 1979 actuarial valuation and experience study for the Highway Patrolmen's Fund.

The valuation and experience study were performed on the basis of accepted actuarial methods and procedures, in accordance with the applicable provisions set forth in Minnesota Statutes (Chapter 356) and stipulated in the Contract between the State of Minnesota and The Wyatt Company.

We hereby certify that on the basis of our valuation, contributions required from employees and the State under Minnesota Statutes (Chapter 352) are adequate to provide benefits payable from the Fund. Furthermore, the entry age normal cost method was utilized in determining the accrued liability for all benefits payable under the Fund.

If, in connection with this valuation of the Fund, additional investigations are indicated, we will be happy to undertake any further computations that may be desired.

Respectfully submitted,

THE WYATT COMPANY

Allan J. Grosh
Fellow, Society of Actuaries

Alan J. Schutz
Associate, Society of Actuaries

AJS:srw

TABLE OF CONTENTS

TABLES

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Actuarial Valuation and Experience Study as of June 30, 1979

INTRODUCTION

Chapter 356 of the Minnesota Statutes, as in effect on June 30, 1979, requires that an actuarial valuation be performed annually. In addition, the Statutes require that the appropriateness of the actuarial assumptions utilized in the valuation be tested by performing an experience study every fourth year.

This report sets forth the results of the actuarial valuation and experience study performed as of June 30, 1979 in compliance with the requirements of the Statutes. The report is divided into two principal parts as follows:

A. PART I - ACTUARIAL VALUATION

This part sets forth the determination of the financial status of the plan as of June 30, 1979. As required by Statutes this determination was prepared using the entry age normal cost method, a prescribed assumed interest rate and salary scale assumption of 5% and 3½% respectively, as well as the actuarial assumptions summarized in later tables.

B. PART II - EXPERIENCE STUDY

This part consists of an analysis of experience under the Minnesota State Retirement System, Highway Patrolmen's Fund during the four year period ended June 30, 1979. The analysis centers primarily around a comparison of the actual experience under the plan and that experience projected by the actuarial assumptions used currently for valuation purposes. This enables the actuary to substantiate the appropriateness of the actuarial assumptions or to suggest modifications where necessary.

The last experience study was performed by the firm of George V. Stennes and Associates Consulting Actuaries as of June 30, 1975, and although certain experience deviations were noted, no changes in assumptions were made. Thus, for the most part, the assumptions used in this year's valuation with the exception of any mandated changes have been in effect since 1971.

* * * * * * * * * *

Although recommendations are made pertaining to possible changes in the pre and post-retirement mortality assumptions as a result of the experience analysis, it should be noted that these changes have not been reflected in this valuation. It is anticipated that the full cost impact of these will be discussed and analyzed in detail in the following year preparatory to adoption in the 1980 valuation. This approach has been discussed in detail with the Executive Director.

Respectfully submitted,

THE WYATT COMPANY

Allan J. Grosh
Fellow, Society of Actuaries

Alan J. Schutz
Associate, Society of Actuaries

Minneapolis, Minnesota
May 2, 1980

PART I

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Actuarial Valuation as of June 30, 1979

PURPOSE AND SUMMARY

The purpose of this report is to set forth the financial status of the Minnesota State Retirement System (MSRS), Highway Patrolmen's Fund in accordance with the applicable provisions set forth in Chapter 356 and Chapter 11, Section 11.25 of the Minnesota Statutes.

Chapter 356 of the Minnesota Statutes sets forth the annual reporting requirements which govern the public employee retirement systems in Minnesota. The principal requirements (in addition to the experience study requirements discussed in Part II of the report) are that an actuarial valuation be performed each year and that the valuation specifically set forth the following items based on an assumed 5% interest rate and a 3½% salary scale assumption:

1. The assets of the plan and the present value of all benefits which will be payable from the plan.

2. The normal cost of the plan (as a level percentage of payroll) based on the entry age normal cost method.

3. The accrued liability of the plan, defined as the present value of all benefits less the present value of future entry age normal costs.

4. An actuarial balance sheet showing accrued assets, accrued liabilities, and the deficit from full funding of the accrued liability (unfunded accrued liability).

5. The annual contribution required to pay normal cost and amortize the June 30, 1979 unfunded accrued liability by June 30, 2009.

6. An analysis explaining the increase or decrease in the unfunded accrued liability since the last valuation.

Chapter 11, Section 11.25 of the Minnesota Statutes pertains to the operation of the Minnesota Adjustable Fixed Benefit Fund (MAFB) and includes requirements regarding the determination of present value of benefits payable from MAFB and the corresponding mortality gain or loss each year, the latter to facilitate an appropriate transfer between the Highway Patrolmen's Fund and the MAFB.

This reporting on the status of MSRS as of June 30, 1979, is intended to comply with all of the requirements regarding actuarial reporting that are set forth in Chapters 356 and 11. The Appendix at the end of the report cross references the information set forth herein with that specifically called for under Chapters 356 and 11 respectively.

In summary, our valuation reveals the following:

1. The prescribed contributions mandated by Chapter 352B of the Minnesota Statutes represent 111.3% of those requirements set forth in Chapter 356.

2. This sufficiency will result in full funding of accrued liabilities within 14 years assuming assumptions utilized are realized.

3. The depth of funding ratio, defined as the assets divided by the present value of accrued benefits on an ongoing basis, was 65.87% as of June 30, 1979.

The results of our valuation underlying the above are set forth in greater detail in the following sections of this report.

CHANGES FROM THE PRIOR YEAR'S REPORTING

This year's valuation reflects two changes in methodology from the prior year's report. The revisions are summarized as follows:

1. The prior year's valuation used basic salary rates as reported. In order to more appropriately reflect actual plan provisions which call for total earnings, we used gross salary as reported for the prior year. We then adjusted this amount to reflect the July 1 rates of increase as discussed later in this report.

2. The manner in which the MAFB Annuity Stabilization Account is disclosed has been revised in accordance with our discussions with the Executive Director.

PRINCIPAL VALUATION RESULTS

The principal results of our valuation may be summarized and compared with those of the June 30, 1978 valuation as follows:

SUMMARY OF PRINCIPAL VALUATION RESULTS

		1978	1979
1.	Normal Cost	1,954,840 (14.19)*	2,398,654 (14.60)*
2.	Accrued Liability	58,725,849	67,797,858
3.	Valuation Assets	36,348,011	41,712,515
4.	Accrued Liability Funding Ratio	61.89%	61.53%
5.	Unfunded Accrued Liability	22,377,838	26,085,343
6.	Chapter 356 Requirement	3,752,758	4,132,865
7.	Prescribed Chapter 352B Requirement	3,856,117	4,600,158
8.	Plan Continuation Liability	**	63,326,307
9.	Number of Years that Prescribed Contributions Fully Fund Accrued Liability	**	14
10.	Continuation Liability Funding Ratio	**	65.87%

* Parentheses indicate item as a percentage of covered payroll.
** Not indicated in prior year's report

The normal cost has increased from 14.19% to 14.60% of covered payroll. Chapter 352B requires that Highway Patrol Officers pay 7% of pay towards normal cost and the State contribute 12% of covered payroll towards normal cost as well as a 9% legislated "additional contribution" by the State for amortizing the unfunded accrued liability. Consequently, after adjusting by .23% of covered payroll for operating expenses, 4.17% (19.00% - 14.60% - 0.23%) in addition to the legislated 9% "additional contribution" is available for amortizing the unfunded accrued liability.

Although the accrued liability of the plan has increased from $58,725,849 to $67,797,858 during the year, the valuation assets of the plan have increased from $36,348,011 to $41,712,515 during the same period. Consequently, the unfunded accrued liability has increased from $22,377,838 on June 30, 1978 to $26,085,343 on June 30, 1979 while the portion of accrued liability funded has decreased from 61.89% to 61.53% during the same period. As explained later in the report, these changes are primarily attributable to a revision in the manner in which salaries have been reported and reflected in the valuation. A detailed reconciliation of the change in the unfunded accrued liability from the prior year's valuation is also set forth later in the report.

The Chapter 356 contribution requirements have increased from $3,752,758 to $4,132,865. The change in the Chapter 356 contribution requirement represents the net effect of (i) extending the time for amortizing the unfunded accrued liability from June 30, 1997 to June 30, 2009, (ii) the change in the manner in which salaries are reported and reflected in the valuation, and (iii) net actuarial gains during the year.

Based on the unfunded accrued liability as of June 30, 1979, and the amount by which prescribed Chapter 352B contributions exceed the Chapter 356 normal cost and assumed operating expenses, we estimate that the unfunded accrued liability will be amortized within 14 years.

The present value of accrued benefits, determined on a <u>plan continuation</u> basis (applying <u>all</u> ongoing actuarial assumptions including assumed salary increases and turnover) was $63,326,307 as of June 30, 1979. As a result, the depth of funding ratio, defined as the valuation assets divided by the present value of accrued benefits, was 65.87%.

Table 1(a) summarizes the results of the valuation in detail, while Table 1(b) sets forth a comparison between the June 30, 1978 and June 30, 1979 principal actuarial valuation results.

VALUATION ASSETS

The Executive Director furnished us with a Financial Report setting forth the assets and liabilities of the Fund as of June 30, 1979. The accounting balance sheet furnished by the Executive Director is set forth in Table 2(a), as adjusted by us to reflect a $339,702 transfer of assets from the Highway Patrolmen's Fund to the MAFB Fund as a result of this year's post-retirement mortality loss regarding MAFB benefits (treatment of MAFB is discussed later in the text).

ACTUARIAL BALANCE SHEETS

Table 2(b) sets forth an actuarial balance sheet summarizing the actuarial valuation. Whereas the previously mentioned accounting balance sheet balances the current assets to date with current accumulated reserves for benefits payable, the actuarial balance sheet compares total assets, including the present value of all future contributions payable to the plan, with the present value of all benefits payable from the plan.

Table 3(a) sets forth a balance sheet comparing the assets and unfunded accrued liability (the total of the two equaling the accrued liability) to the current liabilities and reserves required under the plan. This table is in the format specifically required by Chapter 356 and is supported by attachments in the form of Tables 3(b) and 3(c) which set forth the determination of the June 30, 1979 unfunded accrued liability and the June 30, 1979 MAFB Fund Participation respectively.

MINNESOTA ADJUSTABLE FIXED BENEFIT (MAFB) FUND PARTICIPATION

As shown in Table 3(c) the unadjusted MAFB participation reported in the Financial Statements submitted by the Executive Director was $12,066,969. We determined that the liability for benefits payable under the MAFB has increased from $11,801,348 as of June 30, 1978 to $13,288,007 as of June 30, 1979. Taking into account active participant retirements during the year, this reflects a mortality loss of $339,702 since June 30, 1978. Consequently, item 2 of the table indicates a transfer of the $339,702 mortality loss to the MAFB Fund from the Highway Patrolmen's Fund resulting in a June 30, 1979 MAFB Fund participation of $12,406,671.

The MAFB Fund is basically a vehicle for providing variable annuity payments to pensioners, where the changes in benefit levels from year to year depend on investment performance of the fund. When an active participant retires, assets equal to the present value of future benefits payable to that participant (and beneficiary, if applicable) are transferred from the State and Employee Contribution Reserves to the MAFB Fund. Thereafter, benefits paid to the retiree are made from the MAFB Fund.

Each year, as required by Section 11.25 of the Statutes, as part of a determination whether benefits are to be adjusted, the present value of all future benefits payable from the MAFB are compared to assets on hand in the MAFB Fund after adjustment for mortality gains or losses. The magnitude of the Annuity Stabilization Account (or ASA, which is defined as the adjusted assets on hand in the MAFB Fund less the present value of benefits for retirees in MAFB) determines whether benefits are to be adjusted. If the ASA is positive, then based on a formula set forth in the Statutes, part of this surplus may be used to increase benefits for eligible retirees. If the ASA is negative, then again according to formula, benefits to eligible retirees could decrease, although according to Statute, benefits may not be decreased below their original level upon retirement (or the level on July 1, 1976, whichever is greater).

The ASA has remained fairly stable, with the negative account balance of $917,546 as of June 30, 1978 reducing slightly to a negative balance of $881,336 as of June 30, 1979. This year's ASA has been reflected in all of the tables and balance sheets as follows:

ACCOUNTING TREATMENT OF MAFB AND ASA

ASSETS:	
• Actual Participation	$12,406,671
LIABILITIES:	
• Present Value of Benefits Payable from MAFB as of June 30, 1979	13,288,007
• Annuity Stabilization Account	(881,336)
• Total Liability Equals Reserves Required by MSRS	$12,406,671

In fact, the approach taken is to reflect assets and liabilities as offsetting items with no resulting surplus or deficit to the Highway Patrolmen's Fund, the intent of the Statutes in our opinion. This approach suggests that if the ASA is positive, any surplus simply represents a liability to MAFB for future increases. On the other hand, if it is negative, this deficit represents a fund deficiency in the MAFB which in the absence of legislated ad hoc adjustments, must be covered in full before future increases are granted.

The above represents a slight change from procedures in the prior year's report which we have discussed in detail with the Executive Director. In the prior year's report, the negative ASA was treated as a positive asset rather than a negative liability. Under either method the same unfunded accrued liability and Chapter 356 requirements result.

It is our opinion that our method reflects a consistent treatment throughout the report and presents items for disclosure purposes in a uniform manner. In addition, it is consistently being used in all MSRS valuations.

RECONCILIATION OF THE UNFUNDED ACCRUED LIABILITY

Tables 4 and 5 reconcile the change in the unfunded accrued liability during the year. Table 4 sets forth an accounting balance sheet illustrating that the increase in the unfunded accrued liability is equal to the excess of deductions over income during the year, where any increase in required actuarial reserves is indicated as a deduction item.

Table 5 sets forth our analysis of the change in the unfunded accrued liability. As is shown in detail in the table, the unfunded accrued liability increased from $22,377,838 on June 30, 1978 to $26,085,343. This increase has resulted primarily on account of:

1. A reduction due to contributions (employee plus employer) in excess of normal cost, operating expenses and interest on the unfunded accrued liability, in the amount of $1,136,469.

2. An increase of $5,469,555 due to a methodology change concerning reporting of annual salaries. In prior years, base monthly salary rates were reported and reflected in the valuation. The Statutes, however, call for benefits which are based on actual earnings. The $5,469,555 increase has resulted due to the fact that actual salaries during the year are significantly higher than simple application of basic monthly rates would indicate, because of the interplay of overtime pay which is significant in this case.

3. A decrease due to a net actuarial gain of $625,581.

The net actuarial gain is attributable to the extent that gains from all causes of turnover ($1,301,034) and investment performance ($693,138) have exceeded losses on account of salary increases ($1,028,889, after methodology changes are taken into account) and the MAFB mortality loss.

EMPLOYEE DATA

The Executive Director furnished us with employee information pertaining to all active members, inactive members and retired members of the Fund. Tables 6(a) and 6(b) summarize the changes in active, inactive and retired membership during the year in accordance with the requirements set forth in Section 356.215 of the Minnesota Statutes, Subdivisions 4 and 5.

As noted earlier, to more appropriately reflect the fact that the plan calls for gross salaries to be used in determining benefits payable, we used gross salaries as reported for the prior year as the compensation base for this valuation. In prior years, base salary rates were employed for this purpose. A preliminary analysis indicated that overtime pay accounts for a significant portion of gross earnings and in our opinion should be taken into account to more accurately reflect potential plan costs.

The data reported as of June 30, 1979 reflects a covered payroll of $15,034,183 which represents total member earnings during the year ended June 30, 1979. Chapter 356, Section 356.215, Subdivision 4 of the Statutes requires that the actuarial valuation reflect salaries that will be in force during the ensuing fiscal year for which the valuation is being performed. Based on salary information submitted by the Executive Director, it was determined that the average July, 1979 increase was approximately 8.04%. Accordingly, we increased the reported salaries by 8.04%. This has resulted in a covered payroll of $16,429,135 after annualizing the salaries of those members who worked for less than a year during the reporting period.

PLAN VALUED

The provisions of the Minnesota State Retirement System, Highway Patrolmen's Fund are governed principally by Chapter 352B of the Minnesota Statutes. Table 7 sets forth a summary of the principal plan provisions as of

June 30, 1979. No changes in plan provisions were reported since the last actuarial valuation as of June 30, 1978.

ACTUARIAL METHODS AND ASSUMPTIONS

Actuarial Methods

Chapter 356 of the Minnesota Statutes calls for the determination of normal cost and accrued liability in accordance with the entry age normal cost method, one of several available projected cost methods. Several versions of this method are being used today which represent modifications of the "textbook" approach. One such modification has been used in the past by the prior actuary, and we have continued this practice. The impact of this was to produce a lower normal cost and a higher resulting unfunded accrued liability than would result by applying the more "standard" entry age cost method.

Under the method used, the normal cost is first determined (based on the age at hire of each member) as the level annual dollar deposit required to pay for the cost of each member's projected benefits over a period from his date of hire to his date of retirement. The accrued liability is, by definition, equal to the present value of all projected benefits under the plan less the present value of all future normal costs (the level dollar normal costs are used for this purpose). The unfunded accrued liability is the net of the accrued liability and current valuation assets on hand.

To comply with the requirements of Chapter 356 which calls for normal cost to be determined as a level percentage of salary, the level dollar normal cost is then converted to a level percentage of payroll basis, by applying an approximation which produces a mathematical equivalency.

Actuarial Assumptions

The actuarial assumptions used for this valuation were identical to those used in prior years and are summarized in Tables 8(a) and 8(b).

PART II

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Experience Study as of June 30, 1979

PURPOSE

An actuarial valuation is basically a procedure under which the financial condition of a retirement program is determined. In addition, the valuation provides a determination of funding requirements which set forth the pattern of expected costs in a uniform, predictable and consistent manner. In order to determine the liabilities and applicable annual contribution amounts several assumptions affecting the level of projected benefits which will become payable under the plan are made. The extent to which any valuation method can accurately measure the financial liabilities of a retirement program depends heavily on whether or not the actuarial assumptions, in the aggregate, closely reflect actual experience under the plan.

The purpose of this experience study as called for under Chapter 356 of Minnesota Statutes is to compare "expected experience" predicted by the actuarial assumptions, with "actual experience" over the past four years (July 1, 1975 through June 30, 1979) with a view toward revising those assumptions which prove inconsistent with actual experience and in the aggregate would produce material cost deviations. This study consists of such a comparison and analysis with regard to the following assumptions which are used along with the 5% assumed interest rate and 3½% assumed salary increases mandated by Chapter 356 of the Minnesota Statutes:

1. Separation from service on account of:
    a. Withdrawal;
    b. Death;

c. Disability;

d. Retirement.

2. Mortality experience of retired and disabled annuitants.

3. Operating expense levels.

EXPERIENCE DATA

We have examined the emerging experience of the plan during the four year period ending June 30, 1979. The data, submitted by the Executive Director of the Minnesota State Retirement System, included those items necessary for the June 30, 1979 valuation along with copies of the data submitted to the System's prior actuaries for performance of the June 30, 1976, June 30, 1977 and June 30, 1978 actuarial valuations. The basic data includes all active and retired members reported on the prior four valuation dates as follows:

SUMMARY OF EXPERIENCE DATA FOR THE FOUR YEAR PERIOD ENDING JUNE 30, 1979

Year Ending	Active Participants	Retired Participants*
June 30, 1976	759	224
June 30, 1977	768	222
June 30, 1978	756	244
June 30, 1979	751	258

*Includes disabled

The study has not been done on a sex specific basis as in the case with the analysis for the State Employees Retirement Fund, since the majority of members are male.

In the following sections we summarize the results of the experience study and analyze the appropriateness of the actuarial assumptions with respect to the anticipated impact on the overall cost of the plan. Specific recommendations for any changes are set forth in the last sub-part of this analysis (Summary and Recommendations).

SUMMARY OF RESULTS - RATES OF SEPARATION FROM ACTIVE SERVICE

As follows, we have summarized the expected experience versus actual experience pertaining to rates of separation from active service. It should be noted that expected experience was based on each year's valuation data and on the rates set forth in the active service table (Table 8(b)) later in this report.

1. Withdrawal

The actuarial valuation of the Highway Patrolmen's Fund includes assumptions as to the rate of turnover. That is, based on a member's age, rates of withdrawal prior to reaching retirement age are assumed. The following table sets forth a comparison of actual termination experience over the past four years with that projected by the rates set forth in the present active service table:

WITHDRAWAL PRIOR TO RETIREMENT	
Expected Withdrawal	29
Actual Withdrawal	34
Experience Ratio	117.2%

The assumed withdrawal rates have resulted in an expected number of assumed quits which fairly closely parallel actual experience. The slight excess of actual terminations over those expected introduces a small degree of conservativeness into the valuation and we recommend that this assumption be maintained.

2. Mortality

The following schedule compares actual deaths among active members with the number projected by the assumed mortality rates which are based on the 1959-61 United States Life Tables:

MORTALITY PRIOR TO RETIREMENT	
Expected Deaths	18
Actual Deaths	7
Experience Ratio	38.9%

The above indicates that deaths have occurred about 38.9% as frequently as expected over the past four years. Although the data is somewhat sparse to suggest a direct quantitative result, it is clear that actual mortality has been lower than that assumed. As discussed in more detail in the Summary and Recommendations section, we would recommend that the mortality assumption be revised to reflect the lower actual mortality. It might be noted that the trend towards decreasing mortality has been very common, and that several actuarial mortality tables reflecting this improved mortality experience have been developed in recent years. This change will result in increases in Chapter 356 requirements.

3. Disability

The valuation utilizes rates of assumed disability retirement based on age. Although the plan has different disability provisions for on and off duty disablements, the application of the workers' compensation offset to the on duty provision more or less results in the two provisions being comparable. Therefore, disability experience has been analyzed in the aggregate.

The following table sets forth a comparison of the expected and actual disablements over the past four years:

DISABILITY	
Expected Disabilities	11
Actual Disabilities	9
Experience Ratio	81.8%

Disabilities over the past four years have essentially paralleled those projected by the actuarial assumptions over the past four years. We recommend that the assumed rates of disablement be retained.

4. Age Retirement

The valuation assumes that members will retire at age 57, with the exception of a small group of State Police Officers hired prior to July 1, 1961 who are assumed to retire at age 62½. The following denotes a comparison between expected retirements and actual retirements during the past four years:

RETIREMENT	
Expected Retirements	98
Actual Retirements	55
Experience Ratio	56.1%

The above indicates that members are retiring later than assumed and can be substantiated by the following table which summarizes the average retirement age over the past four years:

AVERAGE RETIREMENT AGES

Year Ending	Average Retirement Age
June 30, 1976	60.4
June 30, 1977	58.2
June 30, 1978	57.8
June 30, 1979	59.0

We note that a trend toward earlier retirement seems to have reversed itself during the last plan year.

If members continue to retire later than the assumed age, the plan will experience actuarial gains. We would recommend that this conservative assumption be retained, but that if the trend were to continue, some consideration might be given to changing it when the next experience study is performed.

SUMMARY OF RESULTS - POST RETIREMENT MORTALITY

1. Mortality After Retirement

The valuation utilizes a mortality assumption based on the 1959-61 United States Life Tables. This assumption is used for both age retirement and disabled retirement annuitants. The following table sets forth a comparison of actual mortality during the four year period ending June 30, 1979 and that which is expected based on the valuation assumptions:

POST-RETIREMENT MORTALITY	
Expected Deaths	37
Actual Deaths	23
Experience Ratio	62.2%

The table shows that the mortality table is not conservative. This is due primarily to the fact that the mortality basis in use is not designed as an annuitant mortality table and therefore, does not have the conservative nature required. This is borne out by the fact that there have been post-retirement mortality losses in each of the past four years. Based on this, we recommend that the post-retirement mortality assumption be revised to a modern annuitant table which reflects the recent trend towards improved mortality. This recommendation is consistent with that being made for pre-retirement mortality and its impact operates in the same direction resulting in increases in actuarial requirements.

SUMMARY OF RESULTS - EXPENSE PROVISIONS

The present valuation assumes that the expenses for the year just ended will apply for the coming year and we see no reason for any change in this procedure.

SUMMARY AND RECOMMENDATIONS

The results of the experience study may be conveniently summarized by the following table, which denotes the ratio of actual experience to that expected by the actuarial assumptions, and sets forth whether or not the disparity between actual and expected experience is (i) on the conservative side (e.g., a change in the indicated direction would reduce requirements), (ii) close enough to be within most statistical tolerance limits, or (iii) not conservative (e.g., an indicated change would increase requirements).

SUMMARY OF EXPERIENCE STUDY

	Percentage of Actual Experience to that Expected	
Assumption	Percentage	Conservative
Withdrawal	117.2	yes
Mortality Prior to Retirement	38.9	no
Disability	81.8	close
Retirement	56.1	yes
Mortality After Retirement	62.2	no

The relative differences between the actual experience and that expected based on the direct application of the actuarial assumptions suggest the same trends reported in the 1975 experience study. Based on these results, we recommend the following:

1. The assumptions concerning rates of termination and disablement should be retained.

2. The assumed retirement age of 57 (62.5 for State Police hired before July 1, 1961) should be retained, with an eye towards increasing the assumption to 58 or 59 if substantiated in future years.

3. The pre and post-retirement mortality assumptions should be revised to reflect the recent trend toward improved mortality. For this purpose, we would recommend the 1971 Group Annuity Mortality Table (or modification thereof). This table was prepared by the Society of Actuaries in order to reflect recent improvements in mortality. In accordance with standard usage of this table, we recommend that female rates be based on the male table, with ages set back six years.

   It should be noted that a change in the mortality basis will increase the reported present value of benefits to be payable from MAFB and serve to reduce or diminish future MAFB mortality losses. Based on a discussion with the actuary for the Legislative Commission on Pensions, we concur that the simplest and most equitable manner in which to reflect this would be to transfer funds from MSRS to the MAFB in the amount of the increase in reserve requirement produced by the revised mortality basis. In this way MSRS would essentially be making a one time payment to eliminate future anticipated mortality losses which will occur if use of the 1959-61 United States Life Tables are retained for retirees. The latter result was experienced in all of the last four years.

4. The method of determining the assumed expense provision should be retained.

We suggest in accordance with the above, that the cost impact on Chapter 356 requirements of the Minnesota Statutes be analyzed completely in the ensuing fiscal year such that changes, if deemed material and necessary, be implemented in the 1980 valuation.

Table 1(a)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Summary of Actuarial Valuation as of June 30, 1979

A.	BASIC DATA	
	1. Active Members	
	a. Number	770
	b. Covered payroll	16,429,135
	c. Average prospective annual benefit 1/	24,209
	2. Retired Members/Beneficiaries	
	a. Number	304
	b. Average annual benefit payable	4,786
	3. Deferred Annuitants	
	a. Number	17
	b. Average annual vested benefit	6,076
	4. Former Members Without Vested Rights	
	a. Number	12
	b. Average employee contributions	142
B.	BASIC FINANCIAL RESULTS	
	1. Normal Cost	2,398,654
	2. Accrued Liability	67,797,858
	3. Valuation Assets	41,712,515
	4. Portion of Accrued Liability Funded	61.53%
	5. Unfunded Accrued Liability [2 - 3]	26,085,343
C.	DETERMINATION OF ANNUAL REQUIREMENT IN ACCORDANCE WITH CHAPTER 356 2/	
	1. Normal Cost	2,398,654 (14.60)
	2. Assumed Operating Expenses	37,322 (0.23)
	3. Amortization of the Unfunded Accrued Liability by June 30, 2009	1,696,889 (10.33)
	4. Total Chapter 356 Requirement [1 + 2 + 3]	4,132,865 (25.16)
D.	DETERMINATION OF CONTRIBUTION SUFFICIENCY 3/	
	1. Actual Prescribed Contributions (Chapter 352B)	
	a. Employee Contributions	1,150,040 (7.00)
	b. Employer "matching" contribution	1,971,496 (12.00)
	c. Employer "additional" contribution	1,478,622 (9.00)
	d. Total of (a) through (c)	4,600,158 (28.00)
	2. Chapter 356 Requirements [Per Item C.4.]	4,132,865
	3. Sufficiency [1.(d) ÷ 2]	111.3%
	4. Number of Years "Additional" Contributions Will Amortize Unfunded Accrued Liability Not Being Funded by Prescribed "Matching" Contributions	14
	5. Portion of Prescribed Contributions Other Than "Additional" Contributions Available for Funding of Unfunded Accrued Liability	685,095
E.	DEPTH OF FUNDING - PLAN CONTINUATION BASIS	
	1. Present Value of Accrued Benefits	
	a. Active members	49,082,214
	b. Deferred annuitants	895,062
	c. Former members without vested rights	1,708
	d. Survivors - Children	169,261
	e. Disabled members	771,391
	f. Benefits payable from MAFB Fund	13,288,007
	g. Annuity Stabilization Account	(881,336)
	h. Total present value of accrued benefits	63,326,307
	2. Valuation Assets	41,712,515
	3. Portion of Accrued Benefits Funded [2 ÷ 1(h)]	65.87%

1/ Reflects assumed increases in salary as set forth in Table 8(a).

2/ Chapter 356 requirements reflect revisions in the law effective for valuations performed subsequent to June 1, 1979. Parentheses indicate Chapter 356 contribution levels as a percentage of salary.

3/ Estimated July 1, 1979 - June 30, 1980 contributions on an accrual basis. Parentheses indicate statutory annual contribution levels as a percentage of salary, as set forth in Chapter 352 of the Minnesota Statutes.

Table 1(b)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Comparison of 1978 and 1979 Actuarial Valuation Results

		1978		1979
1.	Active Members			
	a. Number	751		770
	b. Covered payroll	13,771,848		16,429,135
	c. Average prospective annual benefit 1/	N/A		24,209
2.	Retired Members/Beneficiaries			
	a. Number	291		304
	b. Average annual benefit payable	4,460		4,786
3.	Deferred Annuitants			
	a. Number	19		17
	b. Average annual vested benefit	6,152		6,076
4.	Former Members Without Vested Rights			
	a. Number			12
	b. Average employee contributions			142
5.	Normal Cost 2/ 3/	1,954,840 (14.19)		2,398,654 (14.60)
6.	Accrued Liability	58,725,849	3/	67,797,858
7.	Valuation Assets	36,348,011	3/	41,712,515
8.	Unfunded Accrued Liability	22,377,838		26,085,343
9.	Revised Chapter 356 Requirement (Normal Cost Plus Amortization by 2009) 3/ 4/	3,444,988 (25.01)		4,132,865 (25.16)
10.	Prior Chapter 356 Requirement (Normal Cost Plus Amortization by 1997) 3/ 4/	3,752,758 (27.25)		4,667,479 (28.41)
11.	Present Value of Accrued Benefits - Plan Continuation Basis 5/	N/A		63,326,307
12.	Depth of Funding [7 ÷ 11] 5/	N/A		65.87%

1/ Per salary scale assumption set forth in Table 8(a). Amount for 1978 not readily available from prior report.
2/ Parentheses indicate contribution levels as a percentage of salary.
3/ Not including Annuity Stabilization Account.
4/ Including assumed operating expenses. See text for a description of the recent revisions to Chapter 356 of the Minnesota Statutes. Parentheses indicate contribution levels as a percentage of salary.
5/ Not indicated in prior year's report.

Table 2(a)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Accounting Balance Sheet as of June 30, 1979

A. ASSETS		
1. Cash		3,548.57
2. Short Term Investments (at Cost)		2,308,216.11
3. Accounts Receivable:		
a. Accrued employee contributions	32,035.14	
b. Accrued employer contributions	96,106.15	
c. Other	387.60	128,528.89
4. Accrued Interest on Investments		319,233.45
5. Dividends Declared and Payable, but Not Yet Received		61,410.49
6. Investment in Debt Securities at Amortized Cost		12,516,080.10
7. Investment in G.N.M.A.'s at Amortized Cost		1,220,302.54
8. Investment in Equities at Cost 1/		13,001,763.30
9. Deferred Yield Adjustment Account		144,322.64
10. Participation in the MAFB Fund		12,406,671.21
11. TOTAL ASSETS		42,110,077.30
B. LIABILITIES AND RESERVES		
Liabilities		
1. Accounts Payable		
a. Security purchases	26,480.00	
b. Accrued expenses	873.00	
c. Due MAFB for Mortality Loss	339,702.00	
d. State Employees Retirement Fund	29,624.29	396,679.29
2. Suspense Item: Unredeemed 6 Year Old Warrants		882.60
3. Total Liabilities		397,561.89
Reserves		
1. Minnesota Adjustable Fixed Benefit Fund		
a. Actuarial reserve requirement	13,288,007.00	
b. Annuity stabilization reserve	(881,335.79)	12,406,671.21
2. Disability Benefit Reserve		771,391.00
3. Survivor Benefit Reserve - Children		169,261.00
4. Employee Contribution Reserve		8,505,215.16
5. State Contribution Reserve		19,859,977.04
6. Total Reserves (Valuation Assets) 2/		41,712,515.41
7. TOTAL LIABILITIES AND RESERVES		42,110,077.30

1/ Market value as of June 30, 1979 is $13,527,609.

2/ Portion of assets to be applied as valuation assets towards providing benefits.

Table 2(b)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Actuarial Balance Sheet as of June 30, 1979

A. ASSETS		
1. Assets on Hand from Accounting Balance Sheet:		
a. Participation in MAFB Fund	12,406,671	
b. All other assets	29,703,406	42,110,077
2. Present Value of Employees' Future Contributions		13,347,145
3. Present Value of State Future Contributions Applicable to:		
a. Entry age normal cost	15,053,121	
b. Unfunded accrued liability (Balance of "matching" contribution less .23% for operating expense)	7,951,085	
c. Unfunded accrued liability (Portion to be funded by "additional" contribution)	18,134,258	41,138,464
4. TOTAL ASSETS		96,595,686
B. LIABILITIES		
1. Current Liabilities from Accounting Balance Sheet		397,562
2. Present Value of Earned and Earnable Benefits Payable to Presently Active Members:		
a. Retirement benefits	69,712,190	
b. Disability benefits	5,375,207	
c. Refundments due to death or withdrawal	504,263	
d. Surviving spouse benefits	4,390,633	
e. Vested termination benefits	1,971,738	81,954,031
3. Present Value of Benefits for Deferred Annuitants:		
a. Retirement benefits	887,534	
b. Refundments due to death	7,528	895,062
4. Present Value of Refundments to Former Members Without Vested Rights		1,708
5. Present Value of Survivor Benefits - Children		169,261
6. Present Value of Disability Benefits		771,391
7. Present Value of Benefits Payable from MAFB Fund		13,288,007
8. MAFB Fund Annuity Stabilization Account		(881,336)
9. TOTAL LIABILITIES		96,595,686

Table 3(a)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Chapter 356 Balance Sheet as of June 30, 1979

ASSETS AND UNFUNDED ACCRUED LIABILITY

A.	ASSETS		
1.	Cash		3,548.57
2.	Short Term Investments (at Cost)		2,308,216.11
3.	Accounts Receivable:		
	a. Accrued employee contributions	32,035.14	
	b. Accrued employer contributions	96,106.15	
	c. Other	387.60	128,528.89
4.	Accrued Interest on Investments		319,233.45
5.	Dividends Declared and Payable, but Not Yet Received		61,410.49
6.	Investment in Debt Securities at Amortized Cost		12,516,080.10
7.	Investment in G.N.M.A.'s at Amortized Cost		1,220,302.54
8.	Investment in Equities at Cost		13,001,763.30
9.	Deferred Yield Adjustment Account		144,322.64
10.	Participation in the MAFB Fund		12,406,671.21
11.	Total Assets		42,110,077.30
B.	UNFUNDED ACCRUED LIABILITY		
1.	Unfunded Accrued Liability to be Funded by Portion of Employee Contributions and State "Matching" Contribution in Excess of Entry Age Normal Cost Contribution and Operating Expenses		7,951,085.00
2.	Unfunded Accrued Liability to be Funded by States "Additional" Contribution		18,134,258.00
3.	Total Unfunded Accrued Liability		26,085,342.59
4.	TOTAL ASSETS AND UNFUNDED ACCRUED LIABILITY		68,195,419.89

CURRENT LIABILITIES AND RESERVES REQUIRED

C.	LIABILITIES		
1.	Accounts Payable:		
	a. Security purchases	26,480.00	
	b. Accrued expenses	873.00	
	c. Due MAFB for mortality loss	339,702.00	
	d. Due State Employees Retirement Fund	29,624.29	396,679.29
2.	Suspense Item: Unredeemed 6 Year Old Warrants		882.60
3.	Total Liabilities		397,561.89
D.	RESERVES REQUIRED		
1.	Total Reserves Required per Attached Table 3(b)		67,797,858.00
2.	TOTAL CURRENT LIABILITIES AND RESERVES REQUIRED		68,195,419.89

NOTE: Accumulated contributions, without interest, of members not yet retired amounted to $8,505,215.16 as of June 30, 1979 (includes accrued but unpaid contributions).

Table 3(b)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Determination of Accrued Liability and
Unfunded Accrued Liability as of June 30, 1979

	Present Value of Benefits	Present Value of Applicable Portion of Normal Cost Contribution	Accrued Liability Equals Reserves Required (1)-(2)
A. DETERMINATION OF ACCRUED LIABILITY			
1. Active Members			
a. Retirement benefits	69,712,190	20,792,394	48,919,796
b. Disability benefits	5,375,207	3,088,911	2,286,296
c. Refundments due to death or withdrawal	504,263	514,818	(10,555)
d. Survivor and childrens' benefits	4,390,633	2,955,439	1,435,194
e. Vested termination benefits	1,971,738	1,048,704	923,034
2. Deferred Annuitants	895,062	---	895,062
3. Former Members Without Vested Rights	1,708	---	1,708
4. Survivors - Children	169,261	---	169,261
5. Disabled Members	771,391	---	771,391
6. Benefits Payable From MAFB Fund	13,288,007	---	13,288,007
7. MAFB Fund Annuity Stabilization Account	(881,336)	---	(881,336)
8. Total	96,198,124	28,400,266	67,797,858
B. DETERMINATION OF UNFUNDED ACCRUED LIABILITY			
1. Accrued Liability	---	---	67,797,858
2. Valuation Assets	---	---	41,712,515
3. Unfunded Accrued Liability [1 - 2]	---	---	26,085,343

Table 3(c)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Determination of MAFB Fund Participation
and MAFB Fund Annuity Stabilization Account
as of June 30, 1979

1.	Unadjusted MAFB Fund Participation as of June 30, 1979	12,066,969
2.	Transfer to MAFB Fund from Highway Patrolmen's Fund for 1979 Mortality Loss	339,702
3.	MAFB Fund Participation after Transfer [1 + 2]	12,406,671
4.	Present Value of Benefits Payable from MAFB Fund 1/	13,288,007
5.	MAFB Fund Annuity Stabilization Account [3 - 4]	(881,336)

1/ Allocated to members eligible or not eligible to participate in any January 1, 1980 increases as follows:

a.	Liability for members eligible to participate in increase	11,497,086
b.	Liability for members not eligible to participate in increase	1,790,921

Table 4

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Analysis of Income and Deductions From Income and Effect on the Unfunded Accrued Liability

A.	INCOME		
1.	From Employees		
	a. Employee contributions	1,034,896.78	
	b. Employee accrued contributions receivable	32,035.14	1,066,931.92
2.	From Employers		
	a. Employer contributions	1,754,849.67	
	b. Employer additional contributions	1,322,304.95	
	c. Employer accrued contributions receivable	96,106.15	3,173,260.77
3.	From Investments		
	a. Interest on securities	1,201,633.05	
	b. Dividends on corporate stock	661,116.85	
	c. Recognized unrealized appreciation on stock	0.00	
	d. Gain on sale of securities	45,326.10	
	e. Interest on back payments by employees	829.11	1,908,905.11
4.	From MAFB Fund Participation		
	a. Participation in MAFB Fund Income		706,273.07
5.	Prior Year Adjustment		248.60
6.	TOTAL INCOME		6,855,619.47
B.	DEDUCTIONS FROM INCOME		
1.	Benefits		
	a. Service retirement annuities	1,326,500.77	
	b. Disability retirement benefits	63,564.90	
	c. Survivor benefits (children)	37,563.52	1,427,629.19
2.	Refundments (Employee Contributions)		
	a. Left service	23,299.89	
	b. Erroneous deductions	2,862.89	26,162.78
3.	Operating Expenses 1/		37,322.29
4.	Increase in Total Reserves Required		
	a. Reserves required 6/30/78	58,725,849.00 2/	
	b. Reserves required 6/30/79	67,797,858.00	9,072,009.00
5.	TOTAL DEDUCTIONS FROM INCOME		10,563,123.26
6.	EXCESS OF DEDUCTIONS FROM INCOME OVER INCOME		3,707,503.79
C.	REDUCTION IN UNFUNDED ACCRUED LIABILITY		
1.	Unfunded Accrued Liability 6/30/78		22,377,838.80
2.	Unfunded Accrued Liability 6/30/79		26,085,342.59
3.	INCREASE IN UNFUNDED ACCRUED LIABILITY		3,707,503.79

1/ Represents .23% of covered payroll.
2/ Adjusted from prior years report to eliminate the Annuity Stabilization Account.

Table 5

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Analysis of Change in the Unfunded Accrued Liability
During the Fiscal Year Ending June 30, 1979

1.	Unfunded Accrued Liability as of June 30, 1978		22,377,838
2.	Change Due to Current Rate of Funding and Interest Requirements		
	a. 1978 - 79 past service contribution	(2,255,361)	
	b. 5% interest requirement	1,118,892	(1,136,469)
3.	Increase Due to Methodology Change to Reflect Total Actual Earnings in Lieu of Basic Rates of Salary 1/		5,469,555
4.	Change Due to Actuarial Gains (indicated by parentheses) or Losses (no parentheses) Because of Experience Deviations from Expected		
	a. Salary increases	1,028,889	
	b. Investment income	(693,138)	
	c. MAFB mortality loss	339,702	
	d. Withdrawals, death, disability of active members (balancing item)	(1,301,034)	(625,581)
5.	Unfunded Accrued Liability as of June 30, 1979		26,085,343

1/ From base earnings to actual earnings during the prior plan year. Plan benefits are based on actual earnings.

Table 6(a)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Covered Highway Patrolmen Census Data as of June 30, 1979

	Number
Active at June 30, 1978	751
New Entrants	42
Total	793
Less Separations from Active Service:	
Refund of Contributions 1/	5
Separation with a Vested Right to a Deferred Annuity	1
Disability	3
Service Retirement	14
Total Separations	23
Net Transfers To and From Other Plans	
Active at June 30, 1979	770

AVERAGE ENTRY AGE OF NEW EMPLOYEES

For the Fiscal Year Ending	Male	Female	Average of Total
6/30/76	28.3	22.4	27.3
6/30/77	28.1	27.4	28.0
6/30/78	26.1	26.3	26.1
6/30/79	28.2	26.5	28.1

Average age at entry in State service for all active employees at 6/30/79

Male	27.9
Female	26.1
Total	27.9

1/ Includes those who entered the plan and terminated during the period from July 1, 1978 to June 30, 1979.

Table 6(b)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Highway Patrolmen's Plan Annuitant Census Data as of June 30, 1979

		Number	Annual Annuity Benefit Payable
A.	SERVICE RETIREMENT ANNUITANTS		
	Receiving at June 30, 1978	165	996,306.00
	New	16	148,575.00
	Deaths	4	23,481.72
	Adjustments-Net Result	1	7,857.48
	Receiving at June 30, 1979	178	1,129,256.76
B.	DISABLED EMPLOYEES		
	Receiving at June 30, 1978	8	48,240.24
	New	2	21,291.24
	Deaths	0	0.00
	Disability Rescinded	0	0.00
	Adjustments-Net Result	(1)	(6,829.44)
	Receiving at June 30, 1979	9	62,702.04
C.	WIDOWS RECEIVING AN ANNUITY OR SURVIVOR BENEFIT		
	Beneficiaries Receiving an Optional or Reversionary Annuity		
	Receiving at June 30, 1978	53	132,049.92
	New	1	3,497.64
	Deaths	1	2,062.32
	Adjustments-Net Result	0	161.04
	Receiving at June 30, 1979	53	133,646.28

	Number	Annual Annuity Benefit Payable
Spouses Receiving a Survivor Benefit		
Receiving at June 30, 1978	30	83,612.64
New	2	4,136.16
Deaths	0	0.00
Adjustments-Net Result	0	4,915.80
Receiving at June 30, 1979	32	92,664.60
D. CHILDREN RECEIVING A SURVIVOR BENEFIT		
Receiving at June 30, 1978	35	37,709.64
New	0	0.00
Reinstated	1	1,843.08
No longer eligible	4	3,232.92
Adjustments-Net Result	0	295.92
Receiving at June 30, 1979	32	36,615.72
E. DEFERRED ANNUITANTS		
Deferred as of June 30, 1978	19	116,889.00
New	0	0.00
Began Receiving	1	2,086.20
Transfer to Active	1	11,796.00
Adjustments-Net Result	0	287.04
Deferred as of June 30, 1979	17	103,293.84

AVERAGE AGE AT RETIREMENT OF NEW SERVICE ANNUITANTS

Fiscal Year Ending	Average Retirement Age
6/30/76	60.4
6/30/77	58.2
6/30/78	57.8
6/30/79	59.0
All Existing Service Annuitants	59.0

Page 2 of 2

Table 7

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Summary of Principal Plan Provisions as of June 30, 1979

1. Coverage:	From first date of employment.
2. Service Credit:	Service is credited from date of coverage. For State Police Officers hired after July 1, 1961 no service is credited after age 60.
3. Contributions:	
a. Employee:	7% of salary
b. State of Minnesota:	21% of salary.
4. Final Average Salary:	Monthly average for the highest 5 successive years of salary.
5. Normal Retirement:	
a. Eligibility:	Attainment of age 55 and completion of 10 years of service.
b. Benefit Amount:	2-1/2% of Final Average Salary for each of the first 20 years of service plus 2% of Final Average Salary for each year of service thereafter.
6. Form of Payment:	Life annuity with actuarially equivalent options also available.
7. Disability Retirement:	
a. Eligibility:	
. In line of duty:	None.
. Not in line of duty:	Five years of service and less than age 55.
b. Benefit Amount:	
. In line of duty:	50% of average monthly salary plus 2% for each year of service in excess of 20, offset by Workers' Compensation.
. 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; subject to a minimum of 25%.

	c. Death benefits:	If a member dies while receiving a work related disability benefit, or a non-work related disability benefit after having completed 20 years of service, 20% of his Final Average Salary is payable to the surviving spouse.
8.	Deferred Service Retirement:	
	a. Eligibility:	Completion of 10 years of service.
	b. Benefit Amount:	Retirement benefits payable at normal retirement date are determined according to the normal retirement benefit formula based on the member's Final Average Salary and service at termination, such amount being subject to an increase for each year between termination and retirement of 5% for years prior to January 1, 1981 and 3% compounded annually thereafter.
9.	Return of Contributions:	If a member terminates before becoming eligible for any other benefits under the plan, his employee contributions are returned.
10.	Surviving Spouse Death Benefit:	
	a. Eligibility:	Death of member in service.
	b. Benefit Amount:	20% of Final Average Salary.
11.	Children's Death Benefits:	
	a. Eligibility:	Death benefits are payable to children (below age 18, or 22 if a student) of members who die in active service.
	b. Amount:	10% of Final Average Salary, plus $20 per month prorated equally to such children.
	c. Maximum:	Total benefit to all children may not exceed 40% of Final Average Salary.
12.	Repayment of Contributions:	
	a. Eligible Members:	Rehired members.
	b. Repayment Provision:	Such rehired member may repay all refundments made to him, including interest at 5% compounded annually. In such case, service previously credited during the prior period of membership is restored.

13. Combined Service Provisions:

a. Eligible Members: Members who have had coverage under two or more Minnesota Public Retirement Systems, with a total of at least 10 years of credited service.

b. Benefit Provisions: Benefits under both plans are based on the highest Final Average Salary including all years from both plans, and on the plans in effect on the member's last day in covered public employment.

14. Proportionate Annuity: Any member who terminates after attaining age 65 and completing at least 3 years of service is entitled to a proportionate retirement annuity based on his allowable service credit.

Table 8(a)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S PLAN

Summary of Actuarial Assumptions and Methods

1.	Mortality:	United States Life Tables, 1959-61. These tables were used for both active and retired members and for survivors.
2.	Withdrawal:	Graded rates starting at .03 at age 20 and and decreasing uniformly to zero at age 50, as set forth in the Separation From Active Service Table.
3.	Disability:	The rates of disability were adapted from experience of the New York State Employees' Retirement System, as set forth in the Separation From Active Service Table.
4.	Expenses:	Prior year expenses are assumed to be applicable in the coming year.
5.	Interest Rate:	5% per annum.
6.	Salary Scale:	3-1/2% per annum.
7.	Assumed Retirement Age:	Age 57 for Highway Patrolmen and for State Police Officers hired after June 30, 1961. Age 62.5 for State Police Officers hired before July 1, 1961.
8.	Actuarial Cost Method:	Individual level dollar entry age cost method, modified to approximate a level percentage of future payroll normal cost.

Table 8(b)

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S PLAN

Probabilities of Separation From Active Service
(Number Separating at Each Age Per 10,000 Working at That Age)

Age	Death 1/ Males	Death 1/ Females	Withdrawal 2/	Disability 2/
20	16	6	300	4
21	17	6	290	4
22	17	6	280	5
23	17	6	270	5
24	17	6	260	6
25	16	7	250	6
26	15	7	240	6
27	15	7	230	7
28	15	7	220	7
29	15	8	210	8
30	16	9	200	8
31	16	9	190	9
32	17	10	180	9
33	18	11	170	10
34	19	11	160	10
35	21	12	150	11
36	23	13	140	12
37	25	15	130	13
38	27	16	120	15
39	30	17	110	16
40	33	19	100	18
41	37	21	90	20
42	41	23	80	22
43	45	25	70	24
44	50	28	60	26

Page 1 of 2

Age	Death 1/ Males	Females	Withdrawal 2/	Disability 2/
45	56	30	50	29
46	62	33	40	32
47	69	36	30	36
48	77	40	20	41
49	86	43	10	46
50	96	47		50
51	106	52		57
52	116	56		64
53	126	60		72
54	137	64		80
55	148	69		88
56	159	74		98
57	173	81		108
58	189	89		118
59	207	98		129
60	227	109		141
61	248	120		154
62	269	133		167

1/ United States Life Tables, 1959 - 61.

2/ Same withdrawal and disability rates pertain to males and females.

APPENDIX

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

1/ All as of June 30, 1979.

HIGHWAY PATROLMEN VALUATION AS OF JUNE 30, 1979

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 Minnesota Statutes, Chapter 356. The valuation was made using the entry age normal cost method and assuming 5% interest. The 1978 report was prepared by John Teisberg and Thomas Kuhlman of Towers, Perrin, Forster and Crosby, and the 1979 report was prepared by Allan J. Grosh and Alan J. Schutz of the Wyatt Company

This memorandum contains the following:

1. Statistical and Valuation data
2. Discussion of Valuation Results
3. Experience Study
4. Conclusion

1. Statistical and Valuation Data

Results of the valuation reports as of June 30, 1978 and June 30, 1979 are shown for comparative purposes. Figures are rounded where necessary for simplicity of presentation.

	June 30, 1978	June 30, 1979
(1) Membership		
Active members	751	770
Deferred Annuitants	19	17
Retired Members	165	178
Disabled Members	8	9
Widows of Deceased Members	83	85
Children of Deceased Members	35	32
(2) Payroll and Annuities Payable	(Thousands of Dollars)	
Total Payroll	$13,772	$16,429*
Annuities (annual)	1,298	1,321
(3) Valuation Balance Sheet	(Thousands of Dollars)	
Accrued Liability	$59,643	$68,679
Assets	37,265	42,594
Unfunded Accrued Liability (Deficit)	$22,378	$26,085
Funding Ratio	62.5%	62.0%

*The 1979 payroll figure includes July 1979 increases; the 1978 figure does not. Furthermore, only base salary was used in 1978 compared with total compensation in 1979.

	June 30, 1978	June 30, 1979
(4) Normal Cost and Funding Costs	% of Payroll	% of Payroll
Normal Cost	14.19%	14.60%
Administrative Expense	0.25	0.23
Normal Cost plus Expense	14.44%	14.83%
Normal Cost plus Expense	14.44%	14.83%
Interest on Deficit	8.12	7.94
Total (minimum Contribution)	22.56%*	22.77%
Normal Cost plus Expense	14.44%	14.83%
Amortization by 2009	10.57	10.33
Total (Required Contribution)	25.01%	25.16%
(5) Statutory Contributions		
Employee	7.0%	7.0%
Employer Regular	12.0	12.0
Employer Additional	9.0	9.0
Total Contributions	28.0%	28.0%
(6) Investment Yield *	6.54%	6.91%

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

2. Discussion of Valuation Results

The increase in the normal cost percentage as well as the increase in the number of dollars of deficit can be attributed to the use of total compensation in 1979 versus base salary in prior years.

Although the nunber of dollars of deficit is larger in 1979, the larger payroll figure has served to decrease the interest and amortization contributions as a percentage of payroll. An additional decrease in the amortization requirement, which is not shown in the above display, came from changing the target date from 1997 to 2009. The 1978 amortization percentage, based on the 1997 target date, was 12.80% compared with 10.57% shown above.

The unfunded accrued liability increased from $22,377,838 to $26,085,343 during the year, an increase of $3,707,505. The following is an approximate analysis of this change:

Increases:		
Change in Method	$5,469,555	
Salary Scale Loss	1,028,889	
Mortality Loss - MAFB	339,702	
Total Increases		$6,838,146
Decreases:		
Capital Gain	$ 45,326	
Excess Interest	647,812	
Amortization Contribution	1,136,469	
Deviations in Mortality, Withdrawal & Disablement	1,301,034	
Total Decreases		$3,130,641
Net Increase		$3,707,505

3. Experience Study

As required by statute, the 1979 report included a study of actual experience compared with that predicted by the actuarial assumptions.

The following chart compares the number of actual events during the past four years with the number according to the actuarial assumptions:

	Actual	Expected	Ratio
Withdrawals	34	29	117.2%
Disablements	9	11	81.8%
Mortality - Actives	7	18	38.9%
Mortality - Retireds	23	37	62.2%
Age Retirement	55	98	56.1%

The following shows the average age at retirement during each of the past four years:

Year	1976	1977	1978	1979
Ave. Age	60.4	58.6	57.8	59.0

The greatest deviation has been in the number of deaths which shows that the mortality table employed does not fit the experience. The 1975 study indicated the same trend, but the deviations were not as large. Since the trend observed in 1975 has not only continued but also has deteriorated, the MSRS Actuary recommends a prompt change to a more realistic mortality assumption.

Although the results on withdrawals and disablements are favorable, the margins do not suggest a change. Furthermore, a continuation of the same experience leaves some conservativeness in the picture.

The ratio in the age retirements indicates that retirements are occurring later than assumed. For almost all of the active participants, the assumed average retirement age is 57.0, but for a dwindling number of State Police Officers, it is 62.5. The chart of the actual average ages at retirement confirms the conclusion that the assumptions are conservative. The Actuary recommends future monitoring of this item before any change is considered.

Since the assumed interest rate and the assumed salary increase rate are set by statute, the Actuary did not report on these items. The following chart shows figures which we found readily available:

Year	Interest Rate	Salary Increase
1976	5.19%	NA
77	5.98	NA
78	6.54	6.8%
79	6.91	6.5% (16.4% when July 1979 increases included)

4. Conclusion

The valuation report and experience study filed by the Highway Patrol comply with the various statutes.

Although the funding cost figures in the above display show a good margin of support over requirement (28.0% versus 25.16%), one must reserve judgment until we see the effect of using a more realistic mortality assumption.

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Associate, Society of Actuaries
Commission Actuary

Table 7

MINNESOTA STATE RETIREMENT SYSTEM
HIGHWAY PATROLMEN'S FUND

Summary of Principal Plan Provisions as of June 30, 1979

1. Coverage:	From first date of employment.
2. Service Credit:	Service is credited from date of coverage. For State Police Officers hired after July 1, 1961 no service is credited after age 60.
3. Contributions:	
a. Employee:	7% of salary
b. State of Minnesota:	21% of salary.
4. Final Average Salary:	Monthly average for the highest 5 successive years of salary.
5. Normal Retirement:	
a. Eligibility:	Attainment of age 55 and completion of 10 years of service.
b. Benefit Amount:	2-1/2% of Final Average Salary for each of the first 20 years of service plus 2% of Final Average Salary for each year of service thereafter.
6. Form of Payment:	Life annuity with actuarially equivalent options also available.
7. Disability Retirement:	
a. Eligibility:	
. In line of duty:	None.
. Not in line of duty:	Five years of service and less than age 55.
b. Benefit Amount:	
. In line of duty:	50% of average monthly salary plus 2% for each year of service in excess of 20, offset by Workers' Compensation.
. 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; subject to a minimum of 25%.

c. Death benefits: If a member dies while receiving a work related disability benefit, or a non-work related disability benefit after having completed 20 years of service, 20% of his Final Average Salary is payable to the surviving spouse.

8. Deferred Service Retirement:

a. Eligibility: Completion of 10 years of service.

b. Benefit Amount: Retirement benefits payable at normal retirement date are determined according to the normal retirement benefit formula based on the member's Final Average Salary and service at termination, such amount being subject to an increase for each year between termination and retirement of 5% for years prior to January 1, 1981 and 3% compounded annually thereafter.

9. Return of Contributions: If a member terminates before becoming eligible for any other benefits under the plan, his employee contributions are returned.

10. Surviving Spouse Death Benefit:

a. Eligibility: Death of member in service.

b. Benefit Amount: 20% of Final Average Salary.

11. Children's Death Benefits:

a. Eligibility: Death benefits are payable to children (below age 18, or 22 if a student) of members who die in active service.

b. Amount: 10% of Final Average Salary, plus $20 per month prorated equally to such children.

c. Maximum: Total benefit to all children may not exceed 40% of Final Average Salary.

12. Repayment of Contributions:

a. Eligible Members: Rehired members.

b. Repayment Provision: Such rehired member may repay all refundments made to him, including interest at 5% compounded annually. In such case, service previously credited during the prior period of membership is restored.

Page 2 of 3

13. Combined Service Provisions:

a. Eligible Members: Members who have had coverage under two or more Minnesota Public Retirement Systems, with a total of at least 10 years of credited service.

b. Benefit Provisions: Benefits under both plans are based on the highest Final Average Salary including all years from both plans, and on the plans in effect on the member's last day in covered public employment.

14. Proportionate Annuity: Any member who terminates after attaining age 65 and completing at least 3 years of service is entitled to a proportionate retirement annuity based on his allowable service credit.