Touche Ross & Co.
900 Pillsbury Center
Minneapolis, MN 55402-1483
Telephone: 612 333-2301
Telecopy: 612 375-5418

Touche Ross

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

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1988 actuarial valuation of the Minnesota State Retirement System, General Employees' Retirement Plan.

Our report is divided into the following sections:

The report was completed on the basis of accepted actuarial methods and procedures in accordance with the provisions stipulated in the contract between the State of Minnesota and Touche Ross & Co.

We would be pleased to answer any questions you may have regarding this report.

Touche Ross & Co.

F. Jay Lingo

F. Jay Lingo, F.S.A.

James F. Verlautz

James F. Verlautz, F.S.A.

I. INTRODUCTION AND PURPOSE

The Minnesota State Retirement System (MSRS) administers several retirement funds and plans. The plans administered are the: General State Employees' Plan, Unclassified Employees' Plan, Correctional Employees' Plan, State Patrol Employees' Plan, Judges' Plan, Legislators' Plan, Elective Officers' Plan, Military Affairs Plan, Transportation Pilots' Plan, and a statewide Deferred Compensation Plan for public employees.

The plans administered by MSRS are among those subject to being overseen by the Legislative Commission on Pensions and Retirement (LCPR). The LCPR consists of members of the Minnesota State Senate and Minnesota House of Representatives. Its members are charged with the duties of, among other things:

- Reviewing investment performance.
- Establishing policy for public retirement plans.
- Recommending necessary changes to retirement plan provisions.
- Hiring an actuary to perform annual actuarial valuations and experience studies.
- Overseeing the work of the actuary.

Minnesota Statutes, Sections 356.20 and 356.215, require annual actuarial valuations and periodic experience studies. Of concern to the Board of Directors are the valuations and experience studies which must be performed for the following:

- The General State Employees' Plan;
- The Correctional Employees' Plan;
- The State Patrol Employees' Plan; and
- The Judges' Plan

These valuations and experience studies are prepared by the Wyatt Co., the actuary retained by the LCPR. The Minnesota State Retirement System does not have an actuary on its staff and, therefore, has retained Touche Ross to review, analyze, and critique the actuarial valuations and experience studies.

The purpose of this report is to verify the accuracy of the Wyatt Co.'s results, and to expand on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

We attempted to duplicate the figures shown in the Wyatt Co.'s June 30, 1988 valuation reports. To do so involved repeated discussions with the Wyatt personnel who prepared their reports. Where we were able to discover reasonable justification for the Wyatt Co.'s approach, we adjusted our methods and assumptions to match theirs. (Descriptions of those adjustments are included in Section III.)

In this section of the report we compare the figures generated by the Wyatt Co. with our valuations. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under both Section 352 and Section 356. Table C shows the depth of plan funding based on liabilities incurred to date. These figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's omitted)

	Wyatt Co.	Touche Ross	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$1,482,183	$1,482,682	0.0%
Death	130,699	130,715	0.0
Disability	107,713	111,184	3.2
Withdrawal	430,322	417,983	(2.9)
Total actives	$2,150,917	$2,142,564	(0.4)
Deferred annuitants	18,321	18,229	(0.5)
Former members without vested rights	2,309	2,349	1.7
Participants in MPRI Fund	649,064	649,635	0.1
Total	$2,820,611	$2,812,777	(0.3)
Portion allocated to future service	705,135	690,702	(2.0)
Accrued liability (reserves required)	$2,115,476	$2,122,075	0.3
Valuation assets	1,644,145	1,644,145	0.0
Unfunded accrued liability	$ 471,331	$ 477,930	1.4
Funded ratio	77.7%	77.5%	-

CONTRIBUTIONS

Chapters 352 and 356 set forth requirements as to the level of contributions. Chapter 352 prescribes the actual amount of contributions and Chapter 356 describes the methods used to determine the amount of contribution required to fully fund the Normal Cost and the Unfunded Accrued Liability. Together, the actual contribution and required contribution are used to determine the sufficiency of the actual contribution. These calculations are illustrated in Table B. Amounts shown in parentheses are as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	Wyatt Co.	Touche Ross
1. Normal cost	$ 72,086 (5.47%)	$ 72,182 (5.48%)
2. Assumed operating expense	$ 3,423 (.26%)	$ 3,423 (.26%)
3. Amortization by June 30, 2011 of the unfunded accrued liability	$ 24,753 (1.88%)	$ 25,152 (1.91%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$100,262 (7.61%)	$100,757 (7.65%)
Prescribed Contributions		
1. Employee contributions	$ 49,112 (3.73%)	$ 49,117 (3.73%)
2. Employer contribution	$ 51,350 (3.90%)	$ 51,355 (3.90%)
3. Total Chapter 352A prescribed contribution	$100,462 (7.63%)	$100,472 (7.63%)
Contribution Sufficiency	.02%	(.02%)

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1989. Expected annual payroll = $1,316,804,000.

The depth of funding is an indication of the extent to which the accrued benefits are funded and is measured by the ratio of valuation assets to the present value of accrued benefits. These measurements are made on the plan continuation basis (applying all ongoing actuarial assumptions, including assumed salary increases and turnover) and are illustrated as follows:

TABLE C (000's omitted)

Depth of Funding June 30, 1988

		Wyatt Co.	Touche Ross	Percentage Difference
1.	Active members	$1,105,751	$1,110,590	0.4%
2.	Deferred annuitants	18,321	18,229	(0.5)
3.	Former members without vested rights	2,309	2,349	1.7
4.	Participation in MPRI Fund	649,064	649,635	.1
5.	Total present values of accrued benefits	$1,775,445	$1,780,803	.3
6.	Valuation assets	1,644,145	1,644,145	0.0
7.	Depth of funding	92.6%	92.3%	
8.	Depth of funding excluding MPRI members	88.3%	87.9%	

III. EXPLANATION OF DIFFERENCES

In this section of the report we present our best explanations for any differences between the Wyatt Co.'s methods and assumptions and ours, the changes we made where appropriate to be consistent with the Wyatt Co., and the effects of these changes.

Our calculations for the General Employees' Retirement Plan are very similar to those of the Wyatt Co., and our valuation results in Table A of Section II are essentially the same. Our total present value of benefits is .3% lower than the Wyatt Co.'s, and our total accrued liability is only .3% higher than the Wyatt Co.'s total. With a plan of this size and complexity, duplicating results this closely is unusual.

Our chapter 356 required contribution is 7.65% of payroll. This is only .04% higher than the Wyatt Co.'s number of 7.61% of payroll. The difference in our numbers can be explained by rounding, and is not statistically significant.

When we subtracted the actuarial value of assets to derive the unfunded accrued liability, the percentage difference increased. This difference is misleading since it only occurs because the plan is well funded.

In valuations prior to 1987, we assumed that retirement benefits would never exceed current IRS limits on benefits. During our discussions with the Wyatt Co., they indicated that they expect the IRS limit to increase at the same rate as the salary scale. In effect, this assumes that the limits will never apply to individuals in this plan. We believe that a 6.5% increase assumption for the current IRS limit is too high and should be reviewed. However, this does not have a material affect on the results of this valuation. In order to match the Wyatt Co.'s numbers, we continued to assume the limits would not apply.

IV. CHANGES IN THE UNFUNDED LIABILITY

The General Plan currently has an unfunded liability. Having an unfunded liability is not necessarily undesirable for an ongoing plan, as long as some provision is made to pay off the liability over time. The unfunded liability becomes a problem when it is so large as to preclude benefit security, or when, like any debt, interest on the liability becomes unmanageable.

Generally, unfunded liabilities tend to decrease over time, although some year to year fluctuation is normal. One symptom of a troubled pension plan is a constantly increasing unfunded liability. Annual changes in the unfunded liability occur for the following reasons:

- Part of the contribution made each year goes to pay the normal costs (including expenses). The remaining contribution is called the Past Service Contribution. The unfunded liability is automatically increased each year by the interest requirement (8%). If the past service contribution is less than the interest requirement, there will be a net increase in the liability. When the past service contribution is greater than the interest requirement, part of the liability is "paid off", and the liability decreases.

- The unfunded liability is an actuarial projection of liabilities based on certain assumptions. To the extent actual experience differs from the assumptions, actuarial gains and losses may occur. An actuarial gain will decrease the unfunded liability; an actuarial loss will increase the unfunded liability.

- The assumptions and techniques used in calculating the unfunded liability are changed when circumstances warrant. These changes can produce increases or decreases in the unfunded liability.

- Changes in the legal, economic, and sociological environment often result in changes to retirement plans. These changes frequently result in improved benefits. When these changes result in higher retirement benefits, unfunded liabilities are increased. When the changes increase benefits paid in lieu of retirement benefits, unfunded liabilities can increase or decrease.

During the year ended June 30, 1988, the General Employees' Fund showed an increase in the unfunded liability. This increase was caused by the following reasons:

1. <u>Contribution Rate</u>

   The total contributions to the plan were approximately $85 million. However, normal cost, expenses and interest combined to equal $93 million. This resulted in a shortfall of $8 million, which increases the unfunded liability.

2. <u>Actuarial Losses</u>

   The Fund experienced an actuarial gain of approximately $2 million from salary increases. This is less than 1% of the accrued liability for actives, and indicates that the 6.5% salary assumption was accurate.

   The Fund experienced a $31 million loss on investments. This was primarily due to the market decline during October of 1987. There was also a loss on post-retirement mortality of $4 million due to retirees living longer than anticipated.

   The Wyatt Co. reported a $54 million loss on "other items" that they said was due to fewer active members terminating than anticipated. We did not have the same results. We showed a $9 million loss for "other items". The difference between our $9 million loss and the $54 million loss reported by the Wyatt Co. is caused by our unfunded liability being only 1.4% higher than the Wyatt Co.'s this year, compared to 10% higher last year.

   Overall, the Wyatt Co. reported a net loss (increase in unfunded liability) from actuarial experience of $87 million.

3. <u>Changes in Assumptions and Plan Provisions</u>

   There were no changes in assumptions or provisions since the last valuation.

Changes in Unfunded Actuarial Accrued Liability*

A.	Unfunded actuarial accrued liability at beginning of year	$375,659
B.	Change due to interest requirement and current rate of funding	8,483
C.	Expected unfunded actuarial accrued liability at end of year: (A) + (B)	384,142
D.	Actuarial losses (gains)	87,189
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$471,331

* Results prepared by the Wyatt Company.

V. SENSITIVITY ANALYSIS

When performing an actuarial valuation, liabilities and contributions are developed under a single actuarial cost method and one set of actuarial assumptions. However, since it is unlikely that any given assumption will prove to be exactly correct, analyzing the impact of a variation in an assumption is generally enlightening. This analysis is called a sensitivity analysis.

We have analyzed the sensitivity to change of three of these assumptions and methods mandated by state law. Each of these plays a major role in determining costs:

1. Interest is currently assumed to be 8% for all years until retirement, and 5% thereafter. We examined the effect of changing 8% to 7%.

2. Salaries are assumed to increase 6.5% each year. We examined the effect of a 6% salary increase assumption.

3. The unfunded liability is amortized as a level percent of future payroll. This approach is not permitted for a private sector plan. We examined the effect of amortizing the unfunded liability using a level dollar amount.

	Current (Touche Ross)	Value After Change: Interest	Salary Increase	Amortization
Unfunded liability	$477,930	$641,252	$436,125	$477,930
Actuarially required contribution:				
Amount	$100,757	$121,848	$ 95,029	$120,080
Percent	7.65%	9.25%	7.22%	9.12%
Sufficiency/ (Deficiency)	(.02%)	(1.62%)	.41%	(1.49%)
Plan continuation liability	$1,780,803	$1,920,321	$1,743,964	$1,780,803
Depth of funding	92.3%	85.6%	94.3%	92.3%

GENERAL EMPLOYEES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS**

(000'S Omitted)

Report as of June 30	Accrued Liability	Valuation Assets	Unfunded Accrued Liability	Normal Cost	Actuarial Contribution	Prescribed Contribution	Sufficiency
1980*	$ 737,996	$ 546,988	$191,008	$46,831 (6.82%)	$60,682 (8.84%)	$68,667 (10.00%)	1.16%
1981	831,782	648,943	182,839	52,378 (6.73%)	66,051 (8.49%)	77,796 (10.00%)	1.51
1982	1,004,388	753,250	251,138	54,668 (6.84%)	72,646 (9.09%)	67,898 (8.50%)	(.59)
1983	1,127,574	866,439	261,135	59,653 (6.96%)	78,600 (9.17%)	79,964 (9.33%)	.16
1984	1,267,662	955,850	311,812	55,387 (6.13%)	71,786 (7.95%)	68,874 (7.63%)	(.32)
1985	1,465,114	1,109,683	355,431	62,720 (6.11%)	82,981 (8.08%)	78,349 (7.63%)	(.45)
1986	1,680,837	1,312,577	368,260	61,655 (5.43%)	83,362 (7.34%)	86,654 (7.63%)	.29
1987*	1,894,142	1,518,483	375,659	65,801 (5.45%)	88,150 (7.30%)	92,174 (7.63%)	.33
1988*	2,115,476	1,644,145	471,331	72,086 (5.47%)	100,262 (7.61%)	100,462 (7.63%)	.02

* As prepared by the Wyatt Co.

** Figures shown in parentheses are as a percentage of payroll under normal retirement age.

GENERAL EMPLOYEES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS (Continued)

Report as of June 30	Active Members Number	Active Members Valuation Payroll	Retired Members** Number	Retired Members** Avg. Annual Ben.	Deferred Annuitants Number	Deferred Annuitants Avg. Annual Ben.	Former Members Without Vested Rights
1980*	46,242	$ 686,674,348	9,247	$2,272	765	$2,627	3,516
1981	46,669	777,961,014	9,642	2,432	793	2,944	4,752
1982	43,627	809,410,816	10,211	2,744	880	3,105	4,954
1983	43,191	868,528,661	10,477	2,987	983	3,194	4,881
1984	44,158	922,951,956	10,843	3,271	852	3,859	5,495
1985	44,412	1,048,639,187	11,367	3,651	901	3,944	4,881
1986	45,171	1,135,706,412	11,867	4,069	955	4,029	4,401
1987*	45,707	1,208,043,000	12,341	4,589	1,014	4,271	4,496
1988*	47,040	1,316,671,000	12,877	5,050	1,162	4,501	4,084

* As prepared by the Wyatt Co.
** Including beneficiaries and disabled members.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director furnished us with employee information pertaining to all active members, inactive members, and retired members of the Fund. The following tables summarize the changes in active, inactive, and retired membership during the year.

In order to reflect anticipated current year salary increases, all salaries provided were increased by 6.5%.

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Covered General Employees' Census
Data as of June 30, 1988

	Number	Annual Payroll
General Actives at June 30, 1987	45,700	$1,208,169,834
New Entrants*	6,915	
Total	52,615	
Less Separations from Active Service:		
Refund of Contributions*	3,149	46,379,137
Separation with a Deferred Annuity	237	5,926,854
Separation with Neither Refunds nor Right to a Deferred Annuity	1,344	10,027,577
Disability	41	729,788
Death; No Spouse's Benefits*	40	638,226
Service Retirement	733	19,353,155
Death Spouse's Benefits Payable	0	0
Total Separations	5,544	
Net Adjustments	(8)	0
Net Transfers To and From Other Plans	(28)	
General Actives at June 30, 1988	47,035	1,316,597,958
Military Actives at June 30, 1988	5	205,683
Total Actives at June 30, 1988	47,040	$1,316,803,641

Average Entry Age of New Employees

For the Fiscal Year Ending	Male	Female	Average of Total
6/30/83	28.7	27.4	27.9
6/30/84	29.7	29.4	29.6
6/30/85	31.6	31.0	31.2
6/30/86	32.0	31.2	31.5
6/30/87	32.4	31.9	32.1
6/30/88	33.5	33.6	33.6

* Includes those who entered the plan and terminated during the period from July 1, 1987 to June 30, 1988.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

General Employees' Annuitant Census
Data as of June 30, 1988

	Number	Annual Annuity Benefit Payable
A. Service Retirement Annuitants		
Generals		
Receiving at June 30, 1987	10,977	$51,865,643
New	864	5,429,900
Deaths	(399)	(1,569,030)
Adjustments	(4)	3,804,113
Receiving at June 30, 1988	11,438	$59,530,626
Military Affairs		
Receiving at June 30, 1987	3	$ 41,194
New	0	0
Deaths	(1)	(11,277)
Adjustments	0	2,410
Receiving at June 30, 1988	2	$ 32,327
Unclassified Plans		
Receiving at June 30, 1987	14	$ 32,453
New	1	5,398
Deaths	0	0
Adjustments	0	2,172
Receiving at June 30, 1988	15	$ 40,023
Total service annuitants Receiving at June 30, 1988	11,455	$59,602,976

Appendix A (continued)

	Number	Annual Annuity Benefit Payable
B. Disabled Employees		
Receiving at June 30, 1987	676	$ 2,308,958
New	44	163,400
Deaths	(52)	(190,530)
Adjustments - Net Result	1	173,934
Receiving at June 30, 1988	669	$ 2,455,762
C. Widows Receiving an Annuity or Survivor Benefit		
Beneficiaries Receiving an Optional or Reversionary Annuity:		
Receiving at June 30, 1987	671	$ 2,384,882
New	111	480,663
Deaths	(23)	(52,432)
Adjustments - Net Result	(6)	157,078
Receiving at June 30, 1988	753	$ 2,970,191
D. Deferred Annuitants		
Deferred as of June 30, 1987	1,014	$ 4,331,036
New	278	1,325,805
Began Receiving	(96)	(390,124)
Adjustments - Net Result	(34)	(36,059)
Deferred as of June 30, 1988	1,162	$ 5,230,658

Average Age at Retirement of New Service Annuitants

Fiscal Year Ending	Average Retirement Age
6/30/83	63.3
6/30/84	64.0
6/30/85	64.0
6/30/86	62.6
6/30/87	62.7
6/30/88	62.9
All Existing Service Annuitants	64.0

Appendix B

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1988

General Employees

1. Coverage: From first date of employment.

2. Service Credit: Service is credited from date of coverage.

3. Contributions:

   a. Employee: 3.73% of salary.

   b. State of Minnesota: 3.90% of salary.

4. Final Average Salary: Monthly average for the highest 5 successive years of salary.

5. Normal Retirement:

   a. Eligibility: Earlier of:

      o Attainment of age 65 and completion of 5 years of service. (Changed from age 65 and 10 years of service at June 30, 1987); or

      o Attainment of age 62 with 30 years of service.

   b. Benefit Amount: 1% of final average salary for each of the first 10 years of service plus 1-1/2% of final average salary for each year of service thereafter.

6. Early Retirement:

   a. Eligibility: Earlier of:

      o Attainment of age 55 and completion of 5 years of service. (Changed from age 55 and 10 years of service at June 30, 1987); or

      o Completion of 30 years of service.

Appendix B (continued)

b. Benefit Amount:	Normal retirement benefit formula based on service and final average salary to date of early retirement, but actuarially reduced to reflect payment prior to age 65 (or age 62 if 30 years of service have been completed).
7. Form of Payment:	Life annuity with return on death of any balance of contributions over aggregate monthly payments. Actuarially equivalent options are also available.
8. Disability Retirement:	
a. Eligibility:	Completion of 5 years of service. (Changed from earlier of age 50 with 5 years of service or completion of 10 years of service at June 30, 1987.)
b. Benefit Amount:	Normal retirement benefit formula based on service and final average salary to date of disability retirement.
9. Deferred Service Retirement:	
a. Eligibility:	Completion of 5 years of service and election to leave employee contributions on deposit. (Changed from 10 years of service at June 30, 1987.)
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 of 5% for each year between termination and retirement for years prior to January 1, 1981 and 3% compounded annually thereafter.

Appendix B (continued)

10. Return of Contributions: Upon termination of employment, a member may elect the return of contributions with 5% interest compounded annually in lieu of all other benefits under the plan.

11. Surviving Spouse Death Benefit:

a. Eligibility: Death of member in service at age 50 with at least 5 years of service or any age with 30 years of service. Between June 30, 1986 and June 30, 1987, the requirements were age 50 with 10 years of service. Between June 30, 1984 and June 30, 1986, the requirements were age 55 with 10 years of service.

b. Benefit Amount: The surviving spouse may elect one of the following:

- Refund of member contributions with 5% interest. (Changed from 3-1/2% as of June 30, 1984); or
- 100% of the annuity the member would have received had he retired early (if eligible) and elected a 100% joint and survivor annuity commencing on the later of age 55 or his date of death. Benefit will commence at the later of member age 55 or date of death.

Appendix B (continued)

12. Combined Service Provision:

a. Eligible Members:	Members who have had coverage under two or more Minnesota Public Retirement Systems, with a total of at least 5 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.

13. Proportionate Annuity: Any member who terminated after attaining age 65 and completing at least one year of service is entitled to a proportionate retirement annuity based on his allowable service credit.

APPENDIX C

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. For the June 30, 1988 valuation, we used the individual entry age normal method, with salary scale.

The unfunded liability is amortized by the level percent of payroll method. (Each amortization payment is calculated as if the following year's payment will increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

The tables on the following pages summarize the actuarial assumptions used for this valuation.

CHANGES IN ACTUARIAL ASSUMPTIONS

None.

APPENDIX C

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

1.	Mortality:	1971 Group Annuity Mortality Table with ages set back 8 years for females.
2.	Post-Disablement Mortality:	Combined Annuity Mortality Table.
3.	Withdrawal:	Graded rates based on actual experience developed by the June 30, 1971 and subsequent experience analyses and set forth in the Separation from Active Service Table.
4.	Expenses:	Prior year's expenses expressed as a percentage of prior year's payroll.
5.	Interest Rate:	Pre-retirement - 8% per annum. Post-retirement - 5% per annum.
6.	Salary Scale:	6-1/2% per annum.
7.	Assumed Retirement Age:	Graded rates beginning at age 58 set forth in the Separation from Active Service Table. Fifty percent of those eligible to retire under the Rule of 85 are assumed to do so, and members age 65 or over are assumed to retire one year hence.
8.	Actuarial Cost Method:	Entry age cost method, with normal cost determined as a level percentage of future covered payroll, on an individual basis.

Appendix C (continued)

9. Return of Contributions: Effective June 30, 1987, all employees withdrawing after becoming eligible for a deferred benefit were assumed to take the larger of their contributions, accumulated with interest, or the value of their deferred benefit. Previously, 60% of employees withdrawing before retirement were assumed to elect return of contributions in lieu of a deferred benefit.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Male General Members
Probabilities of Separation from Active Service
(Number Separating at Each Age Per 10,000 Working at That Age)

Age	Withdrawal	Death	Disability	Age and Service Retirement
20	2,400	5		
21	2,250	5		
22	2,080	5		
23	1,920	6		
24	1,760	6		
25	1,600	6		
26	1,470	7		
27	1,340	7		
28	1,230	7		
29	1,130	8		
30	1,040	8	2	
31	950	9	2	
32	890	9	2	
33	830	10	2	
34	770	10	2	
35	720	11	2	
36	680	12	2	
37	640	13	2	
38	600	14	2	
39	560	15	2	
40	530	16	2	
41	500	18	2	
42	480	20	2	
43	460	23	3	
44	430	26	3	
45	410	29	3	
46	390	33	5	
47	370	38	7	
48	350	42	9	
49	340	47	11	

Appendix C (continued)

Age	Withdrawal	Death	Disability	Age and Service Retirement
50	320	53	14	
51	300	59	16	
52	280	65	20	
53	260	71	24	
54	240	78	28	
55	210	85	34	
56	170	93	40	
57	140	100	46	
58	90	109	56	30
59	40	119	66	30
60		131	76	40
61		144	90	150
62		159	110	500
63		174	136	500
64		192	174	2,000
65				10,000

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Female General Members
Probabilities of Separation from Active Service
(Number Separating at Each Age Per 10,000 Working at That Age)

Age	Withdrawal	Death	Disability	Age and Service Retirement
20	3,700	4		
21	3,550	4		
22	3,390	4		
23	3,230	4		
24	3,070	4		
25	2,910	5		
26	2,750	5		
27	2,600	5		
28	2,430	5		
29	2,270	5		
30	2,120	5		
31	1,970	6		
32	1,820	6		
33	1,680	6		
34	1,540	7		
35	1,410	7	1	
36	1,300	7	1	
37	1,190	8	1	
38	1,090	8	1	
39	1,000	9	2	
40	920	9	2	
41	850	10	2	
42	780	10	4	
43	720	11	4	
44	680	12	4	
45	630	13	5	
46	590	14	6	
47	560	15	7	
48	530	16	7	
49	500	18	10	

Appendix C (continued)

Age	Withdrawal	Death	Disability	Age and Service Retirement
50	470	20	10	
51	440	23	12	
52	410	26	14	
53	390	29	16	
54	360	33	20	
55	330	38	24	
56	290	42	30	
57	230	47	36	
58	170	53	44	50
59	90	59	52	50
60		65	62	150
61		71	74	150
62		78	88	200
63		85	104	350
64		93	122	1,100
65				10,000

Touche Ross & Co.
900 Pillsbury Center
Minneapolis, MN 55402-1483
Telephone: 612 333-2301
Telecopy: 612 375-5418

Touche Ross

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

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1988 actuarial valuation of the Minnesota State Retirement System, Correctional Employees' Retirement Plan.

Our report is divided into the following sections:

The report was completed on the basis of accepted actuarial methods and procedures in accordance with the provisions stipulated in the contract between the State of Minnesota and Touche Ross & Co.

We would be pleased to answer any questions you may have regarding this report.

Touche Ross & Co.

F. Jay Lingo

F. Jay Lingo, F.S.A.

James F. Verlautz

James F. Verlautz, F.S.A.

I. INTRODUCTION AND PURPOSE

The Minnesota State Retirement System (MSRS) administers several retirement funds and plans. The plans administered are the: General State Employees' Plan, Unclassified Employees' Plan, Correctional Employees' Plan, State Patrol Employees' Plan, Judges' Plan, Legislators' Plan, Elective Officers' Plan, Military Affairs Plan, Transportation Pilots' Plan, and a statewide Deferred Compensation Plan for public employees.

The plans administered by MSRS are among those subject to being overseen by the Legislative Commission on Pensions and Retirement (LCPR). The LCPR consists of members of the Minnesota State Senate and Minnesota House of Representatives. Its members are charged with the duties of, among other things:

- Reviewing investment performance.
- Establishing policy for public retirement plans.
- Recommending necessary changes to retirement plan provisions.
- Hiring an actuary to perform annual actuarial valuations and experience studies.
- Overseeing the work of the actuary.

Minnesota Statutes, Sections 356.20 and 356.215, require annual actuarial valuations and periodic experience studies. Of concern to the Board of Directors are the valuations and experience studies which must be performed for the following:

- The General State Employees' Plan;
- The Correctional Employees' Plan;
- The State Patrol Employees' Plan; and
- The Judges' Plan

These valuations and experience studies are prepared by the Wyatt Co., the actuary retained by the LCPR. The Minnesota State Retirement System does not have an actuary on its staff and, therefore, has retained Touche Ross to review, analyze, and critique the actuarial valuations and experience studies.

The purpose of this report is to verify the accuracy of the Wyatt Co.'s results, and to expand on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

We attempted to duplicate the figures shown in the Wyatt Co.'s June 30, 1988 valuation reports. To do so involved repeated discussions with the Wyatt personnel who prepared their reports. Where we were able to discover reasonable justification for the Wyatt Co.'s approach, we adjusted our methods and assumptions to match theirs. (Descriptions of those adjustments are included in Section III.)

In this section of the report we compare the figures generated by the Wyatt Co. with our valuations. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under both Section 352 and Section 356. Table C shows the depth of plan funding based on liabilities incurred to date. These figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Wyatt Co.	Touche Ross	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$ 62,763	$ 62,483	(0.4%)
Death	2,216	2,237	0.9
Disability	1,636	1,532	(6.4)
Withdrawal	19,493	19,629	0.7
Total actives	$ 86,108	$ 85,881	(0.3)
Deferred annuitants	2,629	2,652	0.9
Former members without vested rights	245	229	(6.5)
Participants in MPRI Fund	25,435	25,037	(1.6)
Total	$114,417	$113,799	(0.5)
Portion allocated to future service	32,963	33,142	0.5
Accrued liability (reserves required)	$ 81,454	$ 80,657	(1.0)
Valuation assets	74,065	74,065	0.0
Unfunded accrued liability	$ 7,389	$ 6,592	(10.8)
Funded ratio	90.9%	91.8%	-

CONTRIBUTIONS

Chapters 352 and 356 set forth requirements about the level of contributions. Chapter 352 prescribes the actual amount of contributions, and Chapter 356 describes the methods used to determine the amount of contribution required to fully fund the normal cost and the unfunded accrued liability. Together, the actual contribution and required contribution are used to determine the sufficiency of the actual contribution. These calculations are illustrated in Table B. Amounts in parentheses show dollar amounts as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	Wyatt Co.	Touche Ross
1. Normal cost	$3,586 (9.24%)	$3,757 (9.67%)
2. Assumed operating expense	$ 116 (.30%)	$ 116 (.30%)
3. Amortization by June 30, 2017 of the unfunded accrued liability	$ 322 (.83%)	$ 286 (.74%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$4,024 (10.37%)	$4,159 (10.71%)
Prescribed Contributions		
1. Employee contributions	$1,902 (4.90%)	$1,903 (4.90%)
2. Employer contribution	$3,376 (8.70%)	$3,379 (8.70%)
3. Total Chapter 352A prescribed contribution	$5,278 (13.60%)	$5,282 (13.60%)
Contribution Sufficiency	3.23%	2.89%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1989. Expected annual payroll = $38,834,000.

The depth of funding is an indication of the extent to which the accrued benefits are funded and is measured by the ratio of valuation assets to the present value of accrued benefits. These measurements are made on the plan continuation basis (applying all ongoing actuarial assumptions, including assumed salary increases and turnover) and are illustrated as follows:

TABLE C (000's omitted)

Depth of Funding June 30, 1988

		Wyatt Co.	Touche Ross	Percentage Difference
1.	Active members	$40,833	$40,626	(0.5%)
2.	Deferred annuitants	2,629	2,652	0.9
3.	Former members without vested rights	245	229	(6.5)
4.	Participation in MPRI Fund	25,435	25,037	(1.6)
5.	Total present values of accrued benefits	$69,142	$68,544	(0.9)
6.	Valuation assets	74,065	74,065	0.0
7.	Depth of funding	107.1%	108.1%	-
8.	Depth of funding excluding MPRI participants	111.3%	112.7%	-

III. EXPLANATION OF DIFFERENCES

In this section of the report we present our best explanations for any differences between the Wyatt Co.'s methods and assumptions and ours, the changes we made where appropriate to be consistent with the Wyatt Co., and the effects of these changes.

Our calculations for the Correctional Employees' Retirement Plan are very similar to those of the Wyatt Company, and our valuation results in Table A of Section II are very close. Our total present value of benefits is 0.5% lower than the Wyatt Co.'s, while our total accrued liability is only 1.0% lower than the Wyatt Co.'s total.

When we subtracted the actuarial value of assets to derive the unfunded accrued liability, the percentage difference increased to almost 11%. This difference is misleading since it only occurs because the plan is so well funded.

During our discussions with the Wyatt Co., they indicated that they expect the IRS limits on benefits to increase at the same rate as the salary scale. In effect, this assumes that the limits will never apply to individuals in this plan. We believe a 6.5% increase assumption for the current IRS limit is too high and should be reviewed. However, this does not have a material affect on the results of this valuation. In order to match the Wyatt Co.'s numbers, we made the same assumption.

In calculating the present value of disability benefits, the Wyatt Co. assumed that the benefit remained level until death. We believe that the benefit should revert to the General Plan level just as a regular Correctional Plan benefit would do. However, for purposes of this report, we again changed the benefit level to agree with the Wyatt Co.'s and this caused the accrued liability to increase by $300,000. After discussions with the Minnesota State Retirement System, we believe that the Wyatt Co.'s assumption is incorrect.

When the Wyatt Co. calculated the Social Security benefit for each participant they assumed no earnings prior to state employment. We estimated a salary for the member's entire working career, including employment before being hired by the state. We changed our assumption to agree with the Wyatt Co.'s which decreased the accrued liability by approximately 2%.

IV. CHANGES IN THE UNFUNDED LIABILITY

The Correctional Plan currently has an unfunded liability. Having an unfunded liability is not necessarily bad for an ongoing plan, as long as some provision is made to pay off the liability over time. The unfunded liability becomes a problem when it is so large as to preclude benefit security, or when, like any debt, interest on the liability becomes unmanageable.

Generally, unfunded liabilities tend to decrease over time, although some year to year fluctuation is normal. One symptom of a troubled pension plan is a constantly increasing unfunded liability. Annual changes in the unfunded liability occur for the following reasons:

- Part of the contribution made each year goes to pay the normal costs (including expenses). The remaining contribution is called the Past Service Contribution. The unfunded liability is automatically increased each year by the interest requirement (8%). If the past service contribution is less than the interest requirement, there will be a net increase in the liability. When the past service contribution is greater than the interest requirement, part of the liability is "paid off," and the liability decreases.

- The unfunded liability is an actuarial projection of liabilities based on certain assumptions. To the extent actual experience differs from the assumptions, actuarial gains and losses may occur. An actuarial gain will decrease the unfunded liability; an actuarial loss will increase the unfunded liability.

- The assumptions and techniques used in calculating the unfunded liability are changed when circumstances warrant. These changes can produce increases or decreases in the unfunded liability.

- Changes in the legal, economic, and sociological environment often result in changes to retirement plans. These changes frequently result in improved benefits. When these changes result in higher retirement benefits, unfunded liabilities are increased. When the changes increase benefits paid in lieu of retirement benefits, unfunded liabilities can increase or decrease.

During the year ended June 30, 1988, the Correctional Employees' Fund showed an increase in the unfunded liability. This increase was caused by to the following reasons:

1. Contribution Rate

   The total contributions to the plan were approximately $4,842,000. Normal cost, expenses and interest combined to equal $3,720,000. This resulted in a reduction of $1,122,000 in the unfunded liability.

2. Actuarial Losses

   The Fund experienced actuarial losses of approximately $473,000 because of salary increases which were larger than anticipated and $1,797,000 of investment losses. These losses were offset by a $269,000 gain on MPRI fund mortality.

   The Wyatt Co. reported a $1,917,000 loss on "other items" that they said was due to fewer active members terminating than anticipated. We did not have the same results. We showed a $24,210 gain for "other items". The difference between our $24,210 gain and the $1,917,000 loss reported by the Wyatt Co. is caused by our unfunded liability being 10.8% lower than the Wyatt Co.'s this year, compared to 31.8% higher last year.

   Overall, the Wyatt Co. reported a net loss (increase in unfunded liability) of $3,918,000.

3. Changes in Assumptions and Plan Provisions

   No changes in assumptions or plan provisions have occurred since the last valuation.

Changes in Unfunded Actuarial Accrued Liability*
(000's omitted)

A.	Unfunded actuarial accrued liability at beginning of year	$4,593
B.	Change due to interest requirement and current rate of funding	(1,122)
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$3,471
D.	Actuarial losses (gains)	3,918
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$7,389

* Results prepared by the Wyatt Company.

V. SENSITIVITY ANALYSIS

When performining an actuarial valuation, liabilities and contributions are developed under a single actuarial cost method and one set of actuarial assumptions. However, since it is unlikely that any given assumption will prove to be exactly correct, analyzing the impact of a variation in an assumption is generally enlightening. This analysis is called a sensitivity analysis.

We have analyzed the sensitivity to change of three of these assumptions and methods mandated by state law. Each of these plays a major role in determining costs:

1. Interest is currently assumed to be 8% for all years until retirement, and 5% thereafter. We examined the effect of changing 8% to 7%.

2. Salaries are assumed to increase 6.5% each year. We examined the effect of a 6% salary increase assumption.

3. The unfunded liability is amortized as a level percent of future payroll. This approach is not permitted for a private sector plan. We examined the effect of amortizing the unfunded liability using a level dollar amount.

	Current	Value After Change		
	(Touche Ross)	Interest	Salary Increase	Amortization
Unfunded liability	$ 6,592	$11,822	$ 5,096	$ 6,592
Actuarially required Contribution:				
(Amount)	4,159	4,969	3,879	4,413
(Percent)	10.71%	12.80%	9.99%	11.36%
(Sufficiency)	2.89%	.80%	3.61%	2.24%
Plan continuation liability	$68,544	$73,629	$67,246	$68,544
Depth of funding:	108.1%	100.6%	110.1%	108.1%

CORRECTIONAL EMPLOYEES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS**

(000'S Omitted)

Report as of June 30	Accrued Liability	Valuation Assets	Unfunded Accrued Liability	Normal Cost	Actuarial Contribution	Prescribed Contribution	Sufficiency
1980*	$29,251	$22,178	$7,073	$1,787 (10.64%)	$2,284 (13.60%)	$3,359 (20.00%)	6.40%
1981	29,876	26,284	3,592	2,027 (11.05%)	2,301 (12.55%)	3,667 (20.00%)	7.45
1982	34,519	30,400	4,119	2,150 (10.52%)	2,460 (12.04%)	2,568 (12.57%)	.53
1983	39,551	36,068	3,483	2,603 (10.62%)	2,879 (11.75%)	3,998 (16.31%)	4.56
1984	43,888	40,153	3,735	2,562 (9.49%)	2,788 (10.33%)	3,671 (13.60%)	3.27
1985	53,826	48,700	5,126	2,931 (9.43%)	3,269 (10.52%)	4,226 (13.60%)	3.08
1986	58,060	57,472	588	3,113 (9.28%)	3,233 (9.64%)	4,561 (13.60%)	3.96
1987*	72,081	67,488	4,593	3,257 (9.26%)	3,545 (10.08%)	4,782 (13.60%)	3.52
1988*	81,454	74,065	7,389	3,586 (9.24%)	4,024 (10.37%)	5,278 (13.60%)	3.23

* As prepared by the Wyatt Co.

** Figures shown in parentheses are as a percentage of payroll under normal retirement age.

CORRECTIONAL EMPLOYEES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS (Continued)

Report as of June 30	Active Members		Retired Members**		Deferred Annuitants		Former Members Without Vested Rights
	Number	Valuation Payroll	Number	Avg. Annual Ben.	Number	Avg. Annual Ben.	
1980*	990	$16,795,854	257	$4,757	7	$6,714	15
1981	965	18,336,416	275	4,938	5	6,722	38
1982	1,010	20,984,656	293	5,346	10	7,180	39
1983	1,124	25,186,035	295	5,410	12	7,210	27
1984	1,174	26,998,637	326	5,959	25	7,136	95
1985	1,192	31,075,810	329	6,403	29	9,032	79
1986	1,219	33,533,822	328	6,908	35	8,285	83
1987*	1,232	35,155,000	333	7,383	43	7,928	84
1988*	1,267	38,807,000	346	7,740	47	8,572	80

* As prepared by the Wyatt Co.

** Including beneficiaries and disabled members.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director furnished us with employee information pertaining to all active members, inactive members, and retired members of the Fund. The following tables summarize the changes in active, inactive, and retired membership during the year.

In order to reflect anticipated current year salary increases, all salaries provided were increased by 6.5%.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Covered Correctional Employees'
Census Data as of June 30, 1988

	Number	Annual Payroll
Actives at June 30, 1987	1,233	$35,181,294
New Entrants*	120	
Total	1,353	
Less Separations from Active Service:		
Refund of Contributions*	46	905,057
Separation with a Deferred Annuity	7	205,363
Separation with Neither Refund nor Right to a Deferred Annuity	11	188,858
Death	1	38,963
Service Retirement	19	607,624
Disability	0	0
Total Separations	84	
Net Transfers to and from Other Plans	(2)	
Actives at June 30, 1988	1,267	$38,834,315

Average Entry Age of New Employees

For the Fiscal Year Ending	Male	Female	Average of Total
6/30/84	28.7	32.4	29.4
6/30/85	29.2	28.6	29.0
6/30/86	29.8	32.1	30.4
6/30/87	30.0	30.1	30.0
6/30/88	29.8	31.5	30.3

* Includes those who entered the plan and terminated during the period from July 1, 1987 to June 30, 1988.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Correctional Employees' Annuitant Census
Data as of June 30, 1988

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1987	313	$2,315,540
	New	25	296,014
	Deaths	(10)	(64,440)
	Adjustments - Net Result	0	78,196
	Receiving at June 30, 1988	328	$2,625,310
B.	**Disabled Employees**		
	Receiving at June 30, 1987	11	$ 78,306
	New	1	5,494
	Deaths	(6)	(32,294)
	Adjustments - Net Result	—	5,446
	Receiving at June 30, 1988	16	$ 56,952
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1987	9	$ 64,788
	New	3	10,016
	Adjustments - Net Result	0	5,217
	Receiving at June 30, 1988	12	$ 80,021

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	Children Receiving a Survivor Benefit	0	$ 0
E.	Deferred Annuitants		
	Receiving at June 30, 1987	43	340,893
	New	8	88,368
	Began Receiving	(3)	(20,389)
	Adjustments	(1)	(5,975)
	Receiving at June 30, 1988	47	$ 402,897

Average Age at Retirement of New Service Annuitants

Fiscal Year Ending	Average Retirement Age
6/30/83	55.6
6/30/84	57.8
6/30/85	57.8
6/30/86	55.4
6/30/87	56.8
6/30/88	58.0
All Existing Service Annuitants	58.2

Appendix B

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1988

Correctional Employees

1. Coverage: From first date of employment.

2. Service Credit: Service is credited from date of coverage.

3. Contributions:

   a. Employee: 4.90% of salary.

   b. State of Minnesota: 8.70% 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 5 years of service. (Changed from 10 years of service at June 30, 1987.)

   b. Retirement Benefit: General Plan benefit plus an additional benefit defined below.

   c. Additional Benefit: Final average salary times the sum of:

      o 1-1/2% for each of first 10 years of service; plus

      o 1% for each of next 15 years of service; plus

      o 1/2% for each year of service thereafter.

Appendix B (continued

d. Limitation on Additional Benefit: That amount which, when added to the General Plan benefit, provides a retirement benefit of 75% of final average salary.

e. Additional Benefits Period: 84 months or until attainment of age 65, whichever comes first.

f. Minimum Benefit Following Additional Benefit Period: That amount which, when added to Social Security benefits, equals the benefit payable during the additional benefit period.

6. 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 2-1/2% for each year of service up to 25 years and 2% for each year thereafter, 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. Limitation: At age 62, General Plan benefit based on credited service is payable subject to a minimum benefit of 10% of pay.

Appendix B (continued

7. Deferred Service Retirement:

   a. Eligibility: Completion of 5 years of service and election to leave employee contributions on deposit. (Changed from 10 years of service at June 30, 1987.)

   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 of 5% for each year between termination and retirement for years prior to January 1, 1981 and 3% compounded annually thereafter.

8. Return of Contributions: Upon termination of employment, a member may elect the return of contributions with 5% interest compounded annually in lieu of all other benefits under the plan.

9. Surviving Spouse Death Benefit:

   a. Eligibility: Death of member in service at age 50 at least with 5 years of service or at any age with 30 years of service. Between June 30, 1986 and June 30, 1987, the requirements were age 50 with 10 years of service. Between June 30, 1984 and June 30, 1986, the requirements were age 55 with 10 years of service.

Appendix B (continued

b. Benefit Amount: The surviving spouse may elect one of:

- o Refund of member contributions with 5% interest. (Changed from 3-1/2% as of June 30, 1984); or
- o 100% of the annuity the member would have received had he retired early (if eligible) and elected a 100% joint and survivor annuity commencing on the later of age 55 or his date of death. Benefit will commence later of member age 55 or date of death.

10. Combined Service Provision:

a. Eligible Members: Members who have had coverage under two or more Minnesota Public Retirement Systems, with a total of at least 5 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.

12. Proportionate Annuity: Any member who terminated after attaining age 65 and completing at least one year of service is entitled to a proportionate retirement annuity based on his allowable service credit.

APPENDIX C

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. For the June 30, 1988 valuation, we used the individual entry age normal method, with salary scale.

The unfunded liability is amortized by the level percent of payroll method. (Each amortization payment is calculated as if the following year's payment will increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

The tables on the following pages summarize the actuarial assumptions used for this valuation.

CHANGES IN ACTUARIAL ASSUMPTIONS

None.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

1.	Mortality:	1971 Group Annuity Mortality Table with ages set back 8 years for females.
2.	Post-Disablement Mortality:	Combined Annuity Mortality Table.
3.	Withdrawal:	Graded rates based on actual experience developed by the June 30, 1971 and subsequent experience analyses and set forth in the Separation from Active Service Table.
4.	Expenses:	Prior year's expenses expressed as a percentage of prior year's payroll.
5.	Interest Rate:	Pre-retirement - 8% per annum. Post-retirement - 5% per annum.
6.	Salary Scale:	6-1/2% per annum.
7.	Assumed Retirement Age:	Age 58, or if over age 58, one year from the valuation date.
8.	Actuarial Cost Method:	Entry age cost method, with normal cost determined as a level percentage of future covered payroll, on an individual basis.
9.	Social Security:	Based on the present law and 6-1/2% salary scale applicable to current salaries. Future Social Security benefits replace the same proportion of salary as at present.

Appendix C (continued)

10. Return of Contributions: Effective June 30, 1987, all employees withdrawing after becoming eligible for a deferred benefit were assumed to take the larger of their contributions, accumulated with interest, or the value of their deferred benefit. Previously, all employees withdrawing before retirement were assumed to elect return of contributions in lieu of a deferred benefit.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Male Correctional Members
Probabilities of Separation from Active Service
(Number Separating at Each Age Per 10,000 Working at That Age)

Age	Withdrawal	Death	Disability	Age and Service Retirement
20	2,400	5		
21	2,250	5		
22	2,080	5		
23	1,920	6		
24	1,760	6		
25	1,600	6		
26	1,470	7		
27	1,340	7		
28	1,230	7		
29	1,130	8		
30	1,040	8	2	
31	950	9	2	
32	890	9	2	
33	830	10	2	
34	770	10	2	
35	720	11	2	
36	680	12	2	
37	640	13	2	
38	600	14	2	
39	560	15	2	
40	530	16	2	
41	500	18	2	
42	480	20	2	
43	460	23	3	
44	430	26	3	
45	410	29	3	
46	390	33	5	
47	370	38	7	
48	350	42	9	
49	340	47	11	

Appendix C (continued)

Age	Withdrawal	Death	Disability	Age and Service Retirement
50	320	53	14	
51	300	59	16	
52	280	65	20	
53	260	71	24	
54	240	78	28	
55	210	85	34	
56	170	93	40	
57	140	100	46	
58				10,000

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Female Correctional Members
Probabilities of Separation from Active Service
(Number Separating at Each Age Per 10,000 Working at That Age)

Age	Withdrawal	Death	Disability	Age and Service Retirement
20	3,700	4		
21	3,550	4		
22	3,390	4		
23	3,230	4		
24	3,070	4		
25	2,910	5		
26	2,750	5		
27	2,600	5		
28	2,430	5		
29	2,270	5		
30	2,120	5		
31	1,970	6		
32	1,820	6		
33	1,680	6		
34	1,540	7		
35	1,410	7	1	
36	1,300	7	1	
37	1,190	8	1	
38	1,090	8	1	
39	1,000	9	2	
40	920	9	2	
41	850	10	2	
42	780	10	4	
43	720	11	4	
44	680	12	4	
45	630	13	5	
46	590	14	6	
47	560	15	7	
48	530	16	7	
49	500	18	10	

Appendix C (continued)

Age	Withdrawal	Death	Disability	Age and Service Retirement
50	470	20	10	
51	440	23	12	
52	410	26	14	
53	390	29	16	
54	360	33	20	
55	330	38	24	
56	290	42	30	
57	230	47	36	
58				10,000

Touche Ross & Co.
900 Pillsbury Center
Minneapolis, MN 55402-1483
Telephone: 612 333-2301
Telecopy: 612 375-5418

Touche Ross

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

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1988 actuarial valuation of the Minnesota State Retirement System, State Patrol Employees' Retirement Plan.

Our report is divided into the following sections:

The report was completed on the basis of accepted actuarial methods and procedures in accordance with the provisions stipulated in the contract between the State of Minnesota and Touche Ross & Co.

We would be pleased to answer any questions you may have regarding this report.

Touche Ross & Co.

F. Jay Lingo

F. Jay Lingo, F.S.A.

James F. Verlautz

James F. Verlautz, F.S.A.

I. INTRODUCTION AND PURPOSE

The Minnesota State Retirement System (MSRS) administers several retirement funds and plans. The plans administered are the: General State Employees' Plan, Unclassified Employees' Plan, Correctional Employees' Plan, State Patrol Employees' Plan, Judges' Plan, Legislators' Plan, Elective Officers' Plan, Military Affairs Plan, Transportation Pilots' Plan, and a statewide Deferred Compensation Plan for public employees.

The plans administered by MSRS are among those subject to being overseen by the Legislative Commission on Pensions and Retirement (LCPR). The LCPR consists of members of the Minnesota State Senate and Minnesota House of Representatives. Its members are charged with the duties of, among other things:

- Reviewing investment performance.
- Establishing policy for public retirement plans.
- Recommending necessary changes to retirement plan provisions.
- Hiring an actuary to perform annual actuarial valuations and experience studies.
- Overseeing the work of the actuary.

Minnesota Statutes, Sections 356.20 and 356.215, require annual actuarial valuations and periodic experience studies. Of concern to the Board of Directors are the valuations and experience studies which must be performed for the following:

- The General State Employees' Plan;
- The Correctional Employees' Plan;
- The State Patrol Employees' Plan; and
- The Judges' Plan

These valuations and experience studies are prepared by the Wyatt Co., the actuary retained by the LCPR. The Minnesota State Retirement System does not have an actuary on its staff and, therefore, has retained Touche Ross to review, analyze, and critique the actuarial valuations and experience studies.

The purpose of this report is to verify the accuracy of the Wyatt Co.'s results, and to expand on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

We attempted to duplicate the figures shown in the Wyatt Co.'s June 30, 1988 valuation reports. To do so involved repeated discussions with the Wyatt personnel who prepared their reports. Where we were able to discover reasonable justification for the Wyatt Co.'s approach, we adjusted our methods and assumptions to match theirs. (Descriptions of those adjustments are included in Section III.)

In this section of the report we present a comparison of the figures generated by the Wyatt Co. and our valuations. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under both Section 352 and Section 356. Table C shows the depth of plan funding based on liabilities incurred to date. These figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Wyatt Co.	Touche Ross	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$127,539	$129,081	1.2%
Death	5,038	4,071	(19.2)
Disability	12,913	12,022	(6.9)
Withdrawal	14,458	15,282	5.7
Total actives	$159,948	$160,456	0.3
Deferred annuitants	1,248	1,254	0.5
Former members without Vested Rights	52	52	0.0
Participants in MPRI Fund	72,739	72,857	0.2
Participants not in MPRI Fund	7,446	7,196	(3.4)
Total	$241,433	$241,815	0.2
Portion allocated to future service	66,371	66,511	0.2
Accrued liability (reserves required)	$175,062	$175,304	0.1
Valuation assets	148,355	148,355	0.0%
Unfunded accrued liability	$ 26,707	$ 26,949	0.9
Funded ratio	84.7%	84.6%	-

CONTRIBUTIONS

Chapters 352 and 356 set forth requirements about the level of contributions. Chapter 352 prescribes the actual amount of contributions, and Chapter 356 describes the methods used to determine the amount of contribution required to fully fund the normal cost and the unfunded accrued liability. Together, the actual contribution and required contribution are used to determine the sufficiency of the actual contribution. These calculations are illustrated in Table B. Amounts in parentheses show dollar amounts as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	Wyatt Co.	Touche Ross
1. Normal cost	$5,291 (18.08%)	$5,546 (18.95%)
2. Assumed operating expense	$ 176 (.60%)	$ 176 (.60%)
3. Amortization by June 30, 2009 of the unfunded accrued liability	$1,519 (5.19%)	$1,533 (5.24%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$6,986 (23.87%)	$7,255 (24.79%)
Prescribed Contributions		
1. Employee contributions	$2,488 (8.50%)	$2,488 (8.50%)
2. Employer contribution	$5,531 (18.90%)	$5,531 (18.90%)
3. Total Chapter 352B prescribed contribution	$8,019 (27.40%)	$8,019 (27.40%)
Contribution Sufficiency	3.53%	2.61%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1989. Expected annual payroll = $29,267,000.

The depth of funding is an indication of the extent to which the accrued benefits are funded and is measured by the ratio of valuation assets to the present value of accrued benefits. These measurements are made on the plan continuation basis (applying all ongoing actuarial assumptions, including assumed salary increases and turnover) and are illustrated as follows:

TABLE C (000's omitted)

Depth of Funding June 30, 1988

		Wyatt Co.	Touche Ross	Percentage Difference
1.	Active members	$ 85,864	$ 86,111	0.3%
2.	Deferred annuitants	1,248	1,254	0.5
3.	Former members without vested rights	52	52	0.0
4.	Participants in MPRI Fund	72,739	72,857	0.2
5.	Participants not in MPRI Fund	7,446	7,196	(3.4)
6.	Total present values of accrued benefits	$167,349	$167,470	0.1
7.	Valuation assets	148,355	148,355	0.0
8.	Depth of funding	88.7%	88.6%	-
9.	Depth of funding excluding MPRI members	79.9%	79.8%	-

III. EXPLANATION OF DIFFERENCES

In this section of the report we present our best explanations for any differences between the Wyatt Co.'s methods and assumptions and ours, the changes we made where appropriate to be consistent with the Wyatt Co., and the effects of these changes.

Our calculations for the State Patrol Employees' Retirement Plan are very similar to those of the Wyatt Co., and our valuation results in Table A of Section II are very close. Our total present value of benefits is .2% higher than the Wyatt Co.'s total, while our total accrued liability is only .1% higher.

The State Patrol Employees' Plan does not have a cash refund annuity. However, we believe that the Wyatt Co. adds a small amount to the liability (less than 1%) to cover that cost.

We increased the withdrawal liability by 6% to account for the death benefit for future vested terminations. The Wyatt Co. has stated that they calculated this liability directly but are unable to give us the exact amount. We believe that a 6% load is a reasonable approximation for this ancillary benefit.

During our discussions with the Wyatt Co., they indicated that they expect the IRS limit on benefits to increase at the same rate as the salary scale. In effect, this assumes that the limits will never apply to individuals in this plan. We believe a 6.5% increase assumption for the IRS limit is too high and should be reviewed. However, this does not have a material affect on the results of this valuation. In order to match the Wyatt Co.'s numbers we made the same assumption.

The normal cost calculated by the Wyatt Co. is 5% less than ours. This is a more substantial difference than any of the others. We were unable to determine the cause of the difference.

IV. CHANGES IN THE UNFUNDED LIABILITY

The State Patrol Plan currently has an unfunded liability. Having an unfunded liability is not necessarily bad for an ongoing plan, as long as some provision is made to pay off the liability over time. The unfunded liability becomes a problem when it is so large as to preclude benefit security, or when, like any debt, interest on the liability becomes unmanageable.

Generally, unfunded liabilities tend to decrease over time, although some year to year fluctuation is normal. One symptom of a troubled pension plan is a constantly increasing unfunded liability. Annual changes in the unfunded liability occur for the following reasons:

- Part of the contribution made each year goes to pay the normal costs (including expenses). The remaining contribution is called the Past Service Contribution. The unfunded liability is automatically increased each year by the interest requirement (8%). If the past service contribution is less than the interest requirement, there will be a net increase in the liability. When the past service contribution is greater than the interest requirement, part of the liability is "paid off," and the liability decreases.

- The unfunded liability is an actuarial projection of liabilities based on certain assumptions. To the extent actual experience differs from the assumptions, actuarial gains and losses may occur. An actuarial gain will decrease the unfunded liability; an actuarial loss will increase the unfunded liability.

- The assumptions and techniques used in calculating the unfunded liability are changed when circumstances warrant. These changes can produce increases or decreases in the unfunded liability.

- Changes in the legal, economic, and sociological environment often result in changes to retirement plans. These changes frequently result in improved benefits. When these changes result in higher retirement benefits, unfunded liabilities are increased. When the changes increase benefits paid in lieu of retirement benefits, unfunded liabilities can increase or decrease.

During the year ended June 30, 1988, the State Patrol Employees' Fund showed an increase in the unfunded liability. This increase was due to the following reasons:

1. <u>Contribution Rate</u>

   The total contributions to the plan were approximately $7.2 million. Normal cost, expenses and interest combined to equal $6.8 million. This resulted in a surplus of $.4 million, which decreased the unfunded liability.

2. <u>Actuarial Losses</u>

   The Fund experienced an actuarial gain of less than $70,000 from salary increases. This gain is essentially negligible, which indicates that the salary increase assumption for this year was accurate.

   The Fund experienced a $2.4 million loss on investments. This was primarily due to the market crash during October of 1987.

   The remaining sources of gain or loss, including MPRI fund mortality, combined to produce a loss of approximately $.5 million. Overall, there was a net loss (increase in unfunded liability) from actuarial experience of $2.9 million.

3. <u>Changes in Assumptions and Plan Provisions</u>

   There were no changes in assumptions or plan provisions since the last actuarial valuation.

Changes in Unfunded Actuarial Accrued Liability*

A.	Unfunded actuarial accrued liability at beginning of year	$24,231
B.	Change due to interest requirement and current rate of funding	(414)
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$23,817
D.	Actuarial losses (gains)	2,890
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$26,707

* Results prepared by the Wyatt Company.

V. SENSITIVITY ANALYSIS

When performining an actuarial valuation, liabilities and contributions are developed under a single actuarial cost method and one set of assumptions. However, since it is unlikely that any given assumption will prove to be exactly correct, analyzing the impact of a variation in an assumption is generally enlightening. This analysis is called a sensitivity analysis.

We have analyzed the sensitivity to change for three of these assumptions and methods mandated by state law. Each of these plays a major role in determining costs:

1. Interest is currently assumed to be 8% for all years until retirement, and 5% thereafter. We examined the effect of changing 8% to 7%.

2. Salaries are assumed to increase 6.5% each year. We examined the effect of a 6% salary increase assumption.

3. The unfunded liability is amortized as a level percent of future payroll. This approach is not permitted for a private sector plan. We examined the effect of amortizing the unfunded liability using a level dollar amount.

		Values After Change		
	Current (Touche Ross)	Interest	Salary Increase	Amortization
Unfunded liability	$26,949	$33,006	$25,282	$26,949
Actuarially required contribution:				
(Amount)	$7,255	$8,533	$6,822	$8,318
(Percent)	24.79%	29.16%	23.31%	28.40%
(Sufficiency)	2.61%	(1.76%)	4.10%	(1.0%)
Plan continuation liability	$167,470	$176,993	$164,484	$167,470
Depth of funding	88.6%	83.8%	90.2%	88.6%

STATE PATROL

VI. SUMMARY OF HISTORICAL VALUATION RESULTS**

(000'S Omitted)

Report as of June 30	Accrued Liability	Valuation Assets	Unfunded Accrued Liability	Normal Cost	Actuarial Contribution	Prescribed Contribution	Sufficiency
1980*	$ 85,830	$ 49,620	$36,210	$2,791 (15.50%)	$5,214 (28.96%)	$5,041 (28.00%)	(.96%)
1981	100,518	58,720	41,798	3,149 (15.77%)	5,991 (30.00%)	5,591 (28.00%)	(2.00)
1982	111,455	68,183	43,272	3,323 (16.96%)	6,243 (31.85%)	5,488 (28.00%)	(3.85)
1983	132,175	78,775	53,400	3,805 (17.65%)	7,469 (34.64%)	6,361 (29.50%)	(5.14)
1984	119,682	86,784	32,898	4,300 (18.68%)	5,973 (25.95%)	6,306 (27.40%)	1.45
1985	134,440	100,486	33,954	4,756 (18.38%)	6,625 (25.60%)	7,090 (27.40%)	1.80
1986	148,524	118,175	30,349	5,080 (18.49%)	6,840 (24.90%)	7,528 (27.40%)	2.50
1987*	160,628	136,397	24,231	5,173 (18.10%)	6,685 (23.39%)	7,832 (27.40%)	4.01
1988*	175,062	148,355	26,707	5,291 (18.08%)	6,986 (23.87%)	8,019 (27.40%)	3.53

* As prepared by the Wyatt Co.

** Figures shown in parentheses are as a percentage of payroll under normal retirement age.

STATE PATROL

VI. SUMMARY OF HISTORICAL VALUATION RESULTS (Continued)

Report as of June 30	Active Members Number	Active Members Valuation Payroll	Retired Members** Number	Retired Members** Avg. Annual Ben.	Deferred Annuitants Number	Deferred Annuitants Avg. Annual Ben.	Former Members Without Vested Rights
1980*	782	$18,003,587	302	$5,030	23	$7,303	13
1981	793	19,967,408	312	5,699	25	8,503	10
1982	763	20,922,575	339	6,614	28	8,636	10
1983	774	23,066,558	359	7,736	22	8,858	10
1984	741	23,016,272	397	8,907	21	8,005	10
1985	765	25,875,980	407	9,749	20	10,507	9
1986	769	27,474,215	425	11,183	17	10,478	10
1987*	771	28,583,000	430	12,619	16	10,009	8
1988*	740	29,267,000	455	14,214	16	9,881	8

* As prepared by the Wyatt Co.
** Including beneficiaries and disabled members.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director furnished us with employee information pertaining to all active members, inactive members, and retired members of the Fund. The following tables summarize the changes in active, inactive, and retired membership during the year.

In order to reflect anticipated current year salary increases, all salaries provided were increased by 6.5%.

Appendix A

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

State Patrol Census Data as of June 30, 1988

	Number	Annual Payroll
Actives at June 30, 1987	771	$28,582,892
New Entrants*	6	
Total	777	
Less Separations from Active Service:		
Refund of Contributions*	1	29,669
Separation with a Vested Right to a Deferred Annuity	3	104,149
Separation with Neither Refund nor Right to a Deferred Annuity	0	0
Death While Eligible; Surviving Spouse Receiving Annuity	0	0
Service Retirement	32	1,180,713
Death	0	0
Total Separations	36	
Adjustments	(1)	0
Actives at June 30, 1988	740	$29,266,695

Average Entry Age of New Employees

For the Fiscal Year Ending	Male	Female	Average of Total
6/30/84	28.0	31.7	28.3
6/30/85	27.8	23.5	27.4
6/30/86	26.5	22.8	26.4
6/30/87	26.0	36.7	26.4
6/30/88	32.5	34.2	32.7

* Includes those who entered the plan and terminated during the period from July 1, 1987 to June 30, 1988.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

State Patrol Employees' Annuitant Census
Data as of June 30, 1988

		Number	Annual Annuity Benefit Payable
A.	Service Retirement Annuitants		
	Receiving at June 30, 1987	318	$4,651,151
	New	36	810,993
	Deaths	(15)	(132,825)
	Adjustments	0	272,229
	Receiving at June 30, 1988	339	$5,601,548
B.	Disabled Employees		
	Receiving at June 30, 1987		
	MPRIF 10		
	Non-MPRIF 3		
		13	$ 154,962
	New	0	0
	Deaths	0	0
	Adjustments	0	8,548
	Receiving at June 30, 1988	13	$ 163,510
C.	Widows Receiving an Annuity or Survivor Benefit		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1987	93	$ 605,634
	New	10	75,860
	Deaths	(3)	(10,652)
	Adjustments - Net Result	(2)	18,722
	Receiving at June 30, 1988	98	$ 689,564

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	Children Receiving a Survivor Benefit		
	Receiving at June 30, 1987	6	$ 14,287
	New	0	0
	Reinstated	0	0
	No Longer Eligible	(2)	(4,650)
	Adjustments - Net Result	1	2,975
	Receiving at June 30, 1988	5	$ 12,612
E.	Deferred Annuitants		
	Deferred as of June 30, 1987	16	$160,139
	New	4	49,116
	Began Receiving	(4)	(51,156)
	Adjustments - Net Result	0	0
	Deferred as of June 30, 1988	16	$158,099

Average Age at Retirement of New Service Annuitants

Fiscal Year Ending	Average Retirement Age
6/30/83	59.8
6/30/84	58.6
6/30/85	58.3
6/30/86	58.2
6/30/87	57.2
6/30/88	57.5
All Existing Service Annuitants	58.0

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1988

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: 8.5% of salary.

   b. State of Minnesota: 18.9% of salary.

4. Final Average Salary: Monthly average for the highest 5 years of salary.

5. Normal Retirement:

   a. Eligibility: Attainment of age 55 and completion of 5 years of service.

   b. Benefit Amount: 2-1/2% of final average salary for each of the first 25 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: Earlier of:

      o In line of duty: None.

      o Not in line of duty: Five years of service and less than age 55.

Appendix B (continued)

b. Benefit Amount:

- In line of duty: 50% of average monthly salary plus 2-1/2% for each year of service up to 25 years and 2% for each year of service in excess of 25 years.
- Not in line of duty: 2-1/2% of average monthly salary for each year up to and including 25 years, plus 2% for each year in excess of 25, subject to a minimum of 25% of average monthly salary.

c. Death Benefits: If a member dies while receiving a disability benefit, 20% of his final average salary is payable to the surviving spouse for life.

8. Deferred Service Retirement:

a. Eligibility: Completion of 5 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 of 5% for each year between termination and retirement 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 with interest at 5%.

Appendix B (continued)

10. Surviving Spouse Death Benefit:

a. Eligibility:	Death of member in service.
b. Benefit Amount:	20% of final average salary. With 5 or more years of service, changes to a 100% joint and survivor annuity amount as of the date the employee would have attained age 55.

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 refunds 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 Provision:

a. Eligible Members:	Members who have had coverage under two or more Minnesota Public Retirement Systems, with a total of at least 5 years of credited service.

Appendix B (continued)

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 terminated after attaining age 65 and completing at least one year of service is entitled to a proportionate retirement annuity based on his allowable service credit.

15. Pre-1973 Annuitants: State Patrol officers who retired prior to 1973 are entitled to an annual 6% increase in benefits.

APPENDIX C

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. For the June 30, 1988 valuation, we used the traditional individual entry age normal method, with normal costs determined as a percentage of salary.

The normal cost as a percentage of payroll for disability, refund, survivor and vested termination benefits is determined by dividing the present value at entry of the applicable benefit by the present value at entry of future compensation.

The unfunded liability is amortized by the level percent of payroll method. (Each amortization payment is calculated as if the following year's payment will increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

The tables on the following pages summarize the actuarial assumptions used for this valuation.

CHANGE IN ACTUARIAL ASSUMPTIONS

None.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

1.	Mortality:	1971 Group Annuity Mortality Table with ages set back 8 years for females.
2.	Withdrawal:	Rates starting at .03 per 10,000 at age 20 and decreasing to zero at age 55, 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's expenses expressed as a percentage of prior year's payroll.
5.	Interest Rate:	Pre-retirement - 8% per annum. Post-retirement - 5% per annum.
6.	Salary Scale:	6-1/2% per annum, disregarding actual salary history. Benefits in excess of IRC Sec. 415 limits caused by salary increases are disregarded.
7.	Assumed Retirement Age:	Later of age 58 for State Troopers and for State Police Officers hired after June 30, 1961, or age 63 for State Police Officers hired before July 1, 1961, and one year hence.
8.	Actuarial Cost Method:	Individual level percent entry age cost method.
9.	Assumed Survivor Status:	100% assumed married, female spouse 3 years younger. Fifteen percent load on spouse benefits for children's benefits.

Appendix C (continued)

10. Contribution Refund: All employees withdrawing after becoming eligible for a deferred benefit were assumed to leave their contributions on deposit and receive a deferred annuitant benefit. Effective June 30, 1987, all employees withdrawing after becoming eligible for a deferred benefit were assumed to take the larger of their contributions accumulated with interest or the value of their deferred benefit.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

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

Age	Death* Males	Death* Females	Withdrawal**	Disability**
20	5	4	300	4
21	5	4	290	4
22	5	4	280	5
23	6	4	270	5
24	6	4	260	6
25	6	5	250	6
26	7	5	240	6
27	7	5	230	7
28	7	5	220	7
29	8	5	210	8
30	8	5	200	8
31	9	6	190	9
32	9	6	180	9
33	10	6	170	10
34	10	7	160	10
35	11	7	150	11
36	12	7	140	12
37	13	8	130	13
38	14	8	120	15
39	15	9	110	16
40	16	9	100	18
41	18	10	90	20
42	20	10	80	22
43	23	11	70	24
44	26	12	60	26
45	29	13	50	29
46	33	14	50	32
47	38	15	50	36
48	42	16	50	41
49	47	18	50	46

Appendix C (continued)

Age	Death* Males	Death* Females	Withdrawal**	Disability**
50	53	20	200	50
51	59	23	200	57
52	65	26	200	64
53	71	29	200	72
54	78	33	200	80
55	85	38		88
56	93	42		98
57	100	47		108
58	109	53		118
59	119	59		129
60	131	65		141
61	144	71		154
62	159	78		167

* 1971 Group Annuity Mortality Table, with age set back 8 years for females.

** Same withdrawal and disability rates pertain to males and females.

Touche Ross & Co.
900 Pillsbury Center
Minneapolis, MN 55402-1483
Telephone: 612 333-2301
Telecopy: 612 375-5418

Touche Ross

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

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1988 actuarial valuation of the Minnesota State Retirement System, Judges' Retirement Plan.

Our report is divided into the following sections:

The report was completed on the basis of accepted actuarial methods and procedures in accordance with the provisions stipulated in the contract between the State of Minnesota and Touche Ross & Co.

We would be pleased to answer any questions you may have regarding this report.

Touche Ross & Co.

F. Jay Lingo

F. Jay Lingo, F.S.A.

James F. Verlautz

James F. Verlautz, F.S.A.

I. INTRODUCTION AND PURPOSE

The Minnesota State Retirement System (MSRS) administers several retirement funds and plans. The plans administered are the: General State Employees' Plan, Unclassified Employees' Plan, Correctional Employees' Plan, State Patrol Employees' Plan, Judges' Plan, Legislators' Plan, Elective Officers' Plan, Military Affairs Plan, Transportation Pilots' Plan, and a statewide Deferred Compensation Plan for public employees.

The plans administered by MSRS are among those subject to being overseen by the Legislative Commission on Pensions and Retirement (LCPR). The LCPR consists of members of the Minnesota State Senate and Minnesota House of Representatives. Its members are charged with the duties of, among other things:

- Reviewing investment performance.
- Establishing policy for public retirement plans.
- Recommending necessary changes to retirement plan provisions.
- Hiring an actuary to perform annual actuarial valuations and experience studies.
- Overseeing the work of the actuary.

Minnesota Statutes, Sections 356.20 and 356.215, require annual actuarial valuations and periodic experience studies. Of concern to the Board of Directors are the valuations and experience studies which must be performed for the following:

- The General State Employees' Plan;
- The Correctional Employees' Plan;
- The State Patrol Employees' Plan; and
- The Judges' Plan

These valuations and experience studies are prepared by the Wyatt Co., the actuary retained by the LCPR. The Minnesota State Retirement System does not have an actuary on its staff and, therefore, has retained Touche Ross to review, analyze, and critique the actuarial valuations and experience studies.

The purpose of this report is to verify the accuracy of the Wyatt Co.'s results, and to expand on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

We attempted to duplicate the figures shown in the Wyatt Co.'s June 30, 1988 valuation reports. To do so involved repeated discussions with the Wyatt personnel who prepared their reports. Where we were able to discover reasonable justification for the Wyatt Co.'s approach, we adjusted our methods and assumptions to match theirs. (Descriptions of those adjustments are included in Section III.)

In this section of the report we present the figures generated by the Wyatt Co. compared with our valuations. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under both Chapter 490 and Chapter 356. Table C shows the depth of plan funding based on liabilities incurred to date. These figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Wyatt Co.	Touche Ross	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$47,012	$48,873	4.0%
Death	7,726	7,123	(7.8)
Disability	3,540	3,547	.2
Withdrawal	-	-	-
Total actives	$58,278	$59,543	2.2
Deferred annuitants	627	765	22.0
Former members without vested rights	0	0	0.0
Participants in MPRI Fund	17,812	17,730	(.5)
Retirement and survivor benefits from Judges' Fund	12,137	12,270	1.1
Total	$88,854	$90,308	1.6
Portion allocated to future service	29,146	29,501	1.2
Accrued liability (reserves required)	$59,708	$60,807	1.8
Valuation assets	20,760	20,760	0.0
Unfunded accrued liability	$38,948	$40,047	2.8
Funded ratio	34.8%	34.1%	-

CONTRIBUTIONS

Chapters 490 and 356 set forth requirements for the level of contributions. Chapter 490 prescribes the actual amount of contributions, and Chapter 356 describes the methods used to determine the amount of contribution required to fully fund the normal cost and the unfunded accrued liability. Together, the actual contribution and required contribution are used to determine the sufficiency of the actual contribution. These calculations are illustrated in Table B. Amounts shown in parentheses are the dollar amount as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	Wyatt Co.	Touche Ross
1. Normal cost	$2,567 (15.00%)	$2,696 (15.76%)
2. Assumed operating expense	$ 50 (.29%)	$ 50 (.29%)
3. Amortization by June 30, 2009 of the unfunded accrued liability	$2,216 (12.95%)	$2,278 (13.31%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$4,833 (28.25%)	$5,024 (29.36%)
Prescribed Contributions		
1. Employee contributions	$ 759 (4.44%)	$ 759 (4.44%)
2. Employer contribution	$ 0 (0.0%)	$ 0 (0.0%)
3. Total Chapter 490 prescribed contribution	$ 759 (4.44%)	$ 759 (4.44%)
Contribution Sufficiency	(23.81%)	(24.92%)

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1989. Expected annual payroll = $17,109,000.

The depth of funding is an indication of the extent to which the accrued benefits are funded and is measured by the ratio of valuation assets to the present value of accrued benefits. These measurements are made on the plan continuation basis (applying all ongoing actuarial assumptions, including assumed salary increases and turnover) and are illustrated as follows:

TABLE C (000's omitted)

Depth of Funding June 30, 1988

		Wyatt Co.	Touche Ross	Percentage Difference
1.	Active members	$28,813	$29,277	1.6%
2.	Deferred annuitants	627	765	22.0
3.	Former members without vested rights	0	0	0.0
4.	Participation in MPRI Fund	17,812	17,730	(.5)
5.	Participants not in MPRIF	12,137	12,270	1.1
6.	Total present values of accrued benefits	$59,389	$60,042	1.1%
7.	Valuation assets	20,760	20,760	0.0
8.	Depth of funding	35.0%	34.6%	-
9.	Depth of funding excluding MPRI members	7.1%	7.2%	

III. EXPLANATION OF DIFFERENCES

In this section of the report we present our best explanations for any differences between the Wyatt Co.'s methods and assumptions and ours, the changes we made where appropriate to be consistent with the Wyatt Co., and the effects of these changes.

Our calculations for the Judges' Retirement Plan are similar to those of the Wyatt Co., and our valuation results in Table A of Section II are close. Our total present value of benefits is 1.6% higher than the Wyatt Co.'s. Our total accrued liability is only 1.8% higher than the Wyatt Co.'s total. With a plan of this complexity, duplicating results this closely is unusual.

Wyatt assumes that retirement benefits will never exceed IRS limits on benefits. To implement this assumption, they assume the current IRS limit will increase at the same rate as the salary scale. In order to match the Wyatt Co.'s numbers we have also used this assumption. We believe a 6.5% increase assumption for the current IRS limit is too high and should be reviewed.

IV. CHANGES IN THE UNFUNDED LIABILITY

The Judges' Plan currently has an unfunded liability. Having an unfunded liability is not necessarily undesirable for an ongoing plan, as long as some provision is made to pay off the liability over time. The unfunded liability becomes a problem when it is so large as to preclude benefit security, or when, like any debt, interest on the liability becomes unmanageable.

Generally, unfunded liabilities tend to decrease over time, although some year to year fluctuation is normal. One symptom of a troubled pension plan is a constantly increasing unfunded liability. Annual changes in the unfunded liability occur for the following reasons:

- Part of the contribution made each year goes to pay the normal costs (including expenses). The remaining contribution is called the Past Service Contribution. The unfunded liability is automatically increased each year by the interest requirement (8%). If the past service contribution is less than the interest requirement, there will be a net increase in the liability. When the past service contribution is greater than the interest requirement, part of the liability is "paid off", and the liability decreases.

- The unfunded liability is an actuarial projection of liabilities based on certain assumptions. To the extent actual experience differs from the assumptions, actuarial gains and losses may occur. An actuarial gain will decrease the unfunded liability; an actuarial loss will increase the unfunded liability.

- The assumptions and techniques used in calculating the unfunded liability are changed when circumstances warrant. These changes can produce increases or decreases in the unfunded liability.

- Changes in the legal, economic, and sociological environment often result in changes to retirement plans. These changes frequently result in improved benefits. When these changes result in higher retirement benefits, unfunded liabilities are increased. When the changes increase benefits paid in lieu of retirement benefits, unfunded liabilities can increase or decrease.

During the year ended June 30, 1988, the Judges' Fund showed a small increase in the unfunded liability. This increase was caused by the following reasons:

1. Contribution Rate

   The total contributions to the plan were $3,215,000. However, normal cost, expenses and interest combined to equal $4,868,000. This resulted in a shortfall of $1,653,000, which increased the unfunded liability.

2. Actuarial Losses

   The Fund experienced a loss on investments of approximately $93,000. This was caused primarily by the market decline during October of 1987. The fund also experienced an actuarial gain of approximately $280,000 because of salary increases which were smaller than anticipated. The MPRI fund experienced a mortality loss of $456,000 caused by retirees living longer than expected. The remaining sources of gain and loss combined to produce a small loss. Overall, there was a net loss (increase in unfunded liability) from actuarial experience of $294,000.

3. Changes in Assumptions

   No changes in actuarial assumptions have been made since the last valuation.

4. Changes in Plan Provisions

   This valuation reflects three changes in plan provisions since the last valuation. Vesting eligibility has been reduced from 10 years to 5 years, and the Judges who are covered under Social Security had their offset reduced from 75% to 50%. The employee contribution rate was also increased by .75% of salary.

   The unfunded actuarial accrued liability was increased by $1,748,000 due to these changes in plan provisions.

Changes in Unfunded Actuarial Accrued Liability*

A.	Unfunded actuarial accrued liability at beginning of year	$35,253
B.	Change due to interest requirement and current rate of funding	1,653
C.	Expected unfunded actuarial accrued liability at end of year: (A) + (B)	36,906
D.	Actuarial losses (gains)	294
E.	Changes in assumptions and plan provisions	1,748
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$38,948

* Results prepared by the Wyatt Company.

V. SENSITIVITY ANALYSIS

When performing an actuarial valuation, liabilities and contributions are developed under a single actuarial cost method and one set of actuarial assumptions. However, since it is unlikely that any given assumption will prove to be exactly correct, analyzing the impact of a variation in an assumption is generally enlightening. This analysis is called a sensitivity analysis.

We have analyzed the sensitivity to change of three of these assumptions and methods mandated by state law. Each of these plays a major role in determining costs:

1. Interest is currently assumed to be 8% for all years until retirement, and 5% thereafter. We examined the effect of changing 8% to 7%.

2. Salaries are assumed to increase 6.5% each year. We examined the effect of a 6% salary increase assumption.

3. The unfunded liability is amortized as a level percent of future payroll. This approach is not permitted for a private sector plan. We examined the effect of amortizing the unfunded liability using a level dollar amount.

	Current (Touche Ross)	Value After Change: Interest	Value After Change: Salary Increase	Value After Change: Amortization
Unfunded Liability:	$40,047	$41,473	$39,764	$40,047
Actuarially required contribution:				
(Amount)	5,024	5,428	4,893	6,604
(Percent)	29.36%	31.73%	28.60%	38.60%
(Sufficiency)	(24.92%)	(27.29%)	(24.16%)	(34.16%)
Plan continuation liability	$60,042	$62,504	$59,317	$60,042
Depth of funding:	34.6%	33.2%	35.0%	34.6%

JUDGES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS**

(000'S Omitted)

Report as of June 30	Accrued Liability	Valuation Assets	Unfunded Accrued Liability	Normal Cost	Actuarial Contribution	Prescribed Contribution
1980*	$ 31,367	$ 7,641	$23,726	$1,610 (15.16%)	$3,194 (30.08%)	$504 (4.74%)
1981	32,615	8,514	24,101	1,564 (14.73%)	3,198 (30.12%)	496 (4.67%)
1982	35,217	8,740	26,477	1,537 (15.17%)	3,318 (32.74%)	460 (4.54%)
1983	40,556	11,049	29,507	1,807 (15.09%)	3,830 (31.99%)	543 (4.54%)
1984	42,378	11,792	30,586	1,950 (13.84%)	3,484 (24.73%)	589 (4.18%)
1985	46,843	13,784	33,059	2,041 (13.47%)	3,752 (24.77%)	611 (4.04%)
1986	51,102	15,983	35,119	2,225 (13.39%)	4,110 (24.73%)	675 (4.06%)
1987*	54,034	18,781	35,253	2,180 (13.63%)	4,152 (25.96%)	601 (3.76%)
1988*	59,708	20,760	38,948	2,567 (15.00%)	4,833 (28.25%)	759 (4.44%)

* As prepared by the Wyatt Co.

** Figures shown in parentheses are as a percentage of payroll under normal retirement age.

JUDGES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS (Continued)

Report as of June 30	Active Members Number	Active Members Valuation Payroll	Retired Members** Number	Retired Members** Avg. Annual Ben.	Deferred Annuitants Number	Deferred Annuitants Avg. Annual Ben.	Former Members Without Vested Rights
1980*	221	$10,617,000	121	$11,089	4	$ 7,048	3
1981	220	10,618,500	126	11,715	4	7,048	3
1982	220	10,616,226	128	12,703	5	10,105	1
1983	229	12,685,000	135	13,906	5	10,105	0
1984	244	14,083,111	136	14,873	4	9,334	2
1985	239	15,145,615	139	16,136	8	18,810	0
1986	242	16,616,138	138	17,594	8	19,276	0
1987*	238	15,999,000	152	19,047	7	18,137	1
1988*	246	17,109,000	161	20,301	5	19,940	0

* As prepared by the Wyatt Co.
** Including beneficiaries and disabled members.

Touche Ross

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director furnished us with employee information pertaining to all active members, inactive members, and retired members of the Fund. The tables on the following pages summarize the changes in active, inactive, and retired membership during the year.

In order to reflect anticipated current year salary increases, all salaries provided were increased by 2-1/2%.

Appendix A

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Covered Judges' Retirement Fund Employee
Census Data as of June 30, 1988

	Number	Annual Payroll
Judges' Retirement Fund		
Actives at June 30, 1987	236	$15,998,455
New Entrants	17	
Total	253	
Less Separations from Active Service:		
Inactive Nonvested	0	0
Inactive Vested	0	0
Service Retirement	8	558,214
Death While Eligible; Spouse Receiving Annuity	0	0
Total Separations	8	
Actives at June 30, 1988	245	$17,036,690
Supreme Court Justices		
Actives at June 30, 1988	1	72,053
Total Active Judges at June 30, 1988	246	$17,108,743

Average Entry Age of New Employees

For Fiscal Year Ending	Average Age at Entry
6/30/86	47.2
6/30/87	46.4
6/30/88	44.6

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Judges' Retirement Fund Annuitant Census Data
as of June 30,1988

	Number	Annual Annuity Benefit Payable
A. Service Retirement Annuitants		
Receiving at June 30, 1987	87	$2,037,263
New	11	247,903
Deaths	(5)	(107,703)
Adjustments - Net Result	1	152,506
Receiving at June 30, 1988	94	$2,329,969
Non-MPRIF	22	606,390
MPRIF	72	1,723,579
	94	2,329,969
B. Disabled Employees		
Receiving at June 30, 1987	5	$ 111,709
New	0	0
Adjustments - Net Result	0	8,997
Receiving at June 30, 1988	5	$ 120,706
Non-MPRIF	1	21,266
MPRIF	4	99,440
	5	120,706
C. Widows Receiving an Annuity or Survivor Benefit & Children		
Receiving at June 30, 1987	60	$ 746,110
New	6	91,657
Deaths	(3)	(43,498)
Adjustments - Net Result	(1)	23,539
Receiving at June 30, 1988	62	$ 817,808
Non-MPRIF	56	713,593
MPRIF	6	104,215
	62	817,808

Appendix A (continued)

	Number	Annual Annuity Benefit Payable
D. Deferred Annuitants		
Deferred as of June 30, 1987	7	126,956
New	0	0
Began Receiving	(2)	(27,258)
Adjustments	0	0
Deferred at June 30, 1988	5	$ 99,698
Judges	4	63,788
Supreme Court Judges	1	35,910
	5	$ 99,698

Average Age at Retirement of New Service Annuitants*

Fiscal Year Ending	Average Retirement Age
6/30/83	67.7
6/30/84	69.2
6/30/85	68.0
6/30/86	69.1
6/30/87	67.3
6/30/88	65.6
All Existing Service Annuitants	68.3

* Not including District or Supreme Court, or County Paid Judges or Widows

Appendix B

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Summary of Principal Plan Provisions
as of June 30, 1988

JUDGES'S PLAN

1.	Coverage:	From first date as a Judge.
2.	Types of Coverage:	
	a. Including Social Security:	All Judges except those excluded by Item 2(b) are covered by Social Security.
	b. Not Including Social Security:	Judges prior to January 1, 1974 were given the opportunity to elect not to be covered under Social Security.
3.	Contributions:	
	a. From Judges:	Judges pay the Social Security Tax Rate applied to the entire salary, plus an additional 1.25% of salary (Amended). For those Judges with Social Security coverage, the appropriate portion of this contribution is forwarded to Social Security.
	b. From the State:	The State provides any additional funds necessary to meet obligations as Judges retire.
4.	Final Average Salary:	Monthly average for the highest 5 years of salary within the last 10 years.

Appendix B (continued)

5. Normal Retirement:

a. Eligibility: Earlier of:

- o Attainment of age 65 and completion of 5 years of service (Amended); or
- o Attainment of age 70.

b. Benefit Amount: 2-1/2% of final average salary for each year of service prior to June 30, 1980, plus 3% of final average salary for each year thereafter.

c. Maximum Benefit: 65% of annual salary in the year immediately preceding retirement.

6. Early Retirement:

a. Eligibility: Attainment of age 62 and completion of 5 years of service (Amended).

b. Benefit Amount: Normal retirement benefit formula based on service and final average salary to date of early retirement, but reduced 1/2% for each month that actual retirement precedes age 65.

7. Form of Payment: Life annuity with no guarantees upon death. Joint and survivor options are available.

8. Disability Retirement:

a. Eligibility: None other than disablement while in office.

b. Benefit Amount:

- o Full salary for the first two years of disability paid outside the plan.

Appendix B (continued)

- After two years of disability, an annuity computed in the same manner as the full benefit amount for service retirement, subject to a minimum of 25% of final average salary.

9. Deferred Service Retirement:	Any annuity benefit described above may be deferred until the early or normal retirement date.
10. Return of Contributions:	Upon termination of employment, if a Judge qualifies for no other benefits under this plan, he will receive his contributions, accumulated with interest, at a rate of 5% compounded annually.
11. Pre-Retirement Survivor's Annuity:	60% of the annuity determined in the same manner as normal service retirement benefits, assuming the Judge retired on his date of death. Subject to minimum of 25% of final average salary.
12. Post-Retirement Survivor's Annuity:	
a. Joint and Survivor Election:	In lieu of receiving benefits in the standard life annuity form of payment, a retiring Judge may elect actuarially reduced benefits in the joint and survivor annuity form.
b. Prior Survivor's Benefits:	Judges who were in office prior to January 1, 1974 and who continue to make additional contributions of 4% of salary receive benefits in the 50% joint and survivor form, with no actuarial reduction.

Appendix B (continued)

13. Social Security Offset:	For Judges participating in Social Security, Judge's Plan benefits are reduced by 50% of the primary Social Security benefit payable (Amended).

SUPREME COURT JUSTICES' PLAN

1. Coverage:	Supreme Court Justices as of December 31, 1973 who elected coverage under Chapter 490.025 in lieu of coverage under Chapters 490.121 through 490.132.
2. Retirement With Continuation of Compensation:	
a. Eligibility:	Attainment of age 70 and completion of 12 years of Supreme Court service, or 15 years of service as Supreme Court Judge and Judge of District Court.
b. Benefit Amount:	Continuation of final compensation until the end of the term to which the Supreme Court Justice was elected. 50% of final salary plus an additional 2-1/2% of final salary for each year of Supreme Court service in excess of 12, except for service after age 73; payable after the continuation of compensation ceases. The maximum benefit is 75% of final salary.
3. Retirement Without Continuation of Compensation:	
a. Eligibility:	Earlier of: o Attainment of age 65 and completion of 12 years of Supreme Court service; or

Appendix B (continued)

	o Attainment of age 70 and completion of two full terms.
b. Benefit Amount:	50% of final salary plus an additional 2-1/2% of final salary for each year of Supreme Court service in excess of 12.
4. Disability Benefits:	
a. Eligibility:	Disablement after completion of two full terms.
b. Benefit Amount:	50% of final salary plus an additional 2-1/2% of final salary for each year of Supreme Court service in excess of 12.
5. Contributions from Judges:	4% of salary to provide a 50% joint and survivor benefit with no actuarial reduction.

APPENDIX C

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. For the June 30, 1988 valuation, we used the individual entry age normal method, with salary scale.

The unfunded liability is amortized by the level percent of payroll method. (Each amortization payment is calculated as if the following year's payment will increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

The tables on the following pages summarize the actuarial assumptions used for this valuation.

CHANGES IN ACTUARIAL ASSUMPTIONS

None.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

JUDGES' RETIREMENT FUND

1.	Mortality:	1971 Group Annuity Mortality Table for Males with ages set back 8 years for females.
2.	Withdrawal:	None.
3.	Disability:	Graded rates on actual experience, as adjusted by the June 30, 1979 experience analysis and as set forth in the Separation From Active Service Table.
4.	Expenses:	Prior year's expenses expressed as a percentage of prior year's payroll.
5.	Interest Rate:	8% per annum pre-retirement, 5% per annum post-retirement.
6.	Salary Scale:	5% annually for the next year and 6-1/2% per annum for each future year, disregarding actuarial salary history.
7.	Assumed Retirement Age:	Later of age 68 or one year hence.
8.	Actuarial Cost Method:	Entry age cost method, with normal cost determined as a level percentage of future payroll on an individual basis.

Appendix C (continued)

9. Social Security:

a. Primary Amount: Maximum current primary amount ($838.00 per month for 1988), increasing with salary scale.

b. Level Contribution Rate: 7.51% assumed for all future years.

c. Covered Annual Wages: Current annual wage base ($45,000 for 1988), increasing with salary scale.

SUPREME COURT JUSTICES

1. Mortality (Pre- and Post-Retirement): 1971 Group Annuity Mortality Table for Males with ages set back 8 years for females.

2. Withdrawal: None.

3. Interest Rate: 8% pre-retirement, 5% post-retirement.

4. Salary Scale: 6-1/2% per annum, disregarding actual salary history. Benefits in excess of IRC Sec. 415 limits caused by salary increases are disregarded.

5. Expenses: Prior year expenses expressed as a percentage of prior year's payroll.

6. Retirement Age: Latest of:

- Attainment of age 70;
- Completion of 12 years of service; or
- One year from valuation date.

Appendix C (Continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

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

Age	Death	Disability	Age and Service Retirement	Age	Death	Disability	Age and Service Retirement
20	4			45	13	5	
21	4			46	14	6	
22	4			47	15	7	
23	4			48	16	7	
24	4			49	18	10	
25	5			50	20	10	
26	5			51	23	12	
27	5			52	26	14	
28	5			53	29	16	
29	5			54	33	20	
30	5			55	38	24	
31	6			56	42	30	
32	6			57	47	36	
33	6			58	53	44	
34	7			59	59	52	
35	7	1		60	65	62	
36	7	1		61	71	74	
37	8	1		62	78	88	
38	8	1		63	85	104	
39	9	2		64	93	122	
40	9	2		65	100		
41	10	2		66	109		
42	10	4		67	119		
43	11	4		68			10,000
44	12	4					