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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, 1989 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 Deloitte & Touche.

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

DELOITTE & TOUCHE

F. Jay Lingo

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James F. Verlautz

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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 that MSRS administers are 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 duties include:

- 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. The Board of Directors is concerned with the valuations and experience studies which must be performed for:

- 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. Since the Minnesota State Retirement System does not have an actuary on its staff, it has retained Deloitte & Touche to review, analyze, and critique the actuarial valuations and experience studies.

This report evaluates the accuracy of the Wyatt Co.'s results and expands 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, 1989 valuation reports. In doing so we had several discussions with the Wyatt Co.'s personnel who prepared the 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 results that the Wyatt Co. reported with our valuation results. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under Sections 352 and 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.	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$1,763,036	$1,768,524	0.3%
Death	112,058	113,028	0.9
Disability	95,505	93,718	(1.9)
Withdrawal	531,002	515,671	(2.9)
Total actives	$2,501,601	$2,490,941	(0.4)
Deferred Annuitants	21,836	21,819	(0.1)
Former members without vested rights	2,178	2,208	1.4
Participants in MPRI Fund	708,697	709,996	0.2
Non-MPRI Benefit	5,572	6,418	15.2
Total	3,239,884	3,231,382	(0.3)
Portion allocated to future service	783,198	747,933	(4.5)
Accrued liability (reserves required)	$2,456,686	$2,483,449	1.1
Valuation assets	1,871,542	1,871,542	0.0
Unfunded accrued liability	$ 585,144	$ 611,907	4.6
Funded ratio	76.2%	75.4%	--

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 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 amount as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	**Wyatt Co.**	**Deloitte & Touche**
1. Normal cost	$ 86,543 (6.10%)	$ 84,961 (5.99%)
2. Assumed operating expense	$ 3,262 (.23%)	$ 3,262 (.23%)
3. Amortization by June 30, 2020 of the unfunded accrued liability	$ 25,669 (1.81%)	$ 26,892 (1.90%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$115,474 (8.14%)	$115,115 (8.12%)
Prescribed Contributions		
1. Employee contributions	$ 61,548 (4.34%)	$ 61,548 (4.34%)
2. Employer contribution	$ 63,959 (4.51%)	$ 63,959 (4.51%)
3. Total Chapter 352A prescribed contribution	$125,507 (8.85%)	$125,507 (8.85%)
Contribution Sufficiency	.71%	.73%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1990. The expected annual payroll is $1,418,159,000.

The depth of funding indicates 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, 1989

		Wyatt Co.	Deloitte & Touche	Percentage Difference
1.	Active members	$1,370,989	$1,362,664	(0.6%)
2.	Deferred annuitants	21,836	21,819	(0.1)
3.	Former members without vested rights	2,178	2,208	1.4
4.	Participants in MPRI fund	708,697	709,996	.2
5.	Participants not in MPRI fund	5,572	6,418	15.2
6.	Total present values of accrued benefits	$2,109,272	$2,103,105	(0.3)
7.	Valuation assets	1,871,542	1,871,542	0.0
8.	Depth of funding	88.7%	89.0%	--
9.	Depth of funding excluding MPRI members	83.0%	83.4%	--

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 1.1% 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 8.12% of payroll. This is only .02% lower than the Wyatt Co.'s number of 8.14% of payroll. The difference in our numbers is not statistically significant.

When we subtracted the actuarial value of assets to derive the unfunded accrued liability, the percentage difference increased to 4.6%. This difference is misleading since it only occurs because the plan is well funded.

During our discussions with the Wyatt Co., they indicated that they expect the IRS limits on benefits to increase 5% per year. The Wyatt Co. changed their assumption from a rate of 6.5% used last year. We believed that a 6.5% assumption was too high and agree that a 5% increase is reasonable. This assumption along with a 6.5% salary scale results in some IRS limitation for the benefits that this plan provides. The net effect is a slight decrease in potential liabilities.

The General Employees' Retirement Plan has a cash refund annuity. The Wyatt Co. has elected not to adjust for this benefit. In the past, we have recognized this potential liability by applying a 1% load. Because the plan now provides a bounceback annuity at no extra cost, the frequency of cash refund annuities will decrease. Therefore, we now agree with Wyatt that this amount is too insignificant to value.

IV. CHANGES IN THE UNFUNDED LIABILITY

The General Plan currently has an unfunded liability. 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. However the unfunded liability becomes a problem when it is so large that it precludes 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 when:

- 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% last year, 8.5% in future years). 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, 1989, the General Employees' Fund showed an increase in the unfunded liability. This increase was caused because:

1. **Contribution Rate**

   The total contributions to the plan were approximately $90 million. However, expected normal cost, expenses and interest combined to equal $113 million. The Wyatt Co. decreased the $23 million difference by $9 million which is a gain caused by actual salaries being less than the salaries projected last year. The net result was a shortfall of $14 million, which increases the unfunded liability.

2. **Actuarial Gains**

   The Fund experienced an actuarial gain of approximately $31 million from salary increases which were less than expected. The Fund experienced a $63 million gain on investments. There was also a loss on postretirement mortality of $1 million due to retirees living longer than anticipated.

   The Wyatt Co. reported a $35 million loss on "other items." Wyatt's loss on other items is about 1% of the accrued liability and is within the normal range of miscellaneous losses.

   Overall, the Wyatt Co. reported a net gain (decrease in unfunded liability) from actuarial experience of $58 million.

3. **Changes in Assumptions and Plan Provisions**

   Legislation passed in 1989 made many changes to the plan provisions. The most significant changes are detailed in the back of the report and summarized below:

   - A reduction in service requirements from five years to three years for all benefits.
   - An increase in the normal retirement benefit amount.
   - A change in eligibility requirements and benefit amounts for early retirement.
   - An increase in the augmentation for deferred annuities to 5% for each year beyond age 55.
   - An increase in the interest rate credited on refunds of member contributions from 5% to 6%.
   - A Bounceback annuity is now provided at no additional cost.
   - An additional annual payment (valued at $25 times years of service) is made to annuitants who retired before July 1, 1973.

Changes in actuarial assumptions included an increase in the preretirement interest rate assumption from 8% to 8.5%. Also, the date of full amortization of the unfunded liability was changed from June 30, 2011 to June 30, 2020.

The changes in provisions increased the unfunded liability by $231 million. This was offset by a decrease of $74 million due to changes in assumptions. The net effect of these changes was a $157 million increase in unfunded liability.

Changes in Unfunded Actuarial Accrued Liability*

A.	Unfunded actuarial accrued liability at beginning of year	$471,331
B.	Change due to interest requirement and current rate of funding	13,857
C.	Expected unfunded actuarial accrued liability at end of year: (A) + (B)	485,188
D.	Actuarial losses (gains)	(57,584)
E.	Changes in assumptions and plan provisions	157,540
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	585,144

* 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, we analyze the impact of a variation in an assumption. 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 8.5% for all years until retirement, and 5% thereafter. We examined the effect of changing 8.5% to 7.5%.

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.

		Value After Change		
	Current Deloitte & Touche	Interest	Salary Increase	Amortization
Unfunded liability	$ 611,907	$ 780,753	$ 554,907	$ 611,907
Actuarially determined Contribution:				
Amount	115,115	131,588	109,433	142,655
Percent	8.12%	9.28%	7.72%	10.06%
Sufficiency/ (Deficiency)	.73%	(.43%)	1.13%	(1.21)%
Plan contribution liability	$2,103,105	$2,246,994	$2,057,865	$2,103,105
Depth of funding:	89.0%	83.3%	90.9%	89.0%

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
1989*	2,456,686	1,871,542	585,144	86,543 (6.10%)	115,474 (8.14%)	125,507 (8.85%)	.71

* 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 Benefits	Deferred Annuitants: Number	Deferred Annuitants: Avg. Annual Benefits	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
1989*	48,653	1,418,160,000	13,079	5,422	1,355	5,235	3,924

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

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director gave us employee information for 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.

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

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Covered General Employees' Census
Data as of June 30, 1989

	Number	Annual Payroll
General Actives at June 30, 1988	47,040	$1,316,803,641
New Entrants *	5,860	
Total	52,900	
Less Separations from Active Service:		
Refund of Contributions *	2,631	
Separation with a Deferred Annuity	354	
Separation with Neither Refunds nor Right to a Deferred Annuity	902	
Disability	49	
Deaths	95	
Service Retirement	556	
Total Separations	4,587	
Net Adjustments	(335)	
General Actives at June 30, 1989	48,648	1,417,943,087
Military Actives at June 30, 1989	5	215,574
Total Actives at June 30, 1989	48,653	$1,418,158,661

Average Entry Age of New Employees

For the Fiscal Year Ending	Male	Female	Average of Total
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
6/30/89	32.1	32.2	32.2

* Includes those who entered the plan and terminated during the period from July 1, 1988 to June 30, 1989.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

General Employees' Annuitant Census
Data as of June 30, 1989

	Number	Annual Annuity Benefit Payable
A. Service Retirement Annuitants		
Generals		
Receiving at June 30, 1988	11,438	$59,530,626
New	621	3,295,431
Deaths	(447)	(1,803,927)
Adjustments	(65)	3,519,202
Receiving at June 30, 1989	11,547	$64,541,332
Military Affairs		
Receiving at June 30, 1988	2	$ 32,327
New	0	0
Deaths	0	0
Adjustments	0	2,238
Receiving at June 30, 1989	2	$ 34,565
Unclassified Plans		
Receiving at June 30, 1988	15	$ 40,023
New	0	0
Deaths	0	0
Adjustments	0	2,770
Receiving at June 30, 1989	15	$ 42,793
Total service annuitants receiving at June 30, 1989	11,564	$64,618,690

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
B.	**Disabled Employees**		
	Receiving at June 30, 1988	669	$2,455,762
	New	53	218,850
	Deaths	(49)	(185,566)
	Adjustments - Net Result	(8)	119,783
	Receiving at June 30, 1989	665	$2,608,829
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1988	753	$2,970,191
	New	108	488,025
	Deaths	(50)	(152,322)
	Adjustments - Net Result	40	383,875
	Receiving at June 30, 1989	851	$3,689,769
D.	**Deferred Annuitants**		
	Deferred as of June 30, 1988	1,162	$5,230,658
	New	446	
	Began Receiving	(226)	
	Adjustments - Net Result	(27)	
	Deferred as of June 30, 1989	1,355	$7,093,137

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
6/30/89	63.3
All Existing Service Annuitants	63.8

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1989

General Employees

1. **Coverage:**	From first date of employment.
2. **Service Credit:**	Service is credited from date of coverage.
3. **Contributions:**	
a. **Employee:**	4.34% of salary. (Changed from 3.73%)
b. **State of Minnesota:**	4.51% of salary. (Changed from 3.90%)
4. **Final Average Salary:**	Monthly average for the highest five successive years of salary.
5. **Normal Retirement:**	
a. **Eligibility:**	For participants hired before July 1, 1989 eligibility is the earlier of: o Attainment of age 65 and completion of three years of service. (Changed from five years of service) and o Attainment of age 62 with 30 years of service. For participants hired after June 30, 1989, eligibility is the age at which unreduced Social Security benefits commence and completion of three years of service.
b. **Benefit Amount:**	1.5% of Average Salary for each year of Allowable Service. (Changed from 1% of final average salary for each of the first 10 years of service plus 1.5% of final average salary for each year of service thereafter.)

6. **Early Retirement:**

a. **Eligibility:**

For participants hired before July 1, 1989, eligibility is the earlier of:

- Attainment of age 55 and completion of three years of service. (Changed from five years of service); and
- Completion of 30 years of service.
- The age at which age plus service equals at least 90. (Rule of 90)

For participants hired after June 30, 1989, eligibility is attainment of age 55 and completion of three years of service.

b. **Benefit Amount:**

For participants hired before July 1, 1989, the benefit is the greater of:

- 1% of final average salary for each of the first 10 years of service plus 1.5% of final average salary for each subsequent year of service, reduced 0.25% for each month under age 65 (or age 62 if 30 years of service have been completed). No reduction is applied if participant has satisfied the Rule of 90.
- Normal retirement benefit augmented to age 65 at 3% per year actuarially reduced for each month under age 65.

For participants hired after June 30, 1989, the benefit is: the normal retirement benefit augmented to the age unreduced Social Security benefits commence at 3% per year and actuarially reduced for each month before that age. (Changed from normal retirement benefit formula based on service and final average salary to date of early retirement, but actuarially reduced to reflect payment before age 65, or age 62 if 30 years of service have been completed.)

7. **Pre-73 lump sum payments:** Participants retired before July 1, 1973 will receive an additional lump sum payment each year. The initial benefit is the greater of $25 times each year of service or $400 times each year of service less Social Security and any benefits received from a Minnesota public employee pension plan. Benefits will increase by the MPRI fund increase (added in 1989).

8. **Form of Payment:** Life annuity with return on death of any balance of contributions over aggregate monthly payments. Actuarially equivalent options are available, including (new this year) a 50% or 100% Joint & Survivor annuity which at no extra charge reverts to the life annuity amount if the spouse dies before the member.

9. **Disability Retirement:**

   a. **Eligibility:** Completion of three years of service. (Changed from five years of service.)

   b. **Benefit Amount:** Normal retirement benefit formula based on service and final average salary to date of disability retirement.

10. **Deferred Service Retirement:**

    a. **Eligibility:** Completion of three years of service and election to leave employee contributions on deposit. (Changed from five 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 before January 1, 1981; 3% for each year from January 1, 1981 to the January 1 following age 55 and 5% for each year thereafter until early or normal retirement. (Changed from 5% to January 1, 1981 and 3% thereafter.)

11. **Return of Contributions:** Upon termination of employment, a member may elect the return of contributions with 6% interest compounded annually in lieu of all other benefits under the plan. (Changed from 5%.)

12. **Surviving Spouse Death Benefit:**

    a. **Eligibility:** Death of member in service at age 50 with at least three years of service or at any age with 30 years of service. (Changed from five years of service.)

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

       o Refund of member contributions with 6% interest. (Changed from 5%); 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 at the later of the members age 55 or date of death.

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 five years of credited service.

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

14. **Proportionate Annuity:** Any member who 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, 1989 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 would increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

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

CHANGES IN ACTUARIAL ASSUMPTIONS

The preretirement interest rate assumption has been changed from 8.0% to 8.5%. Also, the period over which the unfunded liability is amortized has been increased by nine years. The new amortization target date is June 30, 2020.

Appendix C (continued)

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 eight 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:**	Preretirement - 8.5% per annum. (Changed from 8%.) Postretirement - 5% per annum.
6.	**Salary Scale:**	6.5% 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 90 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.
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	50
59	40	119	66	50
60		131	76	150
61		144	90	150
62		159	110	500
63		174	146	350
64		192	174	1,100
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

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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, 1989 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 Deloitte & Touche

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

DELOITTE & TOUCHE

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 that MSRS administer are 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 duties include:

- 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. The Board of Directors is concerned with the valuations and experience studies which must be performed for:

- 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. Since the Minnesota State Retirement System does not have an actuary on its staff, it has retained Deloitte & Touche to review, analyze, and critique the actuarial valuations and experience studies.

This report evaluates the accuracy of the Wyatt Co.'s results, and expands 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, 1989 valuation reports. In doing so, we had several discussions with the Wyatt Co.'s personnel who prepared the 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 results that the Wyatt Co. reported with our valuation results. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under Sections 352 and 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.	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$ 68,397	$ 68,287	(0.2%)
Death	2,706	2,669	(1.4)
Disability	1,879	1,787	(4.9)
Withdrawal	24,183	23,657	(2.2)
Total actives	$97,165	$96,400	(0.8)
Deferred annuitants	2,828	2,851	0.8
Former members without vested rights	172	167	(2.9)
Participants in MPRI Fund	28,492	28,066	(1.5)
Total	$128,657	$127,484	(0.9)
Portion allocated to future service	35,973	34,914	(2.9)
Accrued liability (reserves required)	$ 92,684	$ 92,570	(0.1)
Valuation assets	85,441	85,441	0.0
Unfunded accrued liability	$ 7,243	$ 7,129	(1.6)
Funded ratio	92.2%	92.3%	--

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 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.**	**Deloitte & Touche**
1.	Normal cost	$4,073 (9.70%)	$4,131 (9.84%)
2.	Assumed operating expense	$ 172 (.41%)	$ 172 (.41%)
3.	Amortization by June 30, 2020 of the unfunded accrued liability	$ 319 (.76%)	$ 313 (.75%)
4.	Total Chapter 356 requirement: (1) + (2) + (3)	$4,564 (10.87%)	$4,616 (11.00%)
Prescribed Contributions			
1.	Employee contributions	$2,057 (4.90%)	$2,056 (4.90%)
2.	Employer contribution	$3,652 (8.70%)	$3,650 (8.70%)
3.	Total Chapter 352A prescribed contribution	$5,709 (13.60%)	$5,706 (13.60%)
Contribution Sufficiency		2.73%	2.60%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1990. The expected annual payroll is $41,954,000.

The depth of funding indicates 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, 1989

		Wyatt Co.	Deloitte & Touche	Percentage Difference
1.	Active members	$47,651	$47,022	(1.3%)
2.	Deferred annuitants	2,828	2,851	0.8
3.	Former members without vested rights	172	167	(2.9)
4.	Participation in MPRI Fund	28,492	28,066	(1.5)
5.	Total present values of accrued benefits	$79,143	$78,106	(1.3)
6.	Valuation assets	85,441	85,441	0.0
7.	Depth of funding	108.0%	109.3%	--
8.	Depth of funding excluding MPRI participants	112.4%	114.7%	--

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 0.9% lower than the Wyatt Co.'s, while our total accrued liability is only 0.1% 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 1.6%. This difference is very small and is larger than the difference in total accrued liability only 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 5% per year. The Wyatt Co. changed their assumption from a rate of 6.5% used last year. We believed that a 6.5% assumption was too high and agree that a 5% increase is reasonable. This assumption along with a 6.5% salary scale results in some IRS limitations on the benefits that this plan provides. The net effect is a slight decrease in potential liabilities.

The Correctional Employees' Retirement Plan has a cash refund annuity. The Wyatt Co. has elected not to adjust for this benefit. In the past, we recognized this potential liability by applying a 1% load. Because the plan now provides a bounceback annuity at no extra cost, the frequency of cash refund annuities will decrease. Therefore, we now agree with Wyatt that this amount is too insignificant to value.

IV. CHANGES IN THE UNFUNDED LIABILITY

The Correctional Plan currently has an unfunded liability. 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. However, the unfunded liability becomes a problem when it is so large that it precludes 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 when:

- 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% last year, 8.5% in future years). 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, 1989, the Correctional Employees' Fund showed a decrease in the unfunded liability. This decrease was caused because:

1. Contribution Rate

   The total contributions to the plan were approximately $4,832,000. Expected normal cost, expenses and interest combined to equal $4,248,000. The Wyatt Co. increased the $584,000 difference by $311,000, which is a gain caused by actual salaries being less than the salaries projected by Wyatt last year. The net result was a reduction of $895,000 in the unfunded liability.

2. Actuarial Losses

   The Fund experienced actuarial gains of approximately $265,000 because of salary increases which were less than anticipated and $3,031,000 of investment gains. According to the Wyatt Co., the fund also experienced a $69,000 gain on MPRI fund mortality. Our calculations included an MPRI Mortality gain of $290,000, but this is not a major difference.

   Wyatt reported an additional loss of $625,000 due to miscellaneous items. This loss is less than 1% of the accrued liability and is within the normal range of miscellaneous losses.

   Overall, the Wyatt Co. reported a net gain (decrease in unfunded liability) of $2,740,000.

3. Changes in Assumptions and Plan Provisions

   Many changes were made to the plan provisions. The most significant changes are detailed at the end of the report and summarized below.

   - A reduction in service requirements from five years to three years for the normal retirement, death and withdrawal benefits.
   - An increase in the normal retirement benefit amount.
   - Allowance for early retirement at age 50 with five years of service.
   - A reduction in the service requirement for nonoccupational disability from five years to one year and an increase in the benefit.
   - An increase in the occupational disability benefit amount.
   - An increase in the interest rate credited on refunds of member contributions from 5% to 6%.
   - A bounceback annuity is now available at no additional cost.

   Changes in actuarial assumptions included an increase in the pre-retirement interest rate assumption from 8% to 8.5%. Also, the date of full amortization of the unfunded liability was changed from June 30, 2017 to June 30, 2020.

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

A.	Unfunded actuarial accrued liability at beginning of year	$7,389
B.	Change due to interest requirement and current rate of funding	(895)
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$6,494
D.	Actuarial losses (gains)	(2,740)
E.	Changes in assumptions and plan provisions	3,489
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$7,243

* Results prepared by the Wyatt Co.

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, we analyze the impact of a variation in an assumption. 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 8.5% for all years until retirement, and 5% thereafter. We examined the effect of changing 8.5% to 7.5%.

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 Deloitte & Touche	Value After Change		
		Interest	**Salary Increase**	**Amortization**
Unfunded liability	$ 7,129	$13,377	$ 5,173	$ 7,129
Actuarially determined Contribution:				
Amount	4,616	5,488	4,318	4,937
Percent	11.00%	13.08%	10.29%	11.77%
Sufficiency	2.60%	.52%	3.31%	1.83%
Plan contribution liability	$78,106	$83,921	$76,413	$78,106
Depth of funding:	109.3%	101.8%	111.8%	109.3%

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
1989*	92,684	85,441	7,243	4,073 (9.70%)	4,564 (10.87%)	5,709 (13.60%)	2.73

* 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) *

(000'S Omitted)

Report Members as of June 30 Rights	Active Members		Retired Members**		Deferred Annuitants		Former
	Number	Valuation Payroll	Number	Avg. Annual Benefits	Number	Avg. Annual Benefits	Without Vested
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	7,983	47	8,572	80
1989*	1,317	41,976,000	357	8,423	58	8,624	57

* Including beneficiaries and disabled members.

** As prepared by the Wyatt Co.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director gave us employee information for 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.

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, 1989

	Number	Annual Payroll
Actives at June 30, 1988	1,267	$38,834,315
New Entrants*	130	
Total	1,397	
Less Separations from Active Service:		
Refund of Contributions*	48	
Separation with a Deferred Annuity	11	
Separation with Neither Refund nor Right to a Deferred Annuity	11	
Death	3	
Service Retirement	19	
Disability	4	
Total Separations	96	
Data Adjustments	16	
Actives at June 30, 1989	1,317	$41,954,249

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
6/30/89	30.3	29.5	30.1

* Includes those who entered the plan and terminated during the period from July 1, 1988 to June 30, 1989.

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Correctional Employees' Annuitant Census
Data as of June 30, 1989

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1988	328	$2,625,310
	New	19	261,411
	Deaths	(11)	(72,504)
	Adjustments - Net Result	1	51,345
	Receiving at June 30, 1989	337	$2,865,562
B.	**Disabled Employees**		
	Receiving at June 30, 1988	6	$ 56,952
	New	4	35,527
	Deaths	(1)	(10,640)
	Retirements	(1)	(2,315)
	Adjustments - Net Result	0	(3,595)
	Receiving at June 30, 1989	8	$ 75,929
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1988	12	$ 80,021
	New	1	1,977
	Deaths	(1)	(20,014)
	Adjustments - Net Result	0	3,443
	Receiving at June 30, 1989	12	$ 65,427

		Number	Annual Annuity Benefit Payable
D.	**Children Receiving a Survivor Benefit**	0	$ 0
E.	**Deferred Annuitants**		
	Receiving at June 30, 1988	47	402,897
	New	17	
	Began Receiving	(2)	
	Return of Actives	(4)	
	Adjustments	—	
	Receiving at June 30, 1989	58	$ 500,172

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
6/30/89	57.2
All Existing Service Annuitants	58.4

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1989

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 five successive years of salary.
5. **Normal Retirement:**	
a. **Eligibility:**	Attainment of age 55 and completion of three years of service. (Changed from five years of service.)
b. **Retirement Benefit:**	General Plan benefit plus an additional benefit defined below.
c. **Additional Benefit:**	Final average salary times 1% for each year of service.
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. **Early Retirement:**

a. **Eligibility:**	Attainment of age 50 and completion of five years of service. (Added in 1989)
b. **Retirement Benefit:**	Normal Retirement Benefit actuarially reduced for commencement at age 55. (Added in 1989).

7. **Disability Retirement:**

a. **Eligibility:**	
o In line of duty:	All employees are eligible.
o Not in line of duty:	One year of service and less than age 55. (Changed from five years of service.)
b. **Benefit Amount:**	
o In line of duty:	50% of average monthly salary plus 2.5% for each year of service in excess of 20 years, offset by Workers' Compensation. (Changed from 2.5% for first five years in excess of 20 and 2% thereafter.)
o Not in line of duty:	2.5% of average monthly salary for each year of service, subject to a minimum of 37.5%. (Changed from 2.5% for first 20 years and 2% thereafter; minimum changed from 25%.)
c. **Limitation:**	At age 62, General Plan benefit based on credited service is payable subject to a minimum benefit based on 15 years of service. (Changed from 10 years of service.)

7. **Deferred Service Retirement:**

a. **Eligibility:**	Completion of three years of service and election to leave employee contributions on deposit. (Changed from five 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 before 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 6% interest compounded annually in lieu of all other benefits under the plan. (Changed from 5%.)

9. **Surviving Spouse Death Benefit:**

a. **Eligibility:** Death of member in service at age 50 at least with three years of service or at any age with 30 years of service. (Changed from age 50 with five years of service.)

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

- o Refund of member contributions with 6% interest. (Changed from 5%); 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 the latter 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 five 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, 1989 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 would increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

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

CHANGES IN ACTUARIAL ASSUMPTIONS

The preretirement interest rate assumption has been changed from 8.0% to 8.5%. Also, the period which the unfunded liability is amortized over has been increased by three years. The new amortization target date is June 30, 2020.

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 eight 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:**	Preretirement - 8.5% per annum. (Changed from 8.0%). Postretirement - 5% per annum.
6.	**Salary Scale:**	6.5% 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 6.5% salary scale applicable to current salaries. Future Social Security benefits replace the same proportion of salary as at present.
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.
11.	**Disability**	All disabilities are assumed to have been occupational.

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

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Touche

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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, 1989 actuarial valuation of the Minnesota State Retirement System, State Patrol Employees' Retirement Plan.

Our report is divided into the following sections:

Section I	-	Introduction and Purpose
Section II	-	Comparison of Valuations
Section III	-	Explanation of Differences
Section IV	-	Changes in the Unfunded Liability
Section V	-	Sensitivity Analysis
Section VI	-	Summary of Historical Valuation Results

Appendices

A. Summary of Employee Data
B. Summary of Principal Plan Provisions as of June 30, 1989
C. Actuarial Methods and Assumptions

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 Deloitte & Touche.

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

DELOITTE & TOUCHE

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 Troopers' 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 that MSRS administers are 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' duties include:

- 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. The Board of Directors is concerned with the valuations and experience studies which must be performed for:

- 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. Since the Minnesota State Retirement System does not have an actuary on its staff, it has retained Deloitte & Touche to review, analyze, and critique the actuarial valuations and experience studies.

This report evaluates the accuracy of the Wyatt Co.'s results, and expands 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, 1989 valuation reports. In doing so, we had several discussions with the Wyatt Co.'s personnel who prepared the 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 results that the Wyatt Co. reported with our valuation results. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under both Chapters 352B and 356. Table C shows the depth of plan funding based on liabilities incurred to date. Table C figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Wyatt Co.	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$139,040	$138,629	(0.3%)
Death	6,232	12,784	105.1
Disability	14,067	13,143	(6.6)
Withdrawal	15,106	15,847	4.9
Total actives	$174,445	$180,403	3.4
Deferred annuitants	1,795	1,801	0.3
Former members without vested rights	59	58	(1.7)
Participants in MPRI Fund	79,129	79,033	(0.1)
Participants not in MPRI Fund	8,256	7,536	(8.7)
Total	$263,684	$268,831	2.0
Portion allocated to future service	69,250	73,859	6.6
Accrued liability (reserves required)	$194,434	$194,972	0.3
Valuation assets	167,271	167,271	0.0
Unfunded accrued liability	$27,163	$27,701	2.0
Funded ratio	86.0%	85.8%	--

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 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 the dollar amounts as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	**Wyatt Co.**	**Deloitte & Touche**
1. Normal cost	$5,740 (17.61%)	$6,393 (19.61%)
2. Assumed operating expense	$ 186 (.57%)	$ 186 (.57%)
3. Amortization by June 1, 2020 of the unfunded accrued liability	$1,193 (3.66%)	$1,217 (3.74%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$7,119 (21.84%)	$7,796 (23.92%)
Prescribed Contributions		
1. Employee contributions	$2,770 (8.50%)	$2,770 (8.50%)
2. Employer contribution	$6,160 (18.90%)	$6,160 (18.90%)
3. Total Chapter 352B prescribed contribution	$8,930 (27.40%)	$8,930 (27.40%)
Contribution Sufficiency	5.56%	3.48%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1990. The expected annual payroll is $32,591,000.

The depth of funding indicates 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, 1989

		Wyatt Co.	Deloitte & Touche	Percentage Difference
1.	Active members	$95,011	$98,670	3.9%
2.	Deferred annuitants	1,795	1,801	0.3
3.	Former members without vested rights	59	58	(1.7)
4.	Participation in MPRI Fund	79,129	79,033	(0.1)
5.	Participants not in MPRI Fund	8,256	7,536	(8.7)
6.	Total present values of accrued benefits	$184,250	$187,098	1.5
7.	Valuation assets	167,271	167,271	0.0
8.	Depth of funding	90.8%	89.4%	--
9.	Depth of funding excluding MPRI members	83.8%	81.6%	--

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 calculation of the liabilities and costs associated with the death benefits were significantly higher than those shown in the Wyatt Co.'s report. We discussed these matters with the Wyatt Co.'s personnel, and they have since acknowledged that their calculations were in error, and that the contribution sufficiency is overstated by 1.24%. Although we did not receive specific figures from the Wyatt Co., we believe that this accounts for the vast majority of the differences in present value of benefits and plan continuation liability.

After adjusting for the 1.24 percent, the Wyatt Co.'s contribution sufficiency is still .84% greater than ours. Based on last year's conversations with the Wyatt Co., we believe this difference is primarily due to interest adjustments on the normal cost. Generally, normal cost is originally calculated as of the beginning of the plan year. We then adjust the normal cost to take into account that part that is paid throughout the year by adding a half year's interest. The Wyatt Co.'s personnel indicated that they do not make this adjustment. The impact of this adjustment is generally minor, but in this case it is significant, and we believe the adjustment should be made.

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

During our discussions, the Wyatt Co. indicated that it expects the IRS limit on benefits to increase at 5% The Wyatt Co. changed its assumption from a rate of 6.5% used last year. We believed that a 6.5% assumption was too high and agree that a 5% increase is reasonable. This assumption along with a 6.5% salary scale results in some IRS limitation on the benefits that this plan provides. The net effect is a slight decrease in potential liabilities.

The current valuation includes an assumption that 100% of the participants are married. The Wyatt Co. has indicated that it believes an 85% assumption is more reasonable. We concur, and with the Board's approval, will use 85% next year.

IV. CHANGES IN THE UNFUNDED LIABILITY

The State Troopers Plan currently has an unfunded liability. 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. However, the unfunded liability becomes a problem when it is so large that it precludes 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 when:

- 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% last year, 8.5% in future years). When 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 which 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, 1989, the State Troopers Fund showed a small increase in the unfunded liability. This increase was caused because:

1. **Contribution Rate**

   The total contributions to the plan were $7.7 million. However, expected normal cost, expenses and interest combined to equal $7.5 million. The Wyatt Co. increased the $.2 million difference by another $.2 million, which was a loss caused by actual salaries being less than the salaries projected by the Wyatt Co. last year. The net result was a surplus of about $.4 million, which decreased the unfunded liability.

2. **Actuarial Losses**

   According to the Wyatt Co., the Fund experienced actuarial losses of $1,101,000 from salary increases and $287,000 from MPRI mortality.

   The Fund experienced a $4,530,000 gain on investments.

   The remaining sources of gain or loss, including Mortality of Other Benefit Recipients, combined to produce a loss of approximately $1.4 million. Overall, there was a net gain (decrease in unfunded liability) from actuarial experience of $1,790,000.

3. **Changes in Assumptions and Plan Provisions**

   Many changes were made to the plan provisions. The most significant changes are detailed in the back of the report and are summarized below:

   - A reduction in service requirements from five years to three years for the normal retirement, death and withdrawal benefits.
   - An increase in the normal retirement benefit amount to 2.5% for each year of service.
   - Allowance for early retirement at age 50 with five years of service.
   - A reduction in the service requirement for nonoccupational disability from five years to one year and an increase in the benefit amount.
   - An increase in the occupational disability benefit amount to 50% of final average salary plus 2.5% for each year of service in excess of 20 years.
   - An increase in the interest rate credited on refunds of member contributions from 5% to 6%.
   - An increase in the surviving spouse death benefit to 50% of final average salary. With three or more years of service the benefit changes to a 100% joint and survivor annuity amount if larger as of the date the employee would have attained age 55.

- A change in the surviving children death benefit which extends the payments to age 23 if a student. The maximum amount of benefit per family is now 70%.

- A bounceback annuity is now available at no additional cost.

- An additional annual payment (valued at $25 times years of service) is made to annuitants who retired before July 1, 1973.

Actuarial assumptions were changed to reflect the mandated increase in the preretirement interest rate from 8% to 8.5%. Because spouses' benefits were increased, we changed our assumption regarding the value of childrens' benefits (compared to spouses' benefits) from 15% to 6%. The date of full amortization of the unfunded liability was changed from June 30, 2011 to June 30, 2020; this change did not affect the amount of unfunded liability.

The Wyatt Co. calculated that the changes in provisions increased the unfunded liability by $6,045,000. This was offset by a decrease of $3,356,000 due to changes in assumptions. The net effect of these changes was a $2,689,000 increase in unfunded liability.

Because of our difference with the Wyatt Co. in the death benefit amount, and possibly for other reasons as well, we obtained different results for the change due to plan provisions. We calculated the change to be about $4 million.

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

A.	Unfunded actuarial accrued liability at beginning of year	$26,707
B.	Change due to interest requirement and current rate of funding	(443)
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$26,264
D.	Actuarial losses (gains)	(1,790)
E.	Changes in assumptions and plan provisions	2,689
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$27,163

* Results prepared by the Wyatt Co.

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, we analyzed the impact of a variation in an assumption. 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 8.5% for all years until retirement, and 5% thereafter. We examined the effect of changing from 8.5% to 7.5%.

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.

		Value After Change		
	Current Deloitte & Touche	Interest	Salary Increase	Amortization
Unfunded liability	$27,701	$34,633	$25,436	$27,701
Actuarially required contribution:				
(Amount)	7,796	8,924	7,380	9,043
(Percent)	23.92%	27.38%	22.64%	27.75%
(Deficiency)	3.48%	0.02%	4.76%	(0.35)
Plan contribution liability	$187,098	$197,706	$183,499	$187,098
Depth of funding:	89.4%	84.6%	91.2%	89.4%

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
1989*	194,434	167,271	27,163	5,740 (17.61%)	7,119 (21.84%)	8,930 (27.40%)	5.56

* 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**
(000'S Omitted)

Report as of June 30	Active Members: Number	Active Members: Valuation Payroll	Retired Members*: Number	Retired Members*: Avg. Annual Benefits	Deferred Annuitants: Number	Deferred Annuitants: Avg. Annual Benefits	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
1989*	765	32,591,000	455 ***	15,506	19	12,340	7

* As prepared by the Wyatt Co.
** Including beneficiaries and disabled members.
*** Does not include children

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director gave us employee information for 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.

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

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

State Patrol Census Data as of June 30, 1989

	Number	Annual Payroll
Actives at June 30, 1988	740	$29,266,695
New Entrants*	46	
Total	786	
Less Separations from Active Service:		
Refund of Contributions*	4	
Separation with a Vested Right to a Deferred Annuity	3	
Separation with Neither Annuity nor Right to a Deferred Annuity	0	
Death While Eligible; Surviving Spouse Receiving Annuity	0	
Service Retirement	14	
Disability	1	
Death	0	
Total Separations	22	
Data Adjustments	1	
Actives at June 30, 1989	765	$32,591,305

Average Entry Age of New Employees

For the Fiscal Year Year Ending	Male	Female	Average Age at Entry
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
6/30/89	28.7	24.3	28.3

* Includes those who entered the plan and terminated during the period from July 1, 1988 to June 30, 1989.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

State Patrol Census Data as of June 30, 1989

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1988	339	$5,601,548
	New	14	296,498
	Deaths	(13)	(145,042)
	Adjustments - Net Result	0	343,618
	Receiving at June 30, 1989	340	$6,096,622
B.	**Disabled Employees**		
	Receiving at June 30, 1988		
	Non-MPRI	11	
	MPRI	3	
		13	$ 163,510
	New	1	9,228
	Deaths	0	0
	Adjustments	0	9,092
	Receiving at June 30, 1989	14	$ 181,830
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1988	98	$ 689,564
	New	5	31,486
	Deaths	(3)	(12,204)
	Adjustments - Net Result	1	56,066
	Receiving at June 30, 1989	101	$ 764,912

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	**Children Receiving a Survivor Benefit**		
	Receiving at June 30, 1988	5	$ 12,612
	New	3	6,173
	Reinstated	0	0
	No Longer Eligible	(1)	(2,825)
	Adjustments - Net Result	0	677
	Receiving at June 30, 1989	7	$ 16,637
E.	**Deferred Annuitants**		
	Deferred as of June 30, 1988	16	$158,099
	New	4	
	Returned as Active	(2)	
	Adjustment - Net Results	1	
	Deferred as of June 30, 1989	19	$234,458

Average Age at Retirement of New Service Annuitants *

Fiscal Year Ending	Average Retirement Age
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
6/30/89	56.2
All Existing Service Annuitants	57.8

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1989

State Patrol Employees

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. **Employees:** 8.5% of salary.

   b. **From the State:** 18.9% of salary.

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

5. **Normal Retirement:**

   a. **Eligibility:** Attainment of age 55 and completion of three years of service. (Changed from five years of service.)

   b. **Benefit Amount:** 2.5% of final average salary for each year of service. (Changed from 2.5% for each of the first 25 years of service plus 2% thereafter.)

6. **Early Retirement:**

   a. **Eligibility:** Attainment of age 50 and completion of five years of service. (Added 1989.)

   b. **Benefit Amount:** Normal Retirement Benefit actuarially reduced for commencement before age 55. (Added 1989.)

7. **Form of Payment:** Life annuity with actuarially equivalent options also available.

8. **Disability Retirement:**

   a. **Eligibility:**

      o In line of duty: All participants are eligible.

      o Not in line of duty: One year of service. (Changed from five years of service.)

b. **Benefit Amount:**

- In line of duty: 50% of average monthly salary plus 2.5% for each year of service in excess of 20 years.
- Not in line of duty: 2.5% of average monthly salary for each year of service subject to a minimum of 37.5% of average monthly salary.

c. **Death Benefits:** If a member dies while receiving a disability benefit, 50% of his final average salary is payable to the surviving spouse for life.

9. **Deferred Service Retirement:**

a. **Eligibility:** Completion of three years of service. (Changed from five years.)

b. **Benefit Amount:** Retirement benefit 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 before January 1, 1981; 3% for each year from January 1, 1981 to the January 1 following age 55 and 5% each year until early or normal retirement. (Changed from 5% to January 1, 1981 and 3% thereafter.)

10. **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 6%. (Changed from 5%.)

11. **Surviving Spouse Death Benefit :**

a. **Eligibility:** Death of member in service.

b. **Benefit Amount:** 50% of final average salary. With three or more years of service, changes to a 100% joint and survivor annuity amount if larger as of the date the employee would have attained age 55. (Changed from 20% of final average salary and five years of service.)

12. **Children's Death Benefits:**

a. **Eligibility:** Death benefits are payable to children (under age 18, or 23 if a student) of members who die in active service. (Changed from 22 if a student.)

b. **Amount:** 10% of final average salary, plus $20 per month prorated equally to such children. Total benefit to spouse and all children must not be less than 50% of salary. (Minimum benefit added in 1989.)

c. **Maximum:** Total benefit to spouse and all children may not exceed 70% of final average salary. (Changed from 40%.)

13. **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 at membership is restored.

14. **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 five 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.

15. **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.

16. **Pre-1973 Annuitants:**

State Patrol officers who retired before 1973 are entitled to an annual 6% increase in benefits.

Participants retired before July 1, 1973 will receive an additional lump sum payment each year. The initial benefit is $25 times each year of service or $400 times each year of service less Social Security benefits received from a Minnesota Public Employee Pension plan. Benefits will increase at the same rate as benefits from the MPRI fund increase. (Added in 1989.)

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, 1989 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.

CHANGES IN ACTUARIAL ASSUMPTIONS

The preretirement interest rate assumption has been changed from 8.0% to 8.5%. Also, the period which the unfunded liability is amortized over has been increased by 11 years. The new amortization target date is June 30, 2020.

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

State Patrol Employees

1.	**Mortality:**	1971 Group Annuity Mortality Table for Males with ages set back eight 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. 85% of disabilities are assumed to be occupational.
4.	**Expenses:**	Prior year's expenses expressed as a percentage of prior year's payroll.
5.	**Interest Rate:**	8.5% per annum preretirement (changed from 8.0%), 5% per annum postretirement.
6.	**Salary Scale:**	6.5% per annum, disregarding actual salary history. Benefits in excess of IRS 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 three years younger. 6% load on spouse benefits for children's benefits (changed from a 15% load).

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.

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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, 1989 actuarial valuation of the Minnesota State Retirement System, Judges' Retirement Fund.

Our report is divided into the following sections:

Section I	-	Introduction and Purpose
Section II	-	Comparison of Valuation Results
Section III	-	Explanation of Differences
Section IV	-	Changes in the Unfunded Liability
Section V	-	Sensitivity Analysis
Section VI	-	Summary of Historical Valuation Results

Appendices

A. Summary of Employee Data
B. Summary of Principal Plan Provisions as of June 30, 1989
C. Actuarial Methods and Assumptions

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 Deloitte & Touche.

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

DELOITTE & TOUCHE

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 that MSRS administer are 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' duties include:

- 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. The Board of Directors is concerned with the valuations and experience studies which must be performed for:

- 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. Since the Minnesota State Retirement System does not have an actuary on its staff, it has retained Deloitte & Touche to review, analyze, and critique the actuarial valuations and experience studies.

This report evaluates the accuracy of the Wyatt Co.'s results, and expands 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, 1989 valuation reports. In doing so, we had several discussions with the Wyatt Co.'s personnel who prepared the 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 results that the Wyatt Co. reported with our valuation results. Three tables are included. Table A shows the derivation of the unfunded liability. Table B shows the annual contribution requirements under Chapters 490 and 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.	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$ 49,127	$ 50,950	3.7%
Death	7,995	7,469	(6.6)
Disability	3,638	3,479	(4.4)
Withdrawal	--	--	--
Total actives	$60,760	$61,898	1.9
Deferred annuitants	450	494	9.8
Former members without vested rights	0	0	0.0
Participants in MPRI Fund	20,169	20,383	1.1
Retirement and survivor benefits from Judges' Fund	12,395	12,106	(2.3)
Total	$ 93,774	$ 94,881	1.2
Portion allocated to future service	28,920	28,978	0.2
Accrued liability (reserves required)	$ 64,854	$ 65,903	1.6
Valuation assets	23,352	23,352	0.0
Unfunded accrued liability	$ 41,502	$ 42,551	2.5
Funded ratio	36.0%	35.4%	--

CONTRIBUTIONS

Chapters 490 and 356 set forth requirements about 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 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 the dollar amounts as a percent of payroll.*

TABLE B (000's omitted)

Actuarially Determined Contribution	**Wyatt Co.**	**Deloitte & Touche**
1. Normal cost	$2,675 (14.26%)	$2,829 (15.08%)
2. Assumed operating expense	$ 58 (.31%)	$ 58 (.31%)
3. Amortization by June 1, 2020 of the unfunded accrued liability	$1,825 (9.73%)	$1,871 (9.97%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$4,558 (24.30%)	$4,758 (25.36%)
Prescribed Contributions		
1. Employee contributions	$ 806 (4.30%)	$ 806 (4.30%)
2. Employer contribution	$3,975 (21.19%)	$ 0 (0.00%)
3. Total Chapter 490 prescribed contribution	$4,781 (25.49%)	$ 806 (4.30%)
Contribution Sufficiency	1.19%	
Average Annual State Contribution		21.06%

The Deloitte & Touche results shown here include only those prescribed contributions which are not dependent on the plan's benefit provisions and the plan's actuarial experience. (i.e., the contributions required from the judges themselves) The Wyatt results include an estimate of terminal funding payments to be made by the State. See the explanation of differences section for a further discussion.

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1990. The expected annual payroll is $18,759,000.

The depth of funding indicates 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, 1989

		Wyatt Co.	Deloitte & Touche	Percentage Difference
1.	Active members	$31,092	$31,577	1.6%
2.	Deferred annuitants	450	494	9.8
3.	Former members without vested rights	0	0	0.0
4.	Participation in MPRI Fund	20,169	20,383	1.1
5.	Participants not in MPRIF	12,395	12,106	(2.3)
6.	Total present values of accrued benefits	$64,106	$64,560	0.7
7.	Valuation assets	23,352	23,352	0.0
8.	Depth of funding	36.4%	36.2%	--
9.	Depth of funding excluding MPRIF members	7.2%	6.7%	--

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 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 1.2% higher than the Wyatt Co.'s. Our total accrued liability is only 1.6% higher than the Wyatt Co.'s total. With a plan of this complexity, duplicating results this closely is unusual.

When determining 60% of the Normal Retirement Benefit to value death benefits, the Wyatt Co. projects service and earnings forward to the normal retirement date. Our understanding of the death benefit under this plan is that the beneficiary receives 60% of the participant's accrued benefit at date of death without reduction. Because of this difference, our value of death benefits is consistently lower than the Wyatt Co.'s. Also, in valuing Deferred Vested participants, the majority of the liability is for one individual's annuity. We assumed this individual's annuity is payable in the form of a 50% Joint and Survivor annuity, while Wyatt assumes it is a straight life annuity. This causes our value of deferred vested benefits to be slightly higher than Wyatt's.

As noted on page 3, we determined contribution sufficiency in a different manner than the Wyatt Co. did. Objections have been raised that the prior approach (the one we used in this report) does not adequately convey the State's commitment to funding this plan, and as such misleads the reader into thinking there is a problem with the Judges Fund. We agree that this is a legitimate argument. However, the language of Chapter 490 indicates that the necessary contributions will be made to ensure that there are sufficient assets to cover benefits. An exhibit that demonstrates a contribution sufficiency using an approach that by definition must produce a sufficiency is not particularly useful. We believe simply stating that the average annual contribution by the State (as a percentage of pay) that is necessary to cover its obligation produces a more meaningful result.

IV. CHANGES IN THE UNFUNDED LIABILITY

The Judges' Plan currently has an unfunded liability. 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. However, the unfunded liability becomes a problem when it is so large that it precludes 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 when:

- 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 which frequently result in improved benefits.

During the year ended June 30, 1989, the Judges' Fund showed a small increase in the unfunded liability. This increase was caused because:

1. **Contribution Rate**

The total contributions to the plan were $3,608,000. However, expected normal cost, expenses and interest combined to equal $5,693,000. The Wyatt Co. reduced the $2,085,000 difference by $98,000, which is a gain caused by actual salaries being less than the salaries projected by the Wyatt Co. last year. The net result was a shortfall of $1,987,000, which increased the unfunded liability.

2. **Actuarial Losses**

The Fund experienced a gain on investments of approximately $298,000. According to the Wyatt Co., the MPRI fund experienced a mortality loss of $130,000 caused by retirees living longer than expected. According to our calculations, this loss was about $420,000. In addition, lower than anticipated mortality for non-MPRI annuitants caused a loss of about $300,000. The remaining sources of gain and loss combined to produce a loss of $1,181,000 according to the Wyatt Co.'s calculations, $516,000 according to our calculations.

3. **Changes in Assumptions**

Effective June 30, 1989, the pre-retirement interest rate changed from 8.0% to 8.5%. The unfunded actuarial accrued liability decreased by $738,000 due to this change. Also reflected is a change in the Amortization Target Date from July 1, 2009 to July 1, 2020. This change had no effect on the unfunded liability.

4. **Changes in Plan Provisions**

The only change in plan provision since the last valuation, was to include Judges in the Combined Service Annuity provision. We did not directly calculate a cost (or cost savings) of this relatively minor change.

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

A.	Unfunded actuarial accrued liability at beginning of year	$38,948
B.	Change due to interest requirement and current rate of funding	1,987
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$40,935
D.	Actuarial losses (gains)	1,305
E.	Changes in assumptions and plan provisions	(738)
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$41,502

* Results prepared by the Wyatt Co.

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, we analyze the impact of a variation in an assumption. 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 8.5% for all years until retirement, and 5% thereafter. We examined the effect of changing 8.5% to 7.5%.
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 Deloitte & Touche	Value After Change: Interest	Value After Change: Salary Increase	Value After Change: Amortization
Unfunded liability	\$42,551	\$44,084	\$42,105	\$42,551
Actuarially required contribution:				
Amount	4,758	4,904	4,725	6,671
Percent	25.36%	26.14%	25.19%	35.56%
Deficiency	21.06%	21.84%	20.89%	32.06%
Plan contribution liability	\$64,560	\$67,055	\$63,713	\$64,560
Depth of funding:	36.7%	34.83%	36.65%	36.17%

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%)
1989*	64,854	23,352	41,502	2,675 (14.26%)	4,558 (24.30%)	806 (4.30%)

* 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**
(000'S Omitted)

Report as of June 30	Active Members: Number	Active Members: Valuation Payroll	Retired Members*: Number	Retired Members*: Avg. Annual Benefits	Deferred Annuitants: Number	Deferred Annuitants: Avg. Annual Benefits	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
1989*	257	18,759,000	166	21,673	4	18,090	0

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

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director gave us employee information for 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.

To be consistent with the Wyatt Co., salaries used in the valuation were different than those that the Executive Director provided. All salaries were taken from the July 25, 1988 memorandum from Jerome F. Hawkins regarding approved salary rates for elected officials and judges. We are unclear as to why these salaries vary so significantly from those included in the MSRS data base.

To reflect anticipated current year salary increases, all salaries provided were increased by 2.5%.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Covered Judges' Retirement Fund Employee Census Data as of June 30, 1989

	Number	Annual Payroll
Judges' Retirement Fund		
Actives at June 30, 1988	245	$17,036,690
New Entrants*	14	
Total	259	
Less Separations from Active Service:		
Inactive Nonvested	0	
Inactive Vested	0	
Service Retirement	5	
Death While Eligible; Spouse Receiving Annuity	2	
Total Separations	7	
Data Adjustments	4	
Actives at June 30, 1989	256	$18,686,446
Supreme Court Justices		
Actives at June 30, 1989	1	$ 72,539
Total Active Judges at June 30, 1989	257	$18,758,985

Average Entry Age of New Employees

For the Fiscal Year Year Ending	Average Age at Entry
6/30/86	47.2
6/30/87	46.4
6/30/88	44.6
6/30/89	44.5

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Judges' Retirement Fund Annuitant Census
Data as of June 30, 1989

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1988	94	$2,329,969
	New	6	154,290
	Deaths	(2)	(23,064)
	Adjustments - Net Result	(1)	100,737
	Receiving at June 30, 1989	97	$2,561,932
	Non-MPRIF	20	594,172
	MPRIF	77	1,967,760
		97	$2,561,932
B.	**Disabled Employees**		
	Receiving at June 30, 1988	5	$ 120,706
	New	0	0
	Adjustments - Net Result	0	8,350
	Receiving at June 30, 1989	5	$ 129,056
	Non-MPRIF	1	22,737
	MPRIF	4	106,319
		5	$ 129,056
C.	**Widows Receiving an Annuity or Survivor Benefit & Children**		
	Receiving at June 30, 1988	62	$ 817,808
	New	4	54,213
	Deaths	(1)	(6,570)
	Adjustments - Net Result	1	76,195
	Receiving at June 30, 1989	66	$ 941,646
	Non-MPRIF	58	800,304
	MPRIF	8	141,342
		66	$ 941,646

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	**Deferred Annuitants**		
	Receiving at June 30, 1988	5	99,698
	New	0	0
	Began Receiving	(1)	(27,336)
	Adjustments	0	0
	Deferred at June 30, 1989	4	$ 72,362
	Judges	3	36,452
	Supreme Court Judges	1	35,910
		4	$ 72,362

Average Age at Retirement of New Service Annuitants *

Fiscal Year Ending	Average Retirement Age
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
6/30/89	65.3

* 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, 1989

JUDGE'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 before 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 .5% of salary. For those Judges with Social Security coverage, the additional contribution is 1.25%, and the appropriate portion of the total 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 five 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 five years of service; or
      - o Attainment of age 70.

   b. **Benefit Amount:** 2.5% of final average salary for each year of service before 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 five years of service.

   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.

- o After two years of disability, an annuity computed in the same way 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 before 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.

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 a 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 2.5% 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

	o Attainment of age 70 and completion of two full terms.
b. **Benefit Amount:**	50% of final salary plus an additional 2.5% 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 2.5% 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, 1989 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 would increase by 6.5%.)

ACTUARIAL ASSUMPTIONS

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

CHANGES IN ACTUARIAL ASSUMPTIONS

The preretirement interest rate was changed from 8.0% to 8.5% effective June 30, 1989. The new amortization target date is July 1, 2020.

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 eight 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:**	8.5% per annum preretirement, 5% per annum postretirement.
6.	**Salary Scale:**	6.5%.
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.

9. **Social Security:**

a. **Primary Amount:**	Maximum current primary amount ($899.00 per month for 1989), increasing with salary scale.
b. **Level Contribution Rate:**	7.51%.
c. **Covered Annual Wages:**	Current annual wage base ($48,000 for 1989), increasing with salary scale.

SUPREME COURT JUSTICES

1. **Mortality (Pre- and PostRetirement):**	1971 Group Annuity Mortality Table for Males with ages set back eight years for females.
2. **Withdrawal:**	None.
3. **Interest Rate:**	8.5% preretirement, 5% postretirement.
4. **Salary Scale:**	6.5% 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: o Attainment of age 70; o Completion of 12 years of service; or o One year from valuation date.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Male 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	5			45	29	3	
21	5			46	33	5	
22	5			47	38	7	
23	6			48	42	9	
24	6			49	47	11	
25	6			50	53	14	
26	7			51	59	16	
27	7			52	65	20	
28	7			53	71	24	
29	8			54	78	28	
30	8	2		55	85	34	
31	9	2		56	93	40	
32	9	2		57	100	46	
33	10	2		58	109	56	
34	10	2		59	119	66	
35	11	2		60	131	76	
36	12	2		61	144	90	
37	13	2		62	159	110	
38	14	2		63	174	136	
39	15	2		64	192	174	
40	16	2		65	213		
41	18	2		66	236		
42	20	2		67	263		
43	23	3		68			10,000
44	26	3					

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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					