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Board of Directors
Minnesota State Retirement System
175 West Lafeyette Frontage Road
St. Paul, Minnesota

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1991 actuarial valuation of the Minnesota State Retirement System, General Employees' Retirement Plan.

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 Actuarial Accrued 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, 1991
	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

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

This report evaluates the accuracy of Milliman & Robertson's results and expands on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

Our role as consulting actuary to MSRS is to verify, analyze, and critique the results reported by Milliman & Robertson. To do this we independently calculate all liabilities of the plan. We were provided with the same participant information as Milliman & Robertson and are operating under the same actuarial standards.

We attempted to duplicate the figures shown in Milliman & Robertson's June 30, 1991 valuation reports. In doing so, we had several discussions with Milliman & Robertson's personnel who prepared the reports. Where we were able to discover reasonable justification for Milliman & Robertson's approach, we adjusted our methods and assumptions to match. (Descriptions of those adjustments are included in Section III.)

In this section of the report, we compare the results that Milliman & Robertson 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. Table C figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Milliman & Robertson	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$2,102,487	$2,140,748	1.8%
Death	83,216	139,488	67.6
Disability	75,980	113,467	49.3
Withdrawal	471,736	555,553	17.8
Total actives	$2,733,419	$2,949,256	7.9
Deferred Annuitants	41,026	37,927	(7.6)
Former members without vested rights	2,303	2,288	(0.7)
Participants in MPRI Fund	877,416	876,840	(0.1)
Non-MPRI Benefit	6,673	7,353	10.2
Total	3,660,837	3,873,664	5.8
Portion allocated to future service	777,234	896,555	15.4
Accrued liability (reserves required)	$2,883,603	2,977,109	3.2
Valuation assets	2,304,312	2,304,312	0.0
Unfunded accrued liability	$ 579,291	$ 672,797	16.1
Funded ratio	79.9%	77.4%	--

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	**Milliman & Robertson**	**Deloitte & Touche**
1. Normal cost	$ 96,554 (5.98%)	$100,767 (6.25%)
2. Assumed operating expense	$ 3,547 (.22%)	$ 3,944 (.24%)
3. Amortization by June 30, 2020 of the unfunded accrued liability	$ 26,763 (1.66%)	$ 31,086 (1.93%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$126,864 (7.86%)	$135,797 (8.42%)
Prescribed Contributions		
1. Employee contributions	$ 66,908 (4.15%)	$ 66,909 (4.15%)
2. Employer contribution	$ 69,165 (4.29%)	$ 69,166 (4.29%)
3. Total Chapter 352 prescribed contribution	$136,073 (8.44%)	$136,075 (8.44%)
Contribution Sufficiency	.58%	.02%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1992. Milliman & Robertson calculates expected annual payroll to be $1,612,238,000.

Our amounts are based on an expected payroll of $1,612,254,000.

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, 1991

		Milliman & Robertson	Deloitte & Touche	Percentage Difference
1.	Active members	$1,592,624	$1,624,502	2.0%
2.	Deferred annuitants	41,026	37,927	(7.6)
3.	Former members without vested rights	2,303	2,288	(0.7)
4.	Participants in MPRI fund	877,416	876,840	(0.1)
5.	Participants not in MPRI fund	6,673	7,353	10.2
6.	Total present values of accrued benefits	$2,520,042	$2,548,910	1.1
7.	Valuation assets	2,304,312	2,304,312	0.0
8.	Depth of funding	91.4%	90.4%	--
9.	Depth of funding excluding MPRI members	86.9%	85.4%	--

III. EXPLANATION OF DIFFERENCES

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

Our total projected benefit for active participants is 7.9% higher than Milliman & Robertson's. We are significantly higher in the death benefit and disability benefit present values. The differences are considerably larger than last year when we obtained results less than 0.1% different from The Wyatt Company.

Through an analysis of gains and losses, we are able to verify that our results are consistent with those obtained by both The Wyatt Company and us last year. Milliman & Robertson has indicated that they have not discussed this large difference with The Wyatt Company personnel. Milliman & Robertson reports the difference as a $57,574,000 "Other Items" gain. They do not explain in their report why that gain occurred.

Milliman & Robertson reports a 0.58% contribution sufficiency. We report only a 0.02% sufficiency. This difference results primarily because of the large liability difference, and also because of an interest adjustment that we make to the normal cost that Milliman & Robertson does not. Milliman & Robertson calculates normal cost as of the beginning of the year and does not make an interest adjustment. Because normal cost is actually paid throughout the year, we feel that it is necessary to adjust the amount by increasing it with one half year of interest.

We discussed this difference with Milliman & Robertson and they noted that they knew about the difference in methods. They used the same method as previously used by The Wyatt Company, but plan to look into this issue further.

The Standards for Actuarial Work states that the amortization of unfunded liability is increased by one half year interest because salaries are paid throughout the year. Although the standards do not directly mention an adjustment, we believe that the normal cost should be adjusted in the same manner as the amortization of the unfunded accrued liability.

We also calculated the assumed operating expense differently than Milliman & Robertson. Milliman & Robertson obtained the expense percentage by dividing last years expense by last years projected payroll. We obtained it by dividing by actual payroll. Actual payroll was obtained by dividing the employee contributions by the employee contribution rate. The actuarial standards simply say to divide by total covered payroll. We believe that our method is more accurate, however, the difference is only .02% of payroll.

Milliman & Robertson assumes that the IRS limits on benefits will increase 6.5% per year. Actual increases over the last two years indicate a 4.6% rate of growth on the IRS limit. Our calculations are based on an increase of 5% per year. However, we are in agreement with Milliman & Robertson personnel that these assumptions do not significantly affect results.

IV. CHANGES IN THE UNFUNDED ACTUARIAL ACCRUED 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 of 8.5%. 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 and assets 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.

During the year ended June 30, 1991, the General Employees' Fund showed an increase in the unfunded liability for the following reasons.

1. **Contribution Rate**

   The total contributions to the plan were approximately $115 million. However, expected normal cost, expenses and interest combined to equal $147 million. The net result was a shortfall of $32 million, which increases the unfunded liability.

2. **Actuarial Gains and Losses**

   The Fund experienced a $12.0 million loss on investments. There was also a loss of $1.0 million due to less retirees dying than anticipated.

   Milliman & Robertson reported actuarial gains of approximately $8.3 million from salary increases which were less than expected and a $57.6 million gain on "other items" which reflects their large decrease in active liability from last years results. We obtained similar results except that we calculated a $27 million "other items" loss which is due in part to the liability for employees hired during the last year.

   Overall, Milliman & Robertson reported a net gain (decrease in unfunded liability) from actuarial experience of $52.4 million.

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

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

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

A.	Unfunded actuarial accrued liability at beginning of year	$599,758
B.	Change due to interest requirement and current rate of funding	31,973
C.	Expected unfunded actuarial accrued liability at end of year: (A) + (B)	$631,731
D.	Actuarial losses (gains)	(52,440)
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$579,291

* Results prepared by Milliman & Robertson.

V. SENSITIVITY ANALYSIS

In the course of 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	$ 672,797	$ 869,226	$ 615,621	$ 672,797
Actuarially determined contribution:				
Amount	135,797	156,370	129,739	165,492
Percent	8.42%	9.70%	8.05%	10.26%
Sufficiency/ (Deficiency)	.02%	(1.26%)	.39%	(1.82%)
Plan continuation liability	$2,548,910	$2,731,281	$2,500,625	$2,548,910
Depth of funding:	90.4%	84.4%	92.1%	90.4%

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
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
1990*	2,707,968	2,108,210	599,758	92,261 (6.10%)	123,591 (8.17%)	127,741 (8.44%)	.27
1991	2,883,603	2,304,312	579,291	96,554 (5.98%)	126,864 (7.86%)	136,073 (8.44%)	.058

* As prepared by the Wyatt Co (1987-1990) and Milliman & Robertson (1991).
** 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
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
1990*	49,576	1,513,522,000	13,385	5,720	1,824	5,741	4,638
1991*	49,718	1,612,238,000	14,007	6,034	2,216	6,594	4,152

* As prepared by the Wyatt Co. (1987-1990) and Milliman & Robertson (1991).
** Including beneficiaries and disabled members.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director provided us with 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, 1991

	Number	Annual Payroll
General Actives at June 30, 1990	49,576	$1,515,247,502
New Entrants *	5,552	
Total	55,128	
Less Separations from Active Service:		
Refund of Contributions *	2,807	
Separation with a Deferred Annuity	575	
Separation with Neither Refunds nor Right to a Deferred Annuity	1,081	
Disability	59	
Deaths	43	
Service Retirement	861	
Total Separations	5,426	
Net Adjustments	12	
General Actives at June 30, 1991	49,714	1,611,876,546
Military & Pilot Actives at June 30, 1990	3	102,439
Pilot Actives at June 30, 1991	5	275,033
Total Actives at June 30, 1991	49,722	$1,612,254,018

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
6/30/90	34.1	33.9	34.0
6/30/91	34.6	35.3	35.0

* Includes those who entered the plan and terminated during the period from July 1, 1990 to June 30, 1991.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

General Employees' Annuitant Census
Data as of June 30, 1991

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1990	11,793	$69,510,515
	New	986	8,007,125
	Deaths	(445)	(2,096,321)
	Adjustments	(15)	3,173,893
	Receiving at June 30, 1991	12,319	$78,595,212
B.	**Disabled Employees**		
	Receiving at June 30, 1990	675	$ 2,800,333
	New	89	410,615
	Deaths	(42)	(163,147)
	Adjustments - Net Result	(3)	98,882
	Receiving at June 30, 1991	719	$ 3,146,683
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1990	900	$ 4,190,643
	New	143	873,331
	Deaths	(21)	(64,263)
	Adjustments - Net Result	(77)	(175,701)
	Receiving at June 30, 1991	945	$ 4,824,010

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	**Deferred Annuitants**		
	Deferred as of June 30, 1990	1,824	$10,333,190
	New	674	
	Began Receiving	(185)	
	Adjustments - Net Result	(106)	
	Deferred as of June 30, 1991	2,207	$14,504,035

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
6/30/90	63.6
6/30/91	62.1
All Existing Service Annuitants	63.5

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1991

General Employees

1. **Coverage:** From first date of employment.

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

3. **Contributions:**

   a. **Employee:** 4.15% of salary.

   b. **State of Minnesota:** 4.29% of salary.

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.

Appendix B (continued)

6. **Early Retirement:**

a. **Eligibility:**

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

- o Attainment of age 55 and completion of three years of service; and
- o Completion of 30 years of service.
- o 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:

- o 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.
- o 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.

7. **Pre-73 lump sum payments:** Participants retired before July 1, 1973 will receive an additional lump sum payment each year. The initial benefit (payable in 1989) 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 each year by the MPRI fund increase.

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 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.

   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.

b. **Benefit Amount:** Retirement benefits payable at early retirement date are determined according to the early 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.

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.

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.

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

o Refund of member contributions with 6% interest, 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 member's 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 three 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, 1991 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 actuarial assumptions have not been changed since the last valuation.

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. 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. Twenty-five 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:**	All employees withdrawing after becoming eligible for a deferred benefit are 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
GENERAL EMPLOYEES' RETIREMENT FUND

Male General Members
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)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

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

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
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)

MINNESOTA STATE RETIREMENT SYSTEM
GENERAL EMPLOYEES' RETIREMENT FUND

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

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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February 1992

Board of Directors
Minnesota State Retirement System
175 West Lafayette Frontage Road
St. Paul, Minnesota

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1991 actuarial valuation of the Minnesota State Retirement System, Correctional Employees' Retirement Plan.

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 Actuarial Accrued 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, 1991
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 Milliman & Robertson, Inc., the actuary retained by the LCPR. Since the Minnesota State Retirement System does not have an actuary on staff, it has retained Deloitte & Touche to review, analyze, and critique the actuarial valuations and experience studies.

This report evaluates the accuracy of Milliman & Robertson's results, and expands on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

Our role as consulting actuary to MSRS is to verify, analyze, and critique the results reported by Milliman & Robertson. To do this, we independently calculate all liabilities of the plan. We were provided with the same participant information as Milliman & Robertson and are operating under the same actuarial standards.

We attempted to duplicate the figures shown in Milliman & Robertson's June 30, 1991 valuation reports. In doing so, we had several discussions with Milliman & Robertson personnel who prepared the reports. Where we were able to discover reasonable justification for Milliman & Robertson's approach, we adjusted our methods and assumptions to match. (Descriptions of those adjustments are included in Section III.)

In this section of the report, we compare the results that Milliman & Robertson 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. The Table C figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Milliman & Robertson	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$ 85,025	$ 82,247	3.3%
Death	3,042	3,216	(5.7)
Disability	2,498	2,188	(12.4)
Withdrawal	26,562	28,649	(7.9)
Total actives	$117,127	$116,300	(0.7)
Deferred annuitants	5,174	5,264	(1.7)
Former members without vested rights	153	150	2.0
Participants in MPRI Fund	33,768	33,817	(0.1)
Total	$156,222	$155,531	(0.4)
Portion allocated to future service	44,051	43,264	(1.8)
Accrued liability (reserves required)	$112,171	$112,267	0.1
Valuation assets	105,926	105,926	0.0
Unfunded accrued liability	$ 6,245	$ 6,341	1.5
Funded ratio	94.4%	94.3%	--

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		**Milliman & Robertson**	**Deloitte & Touche**
1.	Normal cost	$4,987 (9.81%)	$5,125 (10.08%)
2.	Assumed operating expense	$ 224 (.44%)	$ 239 (.47%)
3.	Amortization by June 30, 2020 of the unfunded accrued liability	$ 290 (.57%)	$ 293 (.58%)
4.	Total Chapter 356 requirement: (1) + (2) + (3)	$5,500 (10.82%)	$5,657 (11.13%)
Prescribed Contributions			
1.	Employee contributions	$2,490 (4.90%)	$2,490 (4.90%)
2.	Employer contribution	$3,186 (6.27%)	$3,186 (6.27%)
3.	Total Chapter 352 prescribed contribution	$5,676 (11.17%)	$5,676 (11.17%)
Contribution Sufficiency		0.35%	0.04%

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1992. The expected annual payroll is $50,821,000.

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 <u>all</u> ongoing actuarial assumptions, including assumed salary increases and turnover) and are illustrated as follows:

TABLE C (000's omitted)

Depth of Funding June 30, 1991

		Milliman & Robertson	Deloitte & Touche	Percentage Difference
1.	Present value of accrued benefits			
	a. Active members	$56,002	$56,424	0.8%
	b. Deferred annuitants	5,174	5,264	1.7
	c. Former members without vested rights	153	150	(2.0)
	d. Participation in MPRI Fund	33,768	33,817	0.1
	e. Total present values of accrued benefits	$95,097	$95,655	0.6
2.	Valuation assets	105,926	105,926	0.0
3.	Depth of funding	111.4%	110.7%	--
4.	Depth of funding excluding MPRI members	117.7%	116.6%	--

III. EXPLANATION OF DIFFERENCES

In this section of the report, we present our best explanations for any differences between Milliman & Robertson's methods and assumptions and ours, and the effects of these changes.

Our calculations for the Correctional Employees' Retirement Plan are very similar to those of Milliman & Robertson, and our valuation results in Table A of Section II are close. Our total present value of benefits is 0.4% lower than Milliman & Robertson, while our total accrued liability is only 0.1% higher than Milliman & Robertson's total.

When we subtracted the actuarial value of assets to derive the unfunded accrued liability, the percentage difference increased to 1.5%. This difference is small and is larger than the difference in total accrued liability only because the plan is so well funded.

Milliman & Robertson reports a 0.35% contribution sufficiency. We report a 0.04% sufficiency. This difference results primarily from an interest adjustment that we make to the normal cost that Milliman & Robertson does not. Milliman & Robertson calculates normal cost as of the beginning of the year and does not make an interest adjustment. Because normal cost is actually paid throughout the year, we feel that it is necessary to adjust the amount by increasing it with one half year of interest.

We discussed this difference with Milliman & Robertson and they noted that they knew about the differences in methods. They used the same method as previously used by the Wyatt Company, but plan to look into this issue further.

The Standards for Actuarial Work states that the amortization on unfunded liability is increased by one half year interest because salaries are paid throughout the year. Although the standards do not directly mention an adjustment, we believe that the normal cost should be adjusted in the same manner as the amortization of the unfunded accrued liability.

We calculated the assumed operating expense differently than Milliman & Robertson. Milliman & Robertson obtained the expense percentage by dividing last year's expense by last year's projected payroll. We obtained it by dividing by actual payroll. Actual payroll was obtained by dividing the employee contributions by the employee contribution rate. The actuarial standards simply say to divide by total covered payroll. We believe that our method is more accurate, however, the difference is only .03% of payroll.

Milliman & Robertson assumes that the IRS limits on benefits will increase 6.5% per year. Actual increases over the last two years indicate a 4.6% rate of growth on the IRS limit. Our calculations are based on an increase of 5% per year. However, we agree with Milliman & Robertson personnel that these assumptions do not affect results.

IV. CHANGES IN THE UNFUNDED ACTUARIAL ACCRUED 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. The unfunded liability of the Correctional Plan is small, and should not be considered a problem.

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 of 8.5%. 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 and assets 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.

During the year ended June 30, 1991, the Correctional Employees' Fund showed an increase in the unfunded liability for the following reasons.

1. **Contribution Rate**

   The total contributions to the plan were approximately $4,859,000. Expected normal cost, expenses and interest combined to equal $5,262,000. The net result was an increase of $403,000 in the unfunded liability.

2. **Actuarial Gains and Losses**

   Milliman & Robertson reported a net loss (increase in unfunded liability) of $570,000. The net loss of $570,000 was a result of $2,580,000 in gains due to smaller salary increases than expected and $813,000 due to higher annuitant mortality than expected offset by a $658,000 investment loss and a reported $3,305,000 loss on other items.

   Because Milliman & Robertson did not have last year's projected salary by individual, they had to use a crude estimate of the salary gain. Their estimate was $2,580,000. Since we had information on file from last year, we were able to use an approach that is actuarially more sound. Based on the payroll used for last years valuation, we obtained a salary gain of $937,000. Our results were very close to Milliman & Robertson's in the annuitant mortality gain and the investment return loss. Our net loss due to other items was $1,397,000, resulting in an overall net loss of $341,000.

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

   There were no changes in plan provisions or assumptions since last year's valuation.

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

A.	Unfunded actuarial accrued liability at beginning of year	$5,272
B.	Change due to interest requirement and current rate of funding	403
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$5,675
D.	Actuarial losses (gains)	570
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$6,245

* Results prepared by Milliman & Robertson.

V. SENSITIVITY ANALYSIS

In the course of 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 in		
	Current Deloitte & Touche	Interest	Salary Increase	Amortization
Unfunded liability	$ 6,341	$14,006	$ 4,344	$ 6,341
Actuarially determined Contribution:				
Amount	5,657	6,734	5,318	5,937
Percent	11.13%	13.25%	10.46%	11.68
Sufficiency	0.04%	(2.08%)	.71%	(.51%)
Plan continuation liability	$95,655	$103,059	$93,809	$95,655
Depth of funding:	110.7%	102.8%	112.9%	110.7%

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
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
1990*	102,217	96,945	5,272	4,552 (9.67%)	5,051 (10.73%)	5,259 (11.17%)	0.44
1991*	112,171	105,926	6,245	4,987 (9.81%)	5,500 (10.82%)	5,676 (11.17%)	0.35

* As prepared by the Wyatt Company (1987-1990) and Milliman & Robertson (1991).
** 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 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
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
1990*	1,416	47,075,000	364	8,930	113	8,177	45
1991*	1,467	50,821,000	383	9,297	157	9,689	48

* As prepared by the Wyatt Company (1987-1990) and Milliman & Robertson (1991).
** Including beneficiaries and disabled members.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director provided us with 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, 1991

	Number	Annual Payroll
Actives at June 30, 1990	1,416	$47,074,739
New Entrants*	163	
Total	1,579	
Less Separations from Active Service:		
Refund of Contributions*	36	
Separation with a Deferred Annuity	43	
Separation with Neither Refund nor Right to a Deferred Annuity	18	
Death	1	
Service Retirement	24	
Disability	0	
Total Separations	122	
Data Adjustments	10	
Actives at June 30, 1991	1,467	$50,820,696

Average Entry Age of New Employees

For the Fiscal Year Year Ending	Male	Female	Average Age at Entry
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
6/30/90	30.5	31.1	30.7
6/30/91	31.2	32.3	31.5

* Includes those who entered the plan and terminated during the period from July 1, 1990 to June 30, 1991.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Correctional Employees' Annuitant Census
Data as of June 30, 1991

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1990	340	$3,082,906
	New	26	338,457
	Deaths	(7)	(48,132)
	Adjustments - Net Result	(1)	17,685
	Receiving at June 30, 1991	358	$3,390,916
B.	**Disabled Employees**		
	Receiving at June 30, 1990	9	$ 85,658
	New	0	0
	Deaths	0	0
	Retirements	0	0
	Adjustments - Net Result	3	21,361
	Receiving at June 30, 1991	12	$ 107,019
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1990	15	$ 82,023
	New	1	305
	Deaths	0	0
	Adjustments - Net Result	(3)	(15,558)
	Receiving at June 30, 1991	13	$ 66,770

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	**Children Receiving a Survivor Benefit**	0	$ 0
E.	**Deferred Annuitants**		
	Receiving at June 30, 1990	113	924,033
	New	57	
	Began Receiving Benefits	(5)	
	Return of Actives	(4)	
	Adjustments	(8)	
	Receiving at June 30, 1991	153	$ 1,493,348

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
6/30/90	56.9
6/30/91	57.0
All Existing Service Annuitants	57.6

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1991

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:**	6.27% 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.
	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.

Appendix B (continued)

6. **Early Retirement:**

a. **Eligibility:**	Attainment of age 50 and completion of three years of service.
b. **Retirement Benefit:**	Normal Retirement Benefit actuarially reduced for commencement at age 55.

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.
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.
o Not in line of duty:	2.5% of average monthly salary for each year of service, subject to a minimum of 37.5%.
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.

8. **Deferred Service Retirement:**

a. **Eligibility:**	Completion of three years of service and election to leave employee contributions on deposit.

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.

9. **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.

10. **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.

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

- Refund of member contributions with 6% interest; or
- 100% of the annuity the member would have received had he retired early (if eligible) from the General Employees Retirement Fund 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.

11. **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, 1991 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 actuarial assumptions have not been changed since the last valuation.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

1.	**Mortality:**	1971 Group Annuity Mortality Table with ages set back 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. 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:**	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.
11.	**Disability**	All disabilities are assumed to have been occupational.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
CORRECTIONAL EMPLOYEES' RETIREMENT FUND

Male Correctional Members
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
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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February 1992

Board of Directors
Minnesota State Retirement System
175 West Lafeyette Frontage Road
St. Paul, Minnesota

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1991 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 Valuation Results
Section III	-	Explanation of Differences
Section IV	-	Changes in the Unfunded Actuarial Accrued 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, 1991
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.

III. EXPLANATION OF DIFFERENCES (continued)

We calculated the assumed operating expense differently than Milliman & Robertson. Milliman & Robertson obtained the expense percentage by dividing last year's expense by last year's projected payroll. We obtained it by dividing by actual payroll. Actual payroll was obtained by dividing the employee contributions by the employee contribution rate. The actuarial standards merely say to divide by total covered payroll. We believe that our method is more accurate. However, the difference is only .03% of payroll.

We increased the withdrawal liability by 6% to account for the death benefit for future vested terminations. Milliman & Robertson 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.

Milliman & Robertson assumes that the IRS limits on benefits will increase 6.5% per year. Actual increases over the last two years indicate a 4.6% rate of growth on the IRS limit. Our calculations are based on an increase of 5% per year. However, we are in agreement with Milliman & Robertson personnel that these assumption do not affect results.

IV. CHANGES IN THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The State Patrol Employees' 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 of 8.5%. 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 and assets 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.

During the year ended June 30, 1991, the State Patrol Employees' Fund showed a decrease in the unfunded liability for the following reasons.

1. **Contribution Rate**

   The total contributions to the plan were $7,577,000. However, expected normal cost, expenses and interest combined to equal $8,450,000. The net result was a shortfall of about $873,000, which increased the unfunded liability.

2. **Actuarial Gains and Losses**

   According to Milliman & Robertson, Inc., the Fund experienced actuarial losses of $878,000 from salary increases and $319,000 from MPRI mortality.

   The Fund experienced a $1,127,000 loss on investments.

   The remaining sources of gain or loss, including Mortality of Other Benefit Recipients, combined to produce a gain of $876,000. Overall, there was a net loss (increase in unfunded liability) from actuarial experience of $1,448,000.

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

   The only change since last year's valuation is a change in plan provisions. Due to new legislation, the surviving spouse benefit will no longer terminate upon remarriage. This change has no significant impact on the unfunded liability.

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

A.	Unfunded actuarial accrued liability at beginning of year	$21,644
B.	Change due to interest requirement and current rate of funding	873
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$22,517
D.	Actuarial losses (gains)	1,448
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$23,965

* Results prepared by Milliman & Robertson.

V. SENSITIVITY ANALYSIS

In the course of 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	$25,382	$33,205	$23,353	$25,382
Actuarially determined contribution:				
(Amount)	8,792	10,127	8,340	9,912
(Percent)	23.27%	26.81%	22.08%	26.24%
(Sufficiency)	0.11%	(3.43%)	1.30%	(2.86%)
Plan continuation liability	$216,240	$228,184	$212,576	$216,240
Depth of funding:	92.5%	87.7%	94.1%	92.5%

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 (Deficiency)
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
1990*	207,343	185,699	21,644	6,378 (18.53%)	7,624 (22.15%)	8,048 (23.38%)	1.23
1991*	224,033	200,068	23,965	7,184 (19.02%)	8,529 (22.58%)	8,832 (23.38%)	0.80

* As prepared by the Wyatt Co. (1987-1990) and Milliman & Robertson (1991).
** Figures shown in parentheses are as a percentage of payroll under normal retirement age.

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
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
1990*	788	34,423,000	465 ***	16,394	23	12,549	4
1991*	809	37,777,000	487 ***	18,598	15	14,484	0

* As prepared by the Wyatt Co. (1987 - 1990) and Milliman & Robertson (1991).
** Including beneficiaries and disabled members.
*** Does not include children.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director provided us with 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, 1991

	Number	Annual Payroll
Actives at June 30, 1990	788	$34,423,288
New Entrants*	42	
Total	830	
Less Separations from Active Service:		
Refund of Contributions*	1	
Separation with a Vested Right to a Deferred Annuity	0	
Separation with Neither Annuity nor Right to a Deferred Annuity	0	
Death While Eligible; Surviving Spouse Receiving Annuity	0	
Service Retirement	20	
Disability	1	
Death	0	
Total Separations	22	
Data Adjustments	2	
Actives at June 30, 1991	810	$37,777,000

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
6/30/90	29.5	29.7	29.5
6/30/91	31.6	31.5	31.6

* Includes those who entered the plan and terminated during the period from July 1, 1990 to June 30, 1991.

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

State Patrol Census Data as of June 30, 1991

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1990	346	$6,596,936
	New	27	640,567
	Deaths	(10)	(151,152)
	Adjustments - Net Result	0	326,509
	Receiving at June 30, 1991	363	$7,412,860
B.	**Disabled Employees**		
	Receiving at June 30, 1990		
	MPRI	11	
	Non-MPRI	3	
		14	$ 199,197
	New (MPRI)	1	24,035
	Deaths (MPRI)	0	0
	Adjustments	0	8,749
	Receiving at June 30, 1991	15	$ 231,981
C.	**Widows Receiving an Annuity or Survivor Benefit**		
	Beneficiaries Receiving an Optional or Reversionary Annuity:		
	Receiving at June 30, 1990	105	$ 826,879
	New	8	62,057
	Deaths	(4)	(18,399)
	Adjustments - Net Result	0	48,419
	Receiving at June 30, 1991	109	$ 918,956

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	**Children Receiving a Survivor Benefit**		
	Receiving at June 30, 1990	5	$ 14,223
	New	0	0
	Reinstated	0	0
	No Longer Eligible	0	0
	Adjustments - Net Result	0	(1,078)
	Receiving at June 30, 1991	5	$ 13,145
E.	**Deferred Annuitants**		
	Deferred as of June 30, 1990	23	$276,078
	New	0	
	Retirement	(7)	
	Adjustment - Net Results	(2)	
	Deferred as of June 30, 1991	14	$202,776

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
6/30/90	58.5
6/30/91	57.4
All Existing Service Annuitants	57.7

APPENDIX B

MINNESOTA STATE RETIREMENT SYSTEM
STATE PATROL RETIREMENT FUND

Summary of Principal Plan Provisions as of June 30, 1991

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:	14.88% 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.
	b. Benefit Amount:	2.5% of final average salary for each year of service.
6.	**Early Retirement:**	
	a. Eligibility:	Attainment of age 50 and completion of three years of service.
	b. Benefit Amount:	Normal Retirement Benefit actuarially reduced for commencement before age 55.
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.

	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. o 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.
	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% each year until early or normal retirement.
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%.
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.

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

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 6% compounded annually. In such case, service previously credited during the prior period at membership is restored. (Interest changed from 5%).

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.

Appendix B (continued)

16. Pre-1973 Annuitants:

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

Participants who 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.

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, 1991 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 actuarial assumptions have not been changed since the last valuation.

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 300 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, 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
   - Age 58 for State Police Officers hired after 6/30/61
   - Age 63 for State Police Officers hired before 7/1/61

   and July 1, 1992.

8. **Actuarial Cost Method:** Individual level percent entry age cost method.

Appendix C (continued)

9. **Assumed Survivor Status:** 85% assumed married, female spouse three years younger. 6% load on spouse benefits for children's benefits.

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

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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February 1992

Board of Directors
Minnesota State Retirement System
175 West Lafeyette Frontage Road
St. Paul, Minnesota

Ladies and Gentlemen:

We are pleased to present our report on the June 30, 1991 actuarial valuation of the Minnesota State Retirement System, Judges' Retirement Fund.

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

This report evaluates the accuracy of Milliman & Robertson's results, and expands on any items of particular significance.

II. COMPARISON OF VALUATION RESULTS

Our role as consulting actuary to MSRS is to verify, analyze, and critique the results reported by Milliman & Robertson. To do this we independently calculated all liabilities of the plan. We were provided with the same participant information as Milliman & Robertson and are operating under the same actuarial standards.

We attempted to duplicate the figures shown in Milliman & Robertson's June 30, 1991 valuation reports. In doing so, we had several discussions with Milliman & Robertson's personnel who prepared the reports. Where we were able to discover reasonable justification for Milliman & Robertson's approach, we adjusted our methods and assumptions to match. (Descriptions of those adjustments are included in Section III.)

In this section of the report, we compare the results that Milliman & Robertson 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. Table C figures are also required for Government Accounting Standards Board (GASB) reporting.

TABLE A (000's Omitted)

	Milliman & Robertson	Deloitte & Touche	Percentage Difference
Present Value of Benefits:			
Actives:			
Retirement	$ 63,478	$ 54,973	(13.4%)
Death	8,895	8,183	(8.0)
Disability	4,304	3,904	(9.3)
Withdrawal	--	--	--
Total actives	$76,677	$67,060	(12.5)
Deferred annuitants	212	212	0.0
Former members without vested rights	0	0	0.0
Participants in MPRI Fund	28,104	27,814	(1.0)
Retirement and survivor benefits from Judges' Fund	11,831	11,732	(0.8)
Total	$116,824	$106,818	(8.6)
Portion allocated to future service	38,396	32,608	(15.1)
Accrued liability (reserves required)	$ 78,428	$ 74,210	(5.4)
Valuation assets	33,559	33,559	0.0
Unfunded accrued liability	$ 44,869	$ 40,651	(9.4)
Funded ratio	42.8%	45.2%	--

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	**Milliman & Robertson**	**Deloitte & Touche**
1. Normal cost	$3,396 (15.74%)	$3,098 (14.39%)
2. Assumed operating expense	$ 73 (.34%)	$ 75 (.35%)
3. Amortization by June 1, 2020 of the unfunded accrued liability	$1,946 (9.02%)	$1,878 (8.72%)
4. Total Chapter 356 requirement: (1) + (2) + (3)	$5,415 (25.10%)	$5,051 (23.46%)
Prescribed Contributions		
1. Employee contributions	$ 936 (4.34%)	$ 934 (4.34%)
2. Employer contribution	$4,745 (22.00%)	$4,737 (22.00%)
3. Total Chapter 490 prescribed contribution	$5,681 (26.34%)	$5,671 (26.34%)
Contribution Sufficiency/(Deficiency)	1.24%	2.88%

The Judges Retirement Plan has now been placed on an actuarial funding basis. It had previously been terminally funded. Employer contributions will be payable at the same time as member contributions.

* Assuming that contributions are paid during each payroll period throughout the year ending June 30, 1992. Milliman & Robertson calculates expected annual payroll to be $21,570,000 and bases its calculations on this amount. Our calculations are based on a payroll of $21,530,000. We are uncertain as to the reason for this small difference in payroll.

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, 1991

		Milliman & Robertson	Deloitte & Touche	Percentage Difference
1.	Active members	$36,127	$32,716	(9.4%)
2.	Deferred annuitants	212	212	0.0
3.	Former members without vested rights	0	0	0.0
4.	Participants in MPRI Fund	28,104	27,814	(1.0)
5.	Participants not in MPRIF	11,831	11,732	(0.8)
6.	Total present values of accrued benefits	$76,275	$72,474	(5.0)
7.	Valuation assets	33,559	33,559	0.0
8.	Depth of funding	44.0%	46.3%	--
9.	Depth of funding excluding MPRIF members	11.3%	12.9%	--

III. EXPLANATION OF DIFFERENCES

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

Our calculations for each annuitant group are very similar to Milliman & Robertson's. Milliman & Robertson's initial report had reflected a liability about $1.8 million lower than ours for the Non-MPRI annuitants. We discovered that they did not value the 4% option which allows certain annuitants to receive an unreduced joint & survivor amount. The data tape sent to both Milliman & Robertson and us did not indicate that anyone had this option. However, two years ago we obtained a letter identifying the individuals. We sent this letter to Milliman & Robertson and they reissued the relevant pages of the report to reflect this additional liability.

For active participants, we have dramatically different results. Our total active projected benefit is 12.5% lower than Milliman & Robertson's. Because we so closely match their annuitant liabilities, our total accrued liability is 5.4% lower than theirs. When reduced by the asset value, the difference, which is the unfunded liability, is 9.4% lower than Milliman & Robertson's.

This difference is considerably more than last year's 0.2% difference between The Wyatt Company and us. In dollar values the difference rose from $100,000 to $4,218,000. Through an analysis of gains and losses, we are able to verify that our results are consistent with both The Wyatt Company and our results from last year. Milliman & Robertson has indicated that they have not been in contact with Wyatt personnel to discuss the difference between their liability this year with The Wyatt Company's liability from last year.

Milliman & Robertson calculates a contribution sufficiency of 1.24% compared to our 2.88%. This is primarily because their accrued liability is so much higher than ours. The difference would be even greater if not for the following interest adjustment that we make that Milliman & Robertson does not.

Milliman & Robertson calculates normal cost as of the beginning of the year and does not make an interest adjustment. Because normal cost is actually paid throughout the year, we feel that it is necessary to adjust the amount by increasing it with one half year of interest. We discussed this difference with Milliman & Robertson and they noted that they knew about the difference in methods. They used the same method as previously used by The Wyatt Company, but plan to look into this issue further. The Standards for Actuarial Work states that the amortization of unfunded liability is increased by one half year interest because salaries are paid throughout the year. Although the standards do not directly mention an adjustment, we believe that the normal cost should be adjusted in the same manner as the amortization of the unfunded accrued liability.

III. EXPLANATION OF DIFFERENCES (continued)

We also calculated the assumed operating expense slightly different than Milliman & Robertson. Milliman & Robertson obtained the expense percentage by dividing last year's expense by last year's projected payroll. We obtained it by dividing last year's expense by actual payroll. Actual payroll was obtained by dividing the employee contributions by the employee contribution rate. The actuarial standards simply say to divide by total covered payroll. Although we believe that our method is more accurate, the difference is only .01% of payroll.

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. The unfunded liability of the Judges' Plan had grown very large, and that was one reason an actuarial funding method was adopted this year.

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 of 8.5%. 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.

During the year ended June 30, 1991, the Judges' Fund showed a large increase in the unfunded liability according to Milliman & Robertson. Our results showed a small decrease. The reasons for the difference are outlined below.

1. **Contribution Rate**

During the year member contributions were $799,000. In addition, $5,900,000 was appropriated from the State's General Fund, bringing the total contributions to $6,699,000. However, Milliman & Robertson failed to include the State's appropriation as an employer contribution. Milliman & Robertson has indicated that in retrospect, they would have no problem in labeling this as an employer contribution.

Milliman & Robertson calculates that the expected normal cost, expenses and interest combined to equal $6,617,000 resulting in a net increase in the unfunded liability of $5,818,000. However, since the $5,900,000 amount should be considered a contribution, expected normal cost, expenses, and interest would be $6,366,000 and the unfunded liability should show a net expected decrease of $333,000.

2. **Actuarial Gains and Losses**

We have several significant differences with Milliman & Robertson concerning actuarial gains and losses. The first is a result of their not recognizing the $5,900,000 appropriation as a contribution. Milliman & Robertson included the $5,900,000 amount in their "other items" loss calculation which totalled $221,000. Therefore, their large increase in liability was offset by their large asset increase to create a small loss to the plan. Milliman & Robertson does not provide detailed on the gain and loss calculations, however, the large liability increase over the year is obviously due to a difference in computer programs.

Another difference we observed is that their $4,076,000 salary gain due to salary increases lower than expected is about $2,300,000 larger than ours. This is due in part to Milliman & Robertson determining the gain based on overstated salaries used by The Wyatt Company in last year's valuation. Milliman and Robertson may also have included the assumption change gain that is described below.

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

Milliman & Robertson does not indicate that an assumption change occurred. However, their report states that they assume salary increases of 3% next year and 6.5% for each year after that. This differs from the previous salary assumption. We believe that their assumption is valid given that salaries are assumed frozen until January 1993. However, we believe that the assumption change should be noted in their report and should have been valued to reflect the effect of the change on the unfunded liability. We calculate that the assumption change results in a $497,000 decrease in unfunded liability.

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

A.	Unfunded actuarial accrued liability at beginning of year	$41,280
B.	Change due to interest requirement and current rate of funding	5,818
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$47,098
D.	Actuarial losses (gains)	(2,229)
E.	Changes in assumptions and plan provisions	0
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$44,869

* Results prepared by Milliman & Robertson

The following shows our calculations of the changes in Unfunded Actuarial Accrued Liability based on Deloitte & Touche results which reflects the State appropriation amount of $5,900,000 as an employer calculation and the salary assumption change.

A.	Unfunded actuarial accrued liability at beginning of year	$41,180
B.	Change due to interest requirement and current rate of funding	(344)
C.	Expected actuarial accrued liability at end of year: (A) + (B)	$40,836
D.	Actuarial losses (gains)	312
E.	Change in salary assumption (3% increase next year, 6.5% increase each year after)	(497)
F.	Unfunded actuarial accrued liability at end of year: (C) + (D) + (E)	$40,651

V. SENSITIVITY ANALYSIS

In the course of 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 3.0% next year and 6.5% each year thereafter. We examined the effect of a salary increase assumption change to 3% next year and 6.0% thereafter.

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	$40,651	$42,903	$40,176	$40,651
Actuarially determined contribution:				
Amount	5,051	5,307	4,995	6,845
Percent	23.46%	24.65%	23.20%	31.79%
Sufficiency	2.88%	1.69%	3.14%	(5.45%)
Plan continuation liability	$72,474	$75,941	$71,610	$72,474
Depth of funding:	46.30%	44.19%	46.86%	46.30%

JUDGES

VI. SUMMARY OF HISTORICAL VALUATION RESULTS**

(000'S Omitted)

Report as of June 30	Accrued Liability	Valuation Assets	Unfunded Accrued Liability	Normal Cost	Actuarial Contribution	Prescribed Employee Contribution
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%)
1990*	69,396	28,116	41,280	2,942 (14.24%)	4,874 (23.59%)	891 (4.31%)
1991*	78,428	33,559	44,869	3,396 (15.74%)	5,415 (25.10%)	936 (4.34%)

* As prepared by the Wyatt Company (1987 - 1990) and Milliman & Robertson (1991).

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

VI. SUMMARY OF HISTORICAL VALUATION RESULTS**
(000'S Omitted)

Report as of June 30	Active Members Number	Active Members Valuation Payroll	Retired Members[2] Number	Retired Members[2] Avg. Annual Benefits	Deferred Annuitants Number	Deferred Annuitants Avg. Annual Benefits	Former Members Without Vested Rights
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[1]	238	15,999,000	152	19,047	7	18,137	1
1988[1]	246	17,109,000	161	20,301	5	19,940	0
1989[1]	257	18,759,000	166	21,673	4	18,090	0
1990[1]	262	20,191,000 [3]	178	22,685	2	15,824	1
1991	271	21,570,000	182	24,093	3	11,756	0

(1) As prepared by the Wyatt Company (1987 - 1990) and Milliman & Robertson (1991).

(2) Including beneficiaries and disabled members.

(3) Provided by Deloitte & Touche as correction of Milliman & Robertson's result.

APPENDIX A

SUMMARY OF EMPLOYEE DATA

The Executive Director provided us with 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 Milliman & Robertson salaries used in the valuation were different than those that the Executive Director provided. All salaries were taken from the salary history of Constitutional Officers, Judges, Legislators, and related positions prepared by the Department of Employee Relations in June 1989. We are unclear as to why these salaries vary so significantly from those included in the MSRS data base.

Since salaries are frozen until January 1, 1993, all salaries are frozen at their January 1, 1991 amount.

Appendix A (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Covered Judges' Retirement Fund Employee Census Data as of June 30, 1991

	Number	Annual Payroll
Judges' Retirement Fund		
Actives at June 30, 1990	261	$20,114,110
New Entrants*	21	
Total	282	
Less Separations from Active Service:		
Disability	0	
Terminated with Refund	2	
Terminated with Deferred Benefit	1	
Service Retirement	8	
Death	1	
Total Separations	12	
Data Adjustments	0	
Actives at June 30, 1991	270	$21,441,022
Supreme Court Justices' Plan		
Actives at June 30, 1991	1 *	$ 89,052 **
Total Active Judges at June 30, 1991	271	$21,530,074

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
6/30/90	44.2
6/30/91	45.6

* No change from June 30, 1990.
** Was $76,539 as of June 30, 1990.

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Judges' Retirement Fund Annuitant Census
Data as of June 30, 1991

		Number	Annual Annuity Benefit Payable
A.	**Service Retirement Annuitants**		
	Receiving at June 30, 1990	105	$2,878,042
	New	8	201,701
	Deaths	(6)	(95,483)
	Adjustments - Net Result	2	153,168
	Receiving at June 30, 1991	109	$3,137,428
	Non-MPRIF	13	516,592
	MPRIF	96	2,620,836
		109	$3,137,428
B.	**Disabled Employees**		
	Receiving at June 30, 1990	9	$ 232,028
	New	0	0
	Adjustments - Net Result	0	11,240
	Receiving at June 30, 1991	9	$ 243,268
	Non-MPRIF	1	24,861
	MPRIF	8	218,407
		9	$ 243,268
C.	**Widows Receiving an Annuity or Survivor Benefit & Children**		
	Receiving at June 30, 1990	64	$ 942,953
	New	1	21,047
	Deaths	(1)	(7,308)
	Adjustments - Net Result	0	46,936
	Receiving at June 30, 1991	64	$1,004,628
	Non-MPRIF	54	804,836
	MPRIF	10	199,792
		64	$1,004,628

Appendix A (continued)

		Number	Annual Annuity Benefit Payable
D.	**Deferred Annuitants**		
	Receiving at June 30, 1990	2	$31,648
	New	1	5,136
	Return to Work	0	0
	Adjustments	0	(1,516)
	Deferred at June 30, 1991	3	$ 35,268

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
6/30/90	67.7
6/30/91	67.9

* 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, 1991

JUDGES' 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:	22% of salary.
4. Final Average Salary:	Monthly average for the highest five years of salary within the last 10 years.

5. Normal Retirement:

a. Eligibility: Earlier of:

- Attainment of age 65 and completion of five years of service; or
- 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:

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

Appendix B (continued)

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

Appendix B (continued)

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 years.

5. **Contributions:**

From Judges:	4% of salary to provide a 50% joint and survivor benefit with no actuarial reduction.
From the State:	22% of pay.

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, 1991 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 actuarial assumptions have not been changed since the last valuation.

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Summary of Actuarial Assumptions and Methods

JUDGES' RETIREMENT FUND

1.	**Mortality:**	1971 Group Annuity Mortality Table for Males with ages set back 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.

Appendix C (continued)

9. **Social Security:**

   a. **Primary Amount:** Maximum current primary amount ($1,023 per month for 1991 assuming retirement at normal retirement age. Delayed retirement credit increases this amount if retirement occurs after the normal retirement age), increasing with salary scale.

   b. **Level Contribution Rate:** 7.65%.

   c. **Covered Annual Wages:** Current annual wage base ($53,400 for 1991), 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
Separation from Active Service
(Number Separating at Each Age Per 10,000 Working at That Age)

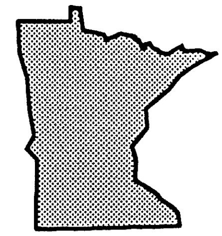
Age	Death	Disability	Age and Service Retirement	Age	Death	Disability	Age and Service Retirement
20	5			45	29	3	
21	5			46	33	5	
22	5			47	38	7	
23	6			48	42	9	
24	6			49	47	11	
25	6			50	53	14	
26	7			51	59	16	
27	7			52	65	20	
28	7			53	71	24	
29	8			54	78	28	
30	8	2		55	85	34	
31	9	2		56	93	40	
32	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					

Appendix C (continued)

MINNESOTA STATE RETIREMENT SYSTEM
JUDGES' RETIREMENT FUND

Male Judges
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					

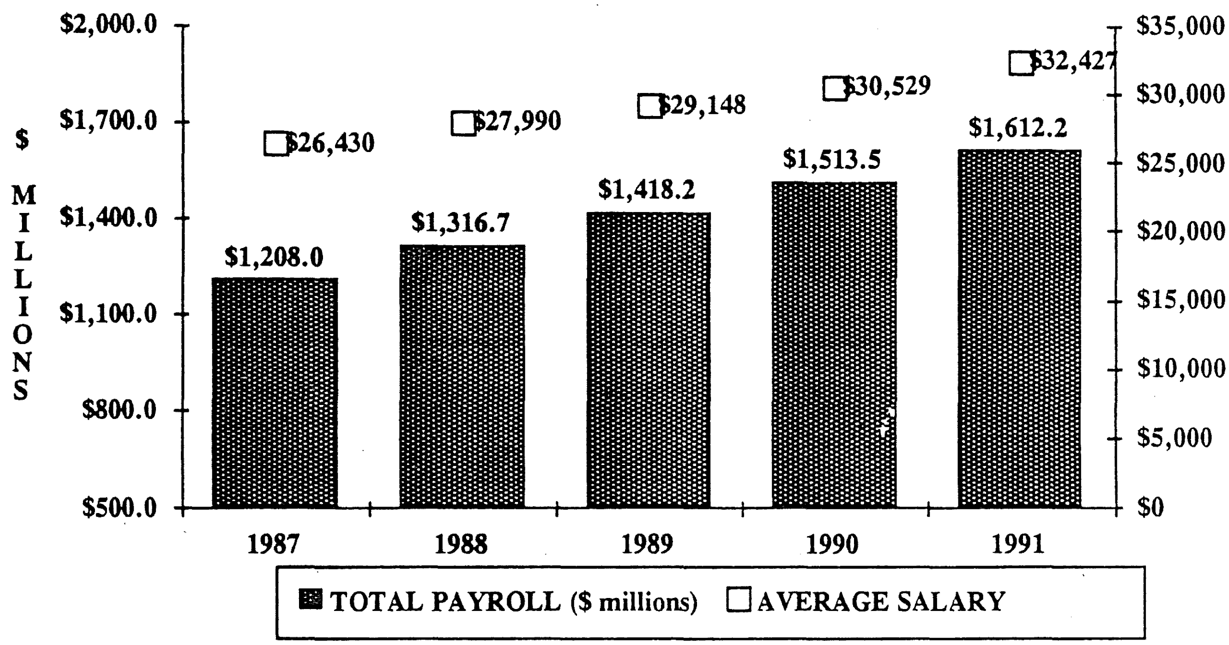


MINNESOTA STATE RETIREMENT SYSTEM

Review of Actuarial Valuations as of June 30, 1991

Deloitte &
Touche

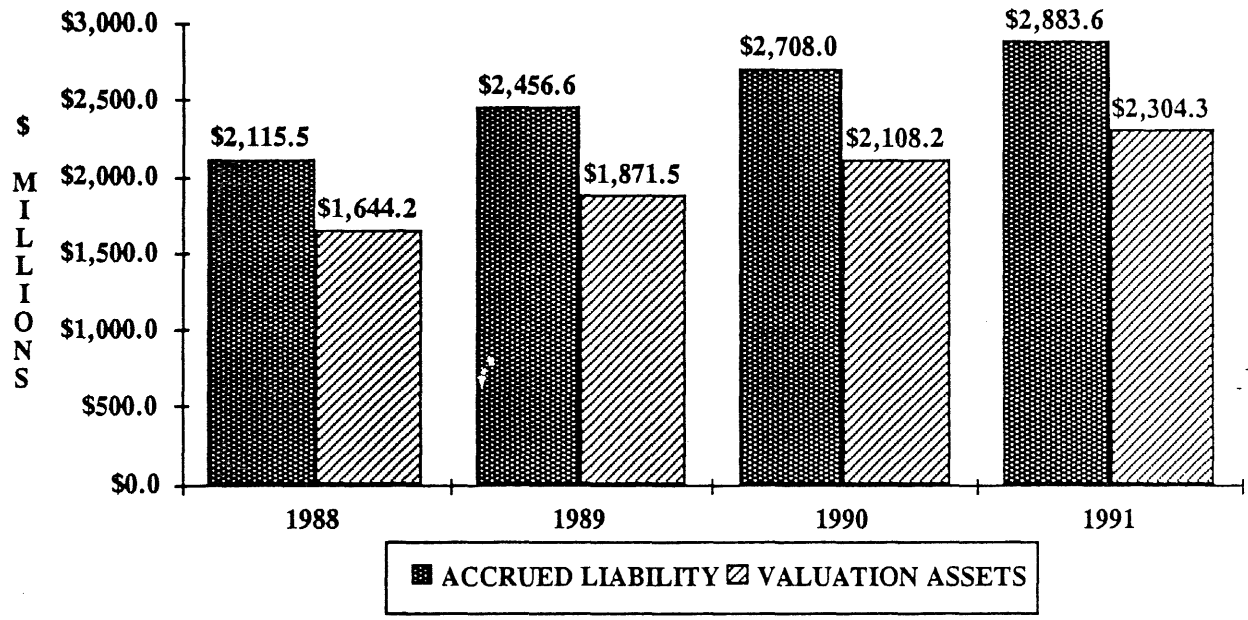
GENERALS ACTIVE MEMBERS
TOTAL PAYROLL AND AVERAGE SALARY



Members	45,707	47,040	48,653	49,576	49,718

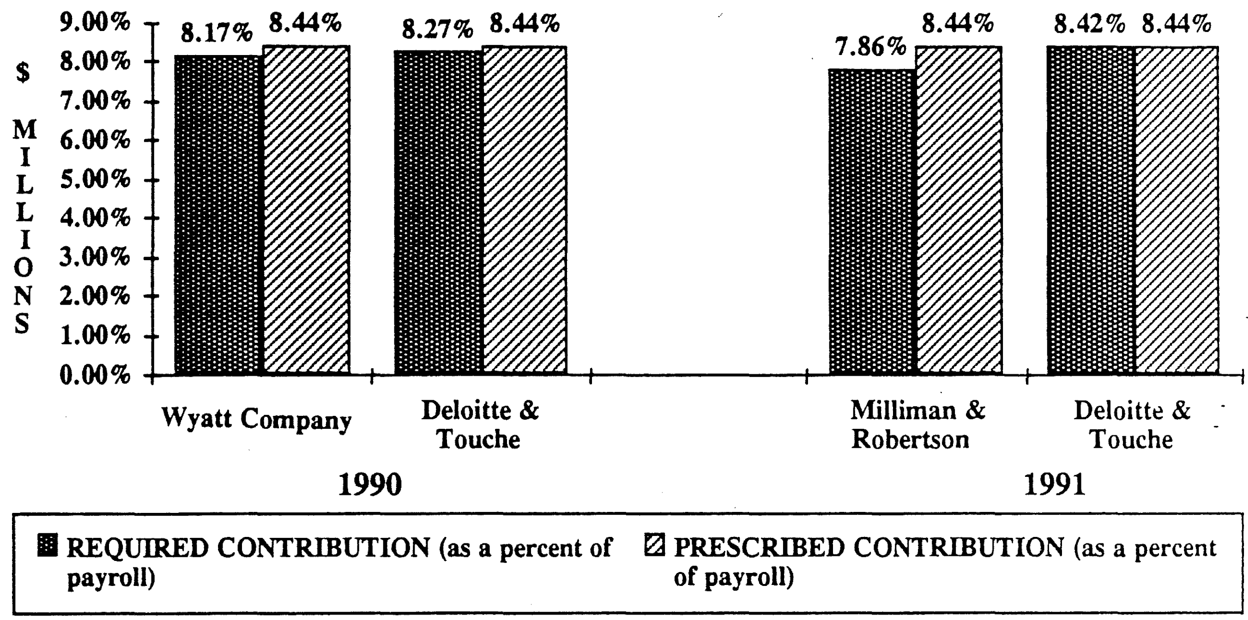
Deloitte & Touche

GENERAL STATE EMPLOYEES' PLAN
TABLE A

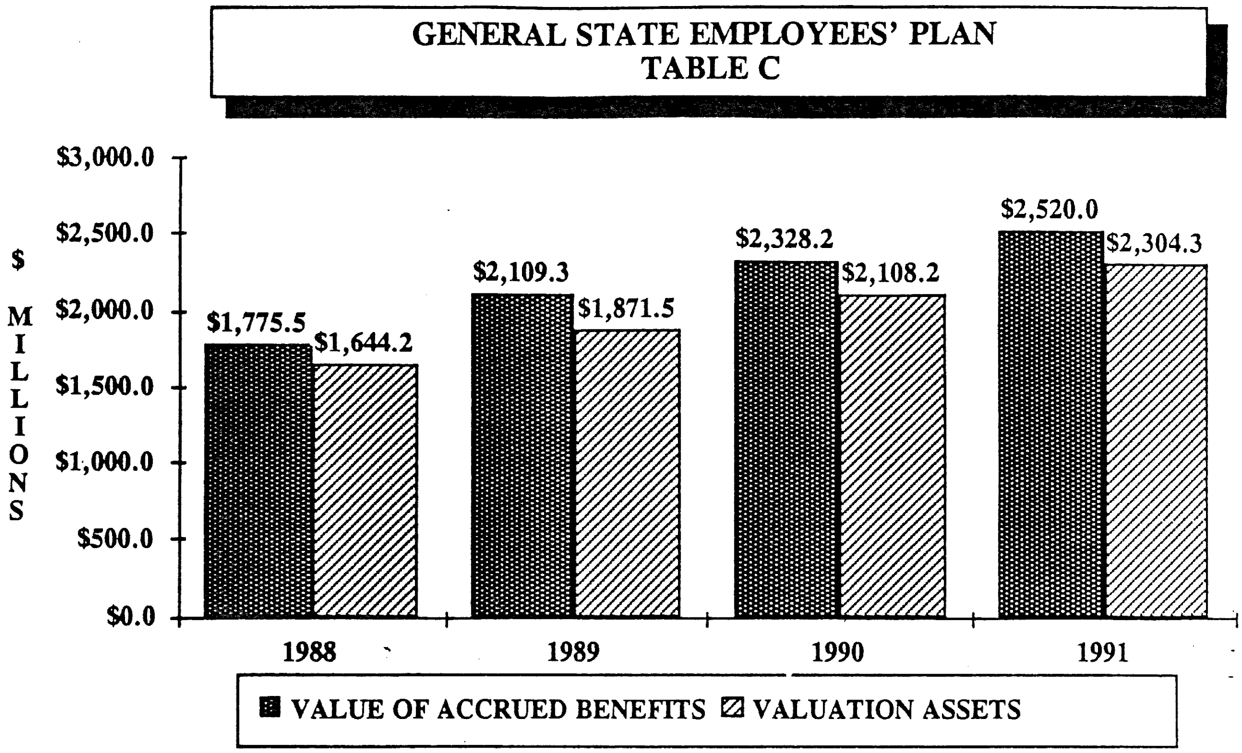


	1988	1989	1990	1991
Accrued Liability	$2,115.5	$2,456.6	$2,708.0	$2,883.6
Valuation Assets	1,644.2	1,871.5	2,108.2	2,304.3
Unfunded Accrued Liability	471.3	585.1	599.8	579.3
Funded Ratio	77.7%	76.2%	77.9%	79.9%

GENERAL STATE EMPLOYEES' PLAN
TABLE B



	1990		1991	
	Wyatt Company	Deloitte & Touche	Milliman & Robertson	Deloitte & Touche
Required Contribution	$ 123.6 (8.17%)	$ 125.3 (8.27%)	$ 126.9 (7.86%)	$135.8 (8.42%)
Prescribed Contribution	$ 127.7 (8.44%)	$ 127.9 (8.44%)	$ 136.1 (8.44%)	$ 136.1 (8.44%)
Sufficiency/(Deficiency)	.27%	0.17%	0.58%	0.02%



	1988	1989	1990	1991
Value of Accrued Benefits	$1,775.5	$2,109.3	$2,328.2	$2,520.0
Valuation Assets	1,644.2	1,871.5	2,108.2	2,304.3
Depth of Funding	92.6%	88.7%	90.6%	91.4%
Depth of Funding, Excluding MPRI Members	88.3%	83.0%	85.9%	86.9%

Deloitte & Touche

GENERAL STATE EMPLOYEES' PLAN

TABLE D

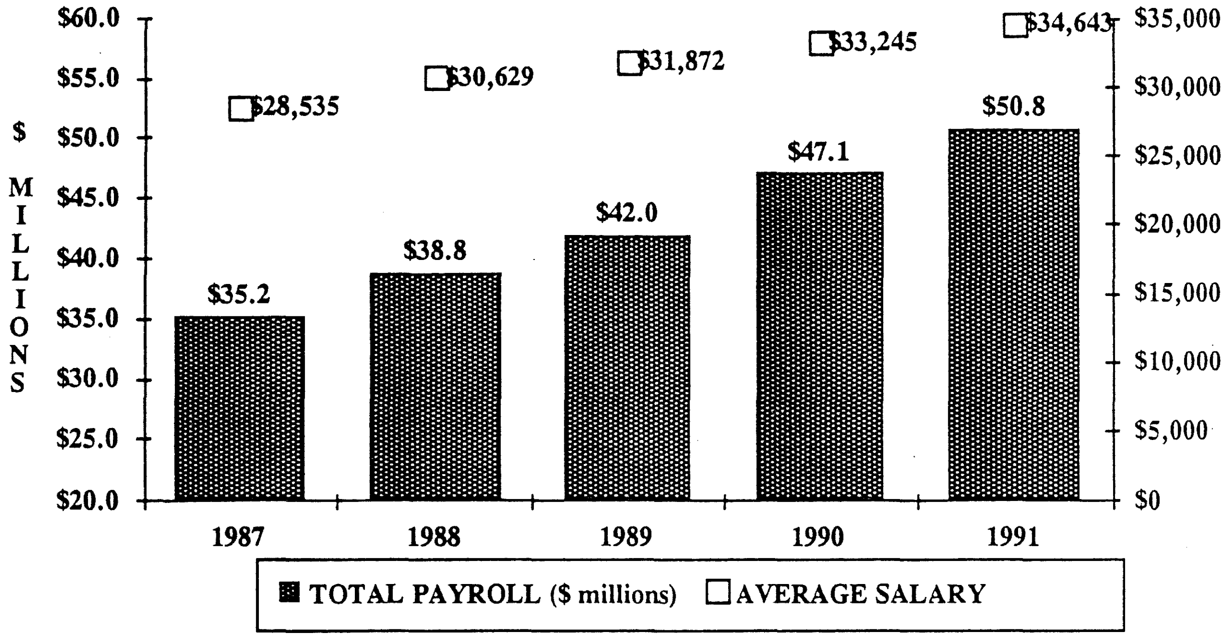
($ IN MILLIONS)

SENSITIVITY TO ASSUMPTIONS

		Value After Change		
	Current	7.5% Interest	6% Salary Increase	Level $ Amortization
A. Required Contribution				
(Amount)	$ 135.8	$ 156.4	$ 129.7	$ 165.5
(Percent)	8.42%	9.70%	8.05%	10.26%
(Sufficiency)	0.02%	(1.26%)	0.39%	(1.82%)
B. Value of Accrued Benefits	$ 2,548.9	$ 2,731.3	$ 2,500.6	$ 2,548.9
C. Depth of Funding	90.4%	84.4%	92.1%	90.4%

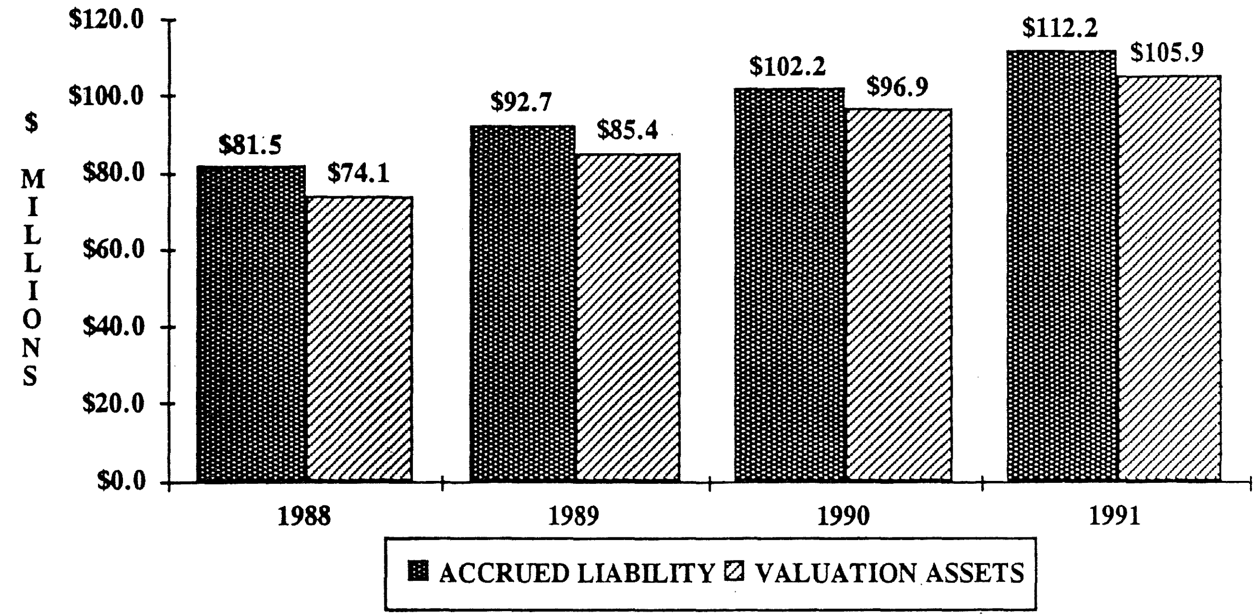
Deloitte & Touche

CORRECTIONAL ACTIVE MEMBERS
TOTAL PAYROLL AND AVERAGE SALARY



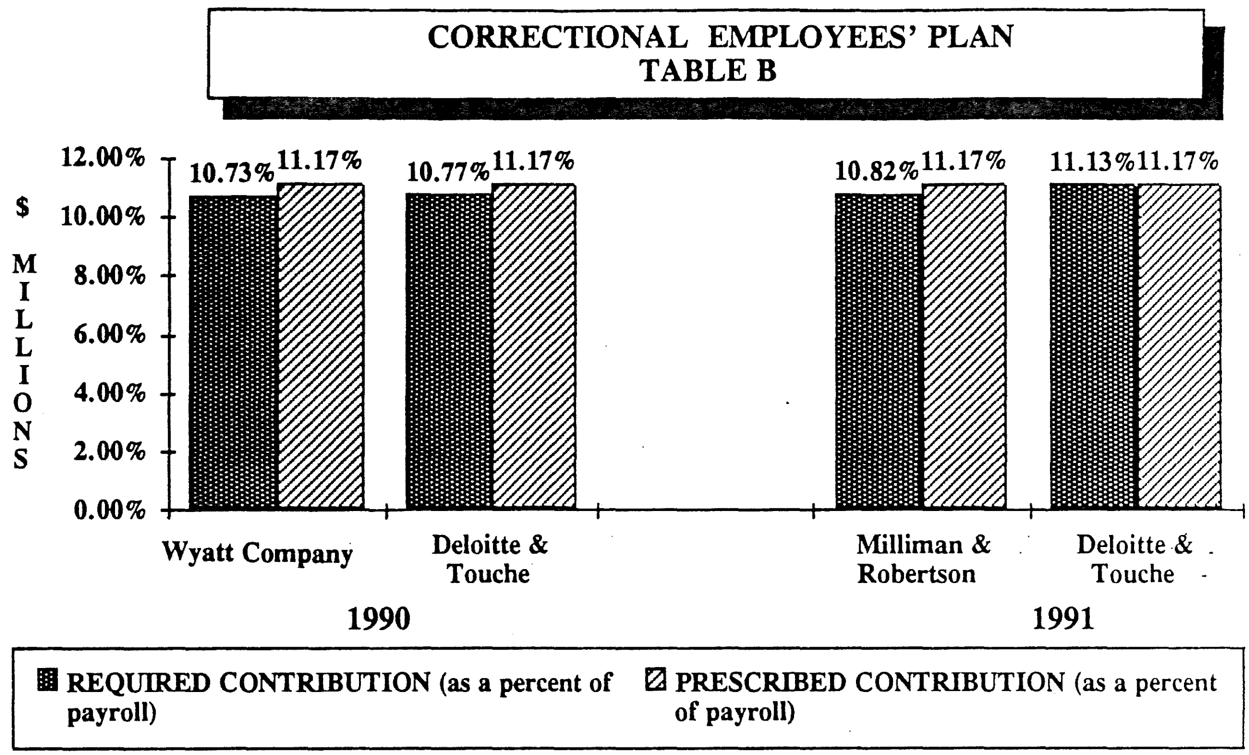
Members	1,232	1,267	1,317	1,416	1,467

CORRECTIONAL EMPLOYEES' PLAN
TABLE A

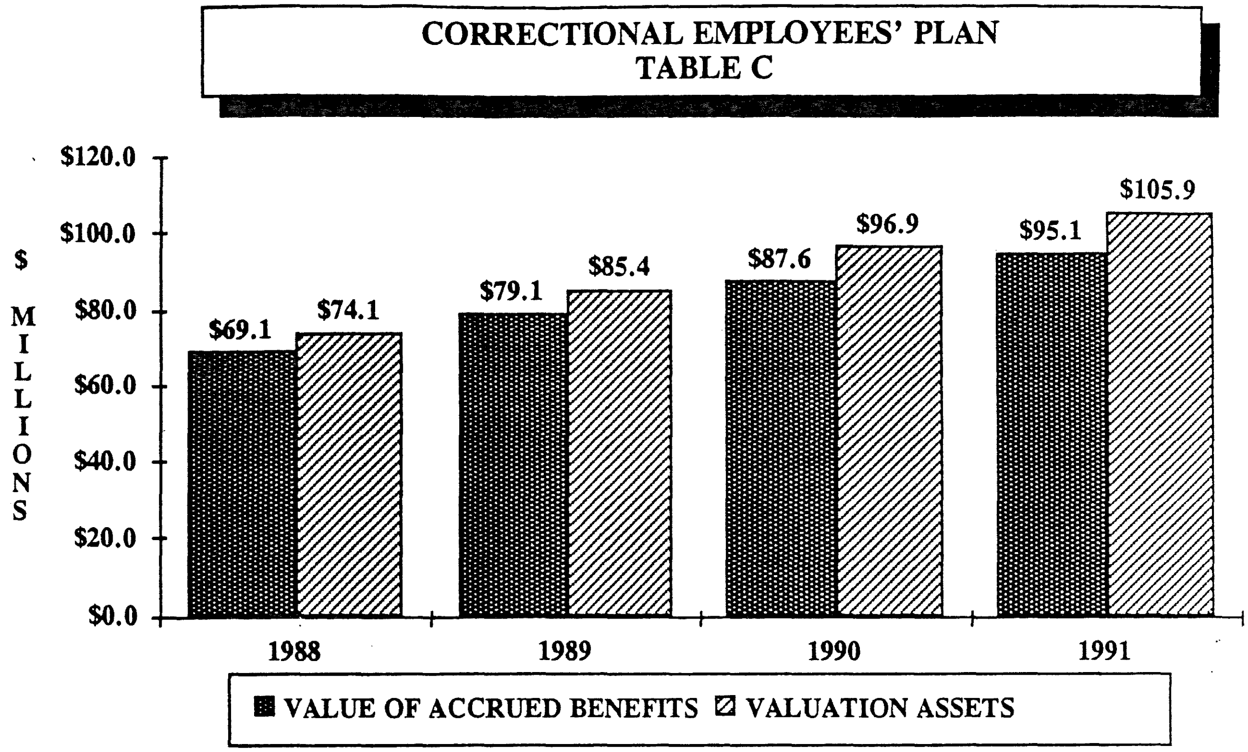


	1988	1989	1990	1991
Accrued Liability	$81.5	$92.6	$102.2	$112.2
Valuation Assets	74.1	85.4	96.9	105.9
Unfunded Accrued Liability	7.4	7.2	5.3	6.3
Funded Ratio	90.9%	92.2%	94.8%	94.4%

Deloitte & Touche



	1990		1991	
	Wyatt Company	Deloitte & Touche	Milliman & Robertson	Deloitte & Touche
Required Contribution	$ 5.1 (10.73%)	$ 5.1 (10.77%)	$5.5 (10.82%)	$5.7 (11.13%)
Prescribed Contribution	$ 5.3 (11.17%)	$ 5.3 (11.17%)	$ 5.7 (11.17%)	$ 5.7 (11.17%)
Sufficiency/(Deficiency)	0.44%	0.40%	0.35%	0.04%



	1988	1989	1990	1991
Value of Accrued Benefits	$69.1	$79.1	$87.6	$95.1
Valuation Assets	74.1	85.4	96.9	105.9
Depth of Funding	107.1%	108.0%	110.7%	111.4%
Depth of Funding, Excluding MPRI Members	111.3%	112.4%	116.7%	117.7%

CORRECTIONAL EMPLOYEES' PLAN

TABLE D

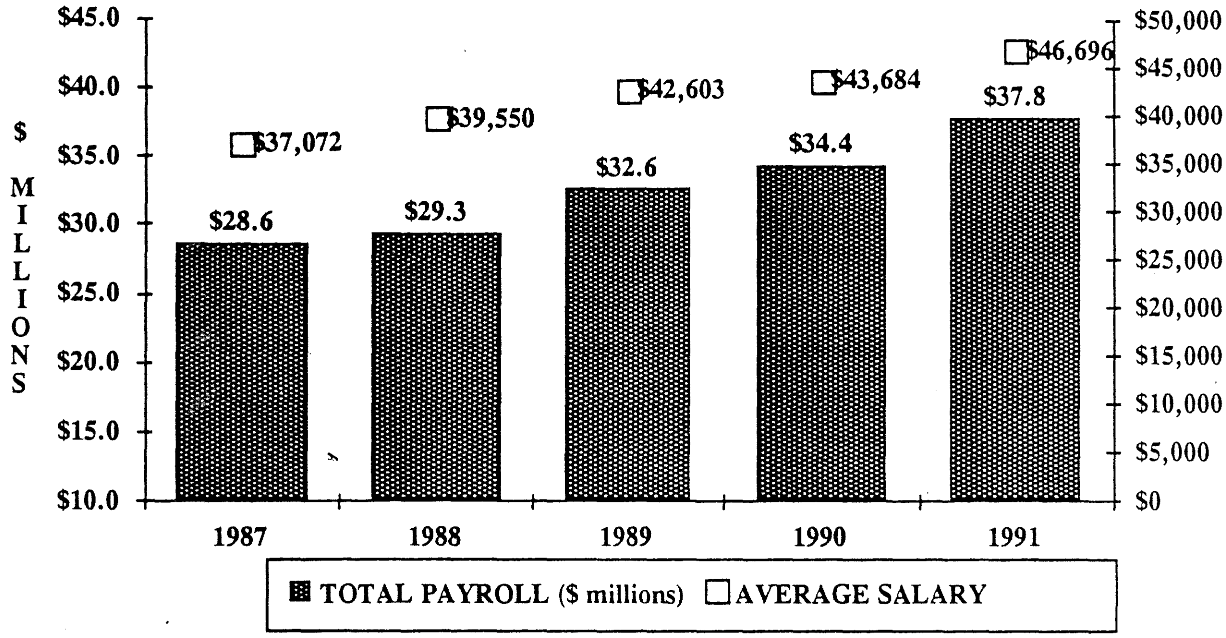
($ IN MILLIONS)

SENSITIVITY TO ASSUMPTIONS

		Value After Change		
	Current	7.5% Interest	6% Salary Increase	Level $ Amortization
A. Required Contribution				
(Amount)	$ 5.7	$ 6.7	$ 5.3	$ 5.9
(Percent)	11.13%	13.25%	10.46%	11.68%
(Sufficiency)	0.04%	(2.08%)	0.71%	(0.51%)
B. Value of Accrued Benefits	$ 95.7	$ 103.1	$ 93.8	$ 95.7
C. Depth of Funding	110.7%	102.8%	112.9%	110.7%

Deloitte & Touche

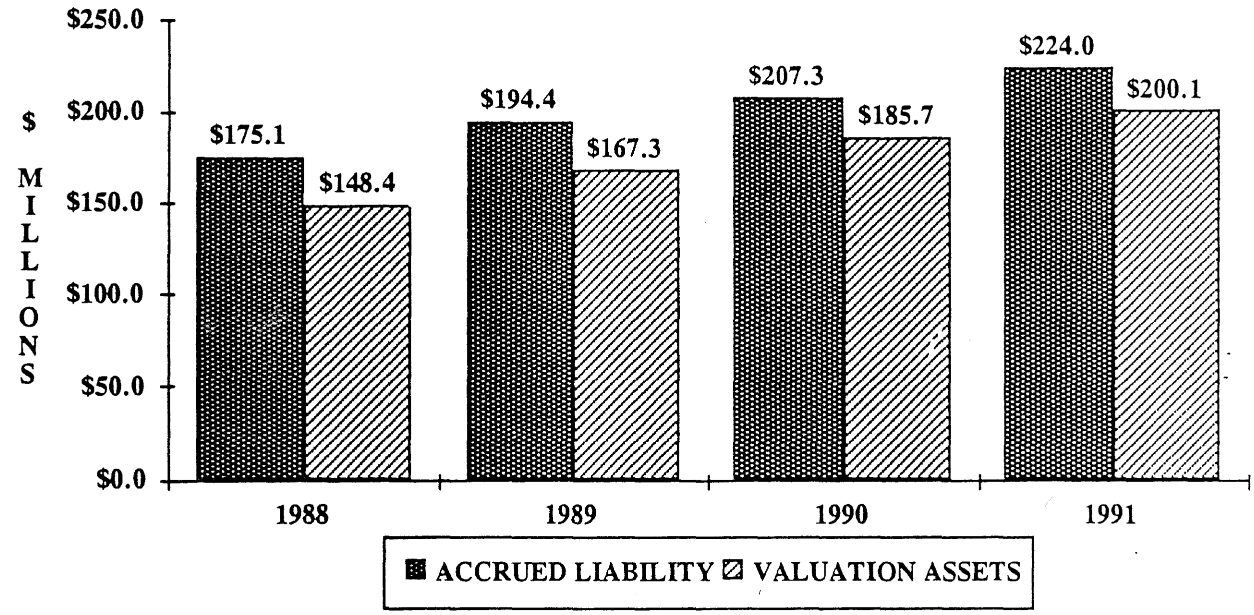
STATE PATROL ACTIVE MEMBERS
TOTAL PAYROLL AND AVERAGE SALARY



Members	771	740	765	788	809

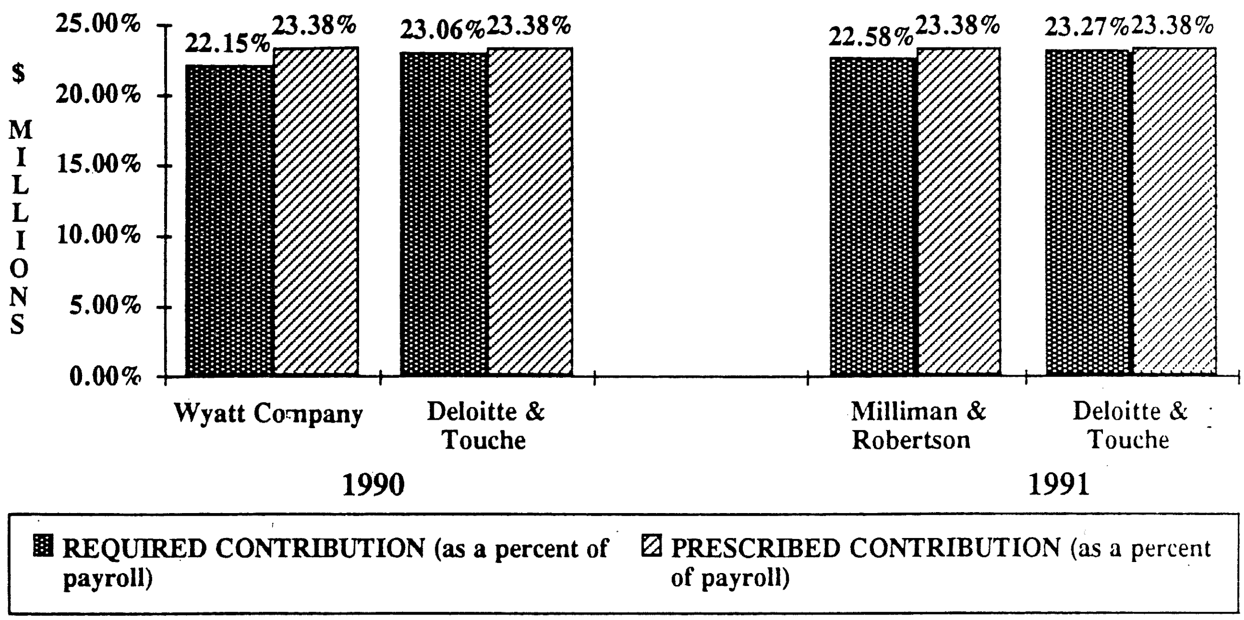
Deloitte & Touche

STATE PATROL PLAN
TABLE A



	1988	1989	1990	1991
Accrued Liability	$175.1	$194.4	$207.3	$224.0
Valuation Assets	148.4	167.3	185.7	200.1
Unfunded Accrued Liability	26.7	27.1	21.6	24.0
Funded Ratio	84.7%	86.0%	89.6%	89.3%

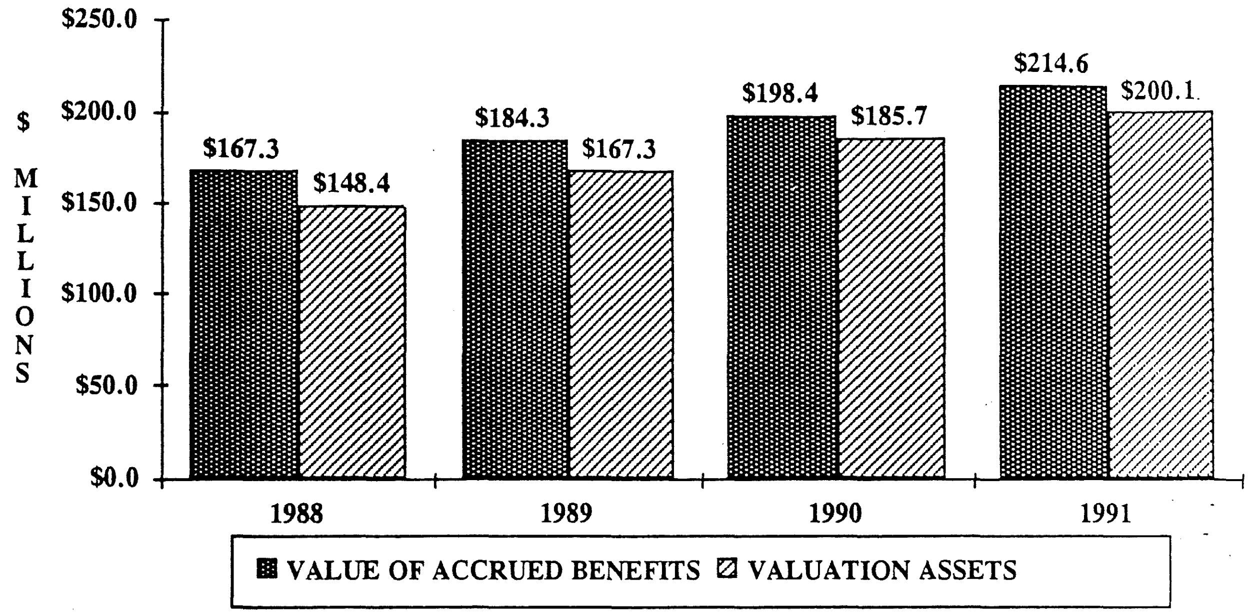
STATE PATROL PLAN
TABLE B



	1990		1991	
	Wyatt Company	Deloitte & Touche	Milliman & Robertson	Deloitte & Touche
Required Contribution	$ 7.6 (22.15%)	$ 7.9 (23.06%)	$ 8.5 (22.58%)	$8.8 (23.27%)
Prescribed Contribution	$ 8.0 (23.38%)	$ 8.0 (23.38%)	$ 8.8 (23.38%)	$ 8.8 (23.38%)
Sufficiency/(Deficiency)	1.23%	0.32%	0.80%	0.11%

Deloitte & Touche

STATE PATROL PLAN
TABLE C



	1988	1989	1990	1991
Value of Accrued Benefits	$167.3	$184.3	$198.4	$214.6
Valuation Assets	148.4	167.3	185.7	200.1
Depth of Funding	88.7%	90.8%	93.6%	93.2%
Depth of Funding, Excluding MPRI Members	79.9%	83.8%	88.8%	87.9%

STATE PATROL PLAN

TABLE D

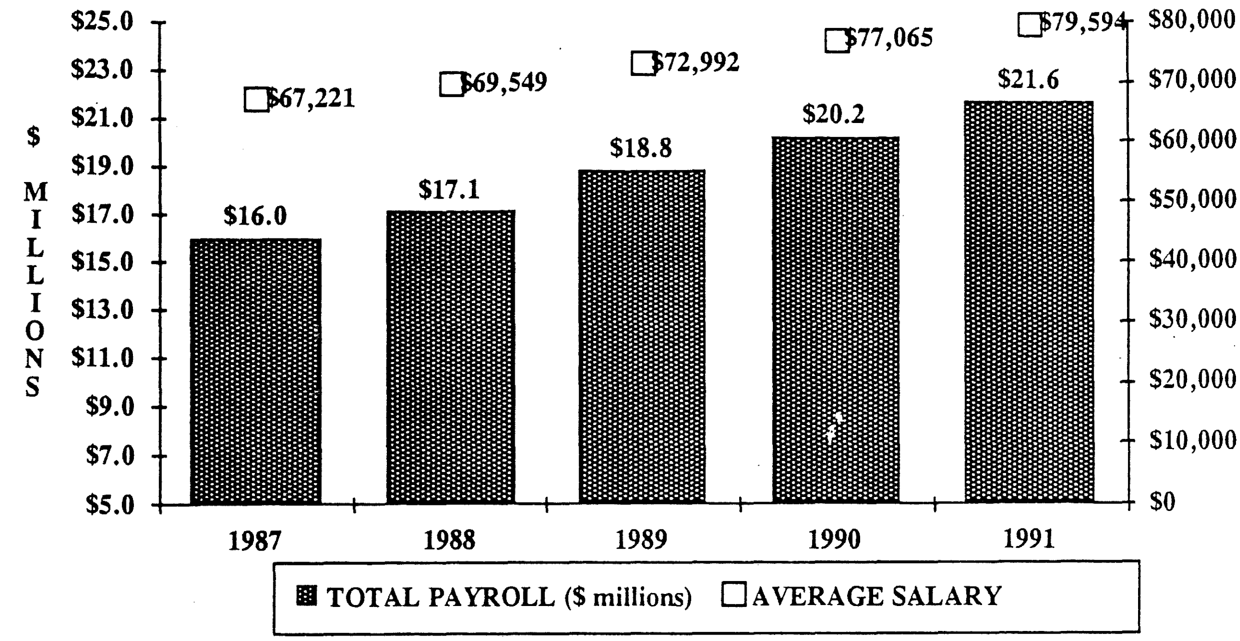
($ IN MILLIONS)

SENSITIVITY TO ASSUMPTIONS

		Value After Change		
	Current	7.5% Interest	6% Salary Increase	Level $ Amortization
A. Required Contribution				
(Amount)	$ 8.8	$ 10.1	$ 8.3	$ 9.9
(Percent)	23.27%	26.81%	22.08%	26.24%
(Sufficiency)	0.11%	(3.43%)	1.30%	(2.86%)
B. Value of Accrued Benefits	$ 216.2	$ 228.2	$ 212.6	$ 216.2
C. Depth of Funding	92.5%	87.7%	94.1%	92.5%

Deloitte & Touche

JUDGES ACTIVE MEMBERS
TOTAL PAYROLL AND AVERAGE SALARY



Members	238	246	257	262	271

Deloitte & Touche

JUDGES' PLAN

COMPARISON OF VALUATION RESULTS

($ IN MILLIONS)

	1990		1991	
	Wyatt Company	Deloitte & Touche	Milliman & Robertson	Deloitte & Touche
A. Accrued Liability	$ 69.4	$ 69.3	$ 78.4	$ 74.2
B. Valuation Assets	$ 28.1	$ 28.1	$ 33.6	$ 33.6
C. Unfunded Accrued Liability	$ 41.3	$ 41.2	$ 44.9	$ 40.7
D. Funded Ratio	40.5%	40.6%	42.8%	45.2%
E. Required Contribution	$ 4.9 (23.59%)	$ 4.9 (24.10%)	$ 5.4 (25.10%)	$ 5.1 (23.46%)
F. Prescribed Contribution	$ .9 (4.31%)	$ .9 (4.31%)	$ 5.7 (26.34%)	$ 5.7 (26.34%)
G. Contribution Sufficiency (Deficiency)	(22.56%)	(19.79%)	1.24%	2.88%

Deloitte & Touche

CONTRIBUTION SUFFICIENCY

	Milliman & Robertson	Deloitte & Touche
General	0.58%	0.02%
Correctional	0.35%	0.04%
State Patrol	0.80%	0.11%
Judges	1.24%	2.88%