Minnesota Legislative Commission on Pensions and Retirement

Replication of the July 1, 2014 Actuarial Valuation of the Minnesota State Retirement System General State Employees Retirement Fund

Prepared by Deloitte Consulting LLP **June 2015**

Contents

Actuarial Valuation Opinion

This report presents the results of the actuarial valuation replication of the Minnesota State Retirement System ("MSRS") General State Employees Retirement Fund ("the Plan") as of July 1, 2014 in accordance with Minnesota Statutes, Section 356.214, Subdivision 4, as directed by the Minnesota Legislative Commission on Pensions and Retirement ("LCPR" or "the Commission").

This actuarial valuation replication has been prepared based upon participant data and financial information provided by MSRS and their retained actuary as of July 1, 2014. We have analyzed the data and other information provided for reasonableness, but we have not independently audited the data. We have no reason to believe the data or other information provided is not complete and accurate, and know of no further information that is essential to the preparation of the actuarial valuation.

All costs, liabilities, rates of interest, and other factors underlying these actuarial computations have been determined on the basis of the same actuarial assumptions and methods used by the retained actuary, It is our opinion that these assumptions and methods are reasonable (or consistent with authoritative guidance) for the purposes described herein.

Future actuarial measurements may differ significantly from current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operations of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law.

Our scope for this replication report did not include analyzing the potential range of such future measurements, and we did not perform that analysis.

This report is prepared solely for the benefit and internal use of the LCPR and the State of Minnesota. This report is not intended for the benefit of any other party and may not be relied upon by any third party for any purpose, and Deloitte Consulting accepts no responsibility or liability with respect to any party other than the LCPR and the State of Minnesota in accordance with its statutory and regulatory requirements.

The undersigned with actuarial credentials collectively meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Any tax advice included in this written communication was not intended or written to be used, and it cannot be used by the taxpayer, for the purpose of avoiding any penalties that may be imposed by any governmental taxing authority or agency.

To the best of our knowledge, no employee of the Deloitte U.S. Firms is an officer or director of the systems. In addition, we are not aware of any relationship between the Deloitte U.S. Firms and the systems that may impair or appear to impair the objectivity of the work detailed in this report.

DELOITTE CONSULTING LLP

Judy K. Stromback

Judy Stromback, FSA, FCA, EA, MAAA
Director

Michael de Leon, FCA, ASA, EA, MAAA
Specialist Leader

Executive Summary

Replication Overview

Process and Scope

This actuarial replication report has been prepared per Minnesota Statute Section 356.214, Subdivision 4. The LCPR has engaged Deloitte Consulting, LLP to perform a replication of the July 1, 2014 actuarial valuation of the General State Employees Retirement Fund administered by MSRS.

The primary purpose of this report is to test the census and financial data, plan provisions, and actuarial assumptions and methods being used by the retained actuary in its July 1, 2014 valuation report by independently performing an actuarial valuation based on the same source data and the statutory plan provisions.

The replication valuation is initially performed without consideration of the retained actuary's report or sample lives. We program the valuation model based on our understanding of applicable assumptions and plan provisions. Once complete, we compare our liability and normal cost results to those of the retained actuary. We also request detailed sample life output to reconcile any differences in the results. If appropriate, we made modifications to our valuation model based on this analysis.

The result of our calculations and the retained actuary's are compared in this report. Because actuarial valuations are complex and rely upon the actuary's chosen actuarial valuation software, differences are expected. Differences greater than 2% of Present Value of Benefits or 5% of Actuarial Accrued Liability are specifically addressed; although some differences that do not meet this threshold are also discussed. We understand, as noted above, that the valuation process is sufficiently complex as to result in variations of this magnitude among actuaries valuing identical benefits and assumptions.

In addition to our independent determination of liabilities and costs, we reviewed the retained actuary's report for completeness and potential improvements. The process by which actuarial valuations are completed is highly technical and not every step can be documented in a valuation report. Where we believe additional documentation may be beneficial to the reader, we've suggested a more robust disclosure. In addition to process oriented commentary, we've considered industry best practices in communicating complex financial concepts to key stakeholders. Additional recommendations have been made based on our research with the goal of providing information that would be valuable to the reader within acknowledged time and resource constraints.

All of the steps above have been completed in accordance with the requirements of Minnesota Statutes and the Standards for Actuarial Work adopted by the LCPR. Our work is also governed by applicable actuarial standards of practice published by the Actuarial Standards Board.

Replication Overview

Summary of Key Findings

In general, we found the actuarial liability and contribution calculations completed by the retained actuary to be consistent with ours within a reasonable threshold. Minor differences are identified below, and have been confirmed with the retained actuary. We are satisfied with the aggregate July 1, 2014 actuarial valuation results as reported by the retained actuary. We believe that they represent a reasonable estimate of the present value of future benefits, accrued liability, and normal cost of the Plan.

The following key findings were identified during the process of our review:

- Census Data: MSRS directly provided us with the census data. We made modifications that we deemed necessary and appropriate. Later in the process, we received the retained actuary's modified database, which matched ours. Therefore, we identified no errors in the data collection and reconciliation process.

- Plan Provisions: The plan provisions as identified in state statute were programmed into our valuation software and compared to those valued by the retained actuary. All benefits appear consistent, with the following exception:

    - The death benefit provided to participants hired prior to July 1, 1989. Our understanding of Minnesota Statutes, Sections, 352.12, 352.115, and 352.116 is that a portion of these participants could receive a benefit based on the maximum of two separate benefit formulas. The retained actuary valued only the primary formula that applies to all participants. We believe this is a reasonable administrative simplification as valuing the maximum of the two benefit formulas for this small subset of the population would have a negligible impact on the liability.

    - Actuarial Assumptions and Methods: The actuarial assumptions and methods prescribed by state statute were programmed into our valuation software along with those assumptions chosen by the Fund and disclosed in the report. We did not identify any assumption that is inconsistent with state statute or documented assumptions, with one very minor exception:

    - In determining optional forms of benefit, we note that the retained actuary is using separate pre-decrement and post-decrement interest rates of 7.5% and 6.5% respectively; however, only the 6.5% rate is documented on page 34 of their valuation report.

- Actuarial Value of Assets: We calculated the Fund's Actuarial Value of Assets independent of the retained actuary, and our results matched.

- Liability Results: Our valuation results were reasonably close to the retained actuary's valuation results. We were 0.3% higher on the basis of Present Value of Future Benefits and 0.2% lower on the basis of the Actuarial Accrued Liability. As is typical, differences do exist in how those liabilities are split by decrement and status group.

- Normal Cost Results: Our valuation results produced a normal cost that is 7.2% lower than that of the retained actuary. The cause of this difference is primarily due to a difference in applying the attribution period. Specifically, the retained actuary uses a normal cost methodology that excludes attribution after decrement, which is assumed to occur at mid-year, whereas our methodology includes the full decrement year. We were able to confirm that for all decrements our differences in normal cost were less than 5%, when adjusting for this difference in methodology.

- Valuation Report: The actuarial valuation was reviewed in its entirety, and we have found the report to satisfy the requirements of ASOP No. 41 and Minnesota Statutes, Section 356.215. The following minor corrections are recommended:

    - In disclosure of the actuarial basis used to convert benefits between payment forms, we found that the pre-decrement discount rate of 7.5% was omitted. This should be corrected, as the actuary does assume optional forms are elected in all plans and therefore the liabilities are affected by this assumption.

  Along with the correction above, we recommend the system and actuary consider making the following additions to the report:

    - We recommend demonstrating the sensitivity of the discount rate assumption by providing the following key metrics using a discount rate 1% higher and 1% lower than the prescribed rate:
        - Actuarial Accrued Liability
        - Unfunded Actuarial Accrued Liability
        - Funded Ratio
        - Contribution Sufficiency/Deficiency

    - We recommend also showing the sensitivity of the threshold year for higher post-retirement benefit increases by showing the same metrics listed above if the threshold is reached immediately and if the threshold is never reached.

Summary of Results

	As of July 1, 2014		
	GRS Valuation	Deloitte Replication Valuation	Percent Difference
Contributions (% of Payroll)			
Statutory Contributions – Chapter 352	11.00%	11.00%	0.00%
Required Contributions – Chapter 356	12.82%	12.36%	-0.46%
Sufficiency / (Deficiency)	-1.82%	-1.36%	0.46%
Funding Ratios (Dollars in Thousands)			
Assets			
Current assets (AVA)	$10,326,272	$10,326,272	0.00%
Current assets (MVA)	$11,498,604	$11,498,604	0.00%
Accrued Liability Funding Ratio			
Actuarial accrued liability	$12,445,126	$12,416,479	-0.23%
Funding ratio (AVA)	82.97%	83.17%	0.20%
Funding ratio (MVA)	92.39%	92.61%	0.22%
Plan Participation			
Active Participants			
Number	49,663	49,663	0.00%
Projected annual earnings (Dollars in Thousands)	$2,653,367	$2,636,067	-0.65%
Average projected annual earnings	$53,427	$53,079	-0.65%
Average age	47.1	47.1	0.00%
Average service	12.0	12.0	0.00%
Service Retirements	29,225	29,225	0.00%
Survivors	3,686	3,686	0.00%
Disability Retirements	1,818	1,818	0.00%
Deferred Retirements	16,472	16,472	0.00%
Terminated Other Non-Vested	5,818	5,818	0.00%
Total	106,682	106,682	0.00%

Supporting Information

Inventory of Market Value of Assets as of June 30, 2014

The following table shows an inventory of assets for the current year.

Table 1 (Dollars in Thousands)

	Market Value as of June 30, 2014	
	GRS Valuation	Deloitte Replication Valuation
Cash, cash equivalents, short term securities	$ 292,465	$ 292,465
Debt securities	2,683,530	2,683,530
Equity securities	8,503,521	8,503,521
Other investments	1,260,671	1,260,671
Contributions receivable	16,188	16,188
Amounts Payable	(1,257,771)	(1,257,771)
Market Value of Assets	$ 11,498,604	$ 11,498,604

Reconciliation of Market Value of Assets as of June 30, 2014

The following table contains a summary of transactions during the year and develops an approximate actual rate of return on the Market Value of Assets.

Table 2 (Dollars in Thousands)

	GRS Valuation	Deloitte Replication Valuation
1. Market Value of Assets as of June 30, 2013	$10,033,499	$10,033,499
2. Adjustment to Market Value of Assets to match restated MSRS fund balance	($61)	($61)
3. Market Value of Assets as of July 1, 2013: (1) + (2)	$10,033,438	$10,033,438
Income		
4. Employer contributions made during the Plan Year 2014	$128,037	$128,037
5. Employee contributions	$131,033	$131,033
6. Investment income including interest, dividends, realized and unrealized appreciation (depreciation)		
a. Investment income / (loss)	$1,845,607	$1,845,607
b. Investment expenses	($15,986)	($15,986)
c. Net investment income / (loss)	$1,829,621	$1,829,621
7. Other	$21,014	$21,014
8. Total Income: (4) + (5) + (6c) + (7)	$2,109,705	$2,109,705
Disbursements		
9. Benefit payments		
a. Annuity benefits	($623,942)	($623,942)
b. Refunds	($11,986)	($11,986)
c. Total benefit payments	($635,928)	($635,928)
10. Expenses and fees		
a. Other	($486)	($486)
b. Administrative	($8,125)	($8,125)
c. Total expenses and fees	($8,611)	($8,611)
11. Total disbursements: (9c) + (10c)	($644,539)	($644,539)
12. Market Value of Assets as of June 30, 2014: (3) + (8) + (11)	$11,498,604	$11,498,604
13. State Board of Investment calculated investment return	18.60%	18.60%

Actuarial Value of Assets as of June 30, 2014

The following table shows the development of the Actuarial Value of Assets.

Table 3 (Dollars in Thousands)

Development of Actuarial Value of Assets				GRS Valuation	Deloitte Replication Valuation
1 Market Value of Assets as of June 30, 2014				$11,498,604	$11,498,604
2 Determination of average balance					
a. Total assets available at beginning of year				$10,033,438	$10,033,438
b. Total assets available at end of year				$11,498,604	$11,498,604
c. Net investment income for fiscal year				$1,829,621	$1,829,621
d. Average balance: [(2a) + (2b) - (2c)] / 2				$9,851,211	$9,851,211
3 Expected Return: 8.0% x (2d)				$788,097	$788,097
4 Net investment income for fiscal year				$1,829,621	$1,829,621
5 Current year asset Gain / (Loss): (4) – (3)				$1,041,524	$1,041,524
6 Asset Gain/(Loss) not recognized in Actuarial Value of Assets					
	Period Ending	Gain / (Loss)	Portion Not Recognized	Amount Not Recognized	Amount Not Recognized
	6/30/2014	$1,041,524	80%	$833,220	$833,220
	6/30/2013	$561,056	60%	$336,634	$336,634
	6/30/2012	($554,532)	40%	($221,813)	($221,813)
	6/30/2011	$1,121,457	20%	$224,291	$224,291
	6/30/2010	$465,050	0%	$0	$0
	Total	$2,634,555		$1,172,332	$1,172,332
7 Actuarial Value of Assets as of June 30, 2014: (1) – (6)				$10,326,272	$10,326,272
8 Approximate actual rate of return on the Actuarial Value of Assets				14.50%	14.30%
9 Ratio of actuarial value of assets to market value of assets				0.90	0.90

Determination of Unfunded Actuarial Accrued Liability and Supplemental Contribution Rate

Table 4 (Dollars in Thousands)

	Actuarial Present Value of Projected Benefits		Actuarial Present Value of Future Normal Costs		Actuarial Accrued Liability	
	GRS Valuation	Deloitte Replication Valuation	GRS Valuation	Deloitte Replication Valuation	GRS Valuation	Deloitte Replication Valuation
1. Determination of Actuarial Accrued Liability (AAL)						
a. Active Members						
i. Retirement annuities	$ 5,410,189	$ 5,426,285	$ 904,177	$ 950,964	$ 4,506,012	$ 4,475,321
ii. Disability benefits	216,663	224,472	71,642	74,385	145,021	150,087
iii. Survivor's benefits	96,602	97,555	24,069	24,742	72,533	72,813
iv. Deferred retirements	275,055	286,620	226,070	230,840	48,985	55,780
v. Refunds*	23,820	26,790	77,441	88,193	(53,621)	(61,403)
vi. Total	$ 6,022,329	$ 6,061,722	$ 1,303,399	$ 1,369,124	$ 4,718,930	$ 4,692,598
b. Deferred retirements with future augmentation	1,239,741	1,242,849	-	-	1,239,741	1,242,849
c. Former members without vested rights	5,804	5,871	-	-	5,804	5,871
d. Benefit recipients	6,471,998	6,469,209	-	-	6,471,998	6,469,209
e. Contingent actuarial accrued liability	8,653	5,953	-	-	8,653	5,953
f. Total	$ 13,748,525	$ 13,785,603	$ 1,303,399	$ 1,369,124	$ 12,445,126	$ 12,416,479
2. Determination of Unfunded Actuarial Accrued Liability (UAAL)**						
a. Actuarial accrued liability					$ 12,445,126	$ 12,416,479
b. Current assets (AVA)					10,326,272	10,326,272
c. Unfunded actuarial accrued liability					$ 2,118,854	$ 2,090,207
3. Determination of Supplemental Contribution Rate						
a. Present value of future payrolls through the amortization date of June 30, 2014					$ 41,268,188	$ 40,523,554
b. Supplemental contribution rate					5.13%	5.16%

*Includes non-vested refunds and non-married survivor benefits only.

**The amortization of the unfunded actuarial accrued liability (UAAL) using the current amortization method results in initial payments less than the "interest only" payment on the UAAL. Payments less than the interest only amount will result in the UAAL increasing for an initial period of time.

Determination of Contribution Sufficiency/ (Deficiency)

Table 5 (Dollars in Thousands)

	Percent of Payroll		Dollar Amount	
	GRS Valuation	Deloitte Replication Valuation	GRS Valuation	Deloitte Replication Valuation
1. Statutory contributions – Chapter 352				
a. Employee contributions	5.50%	5.50%	$ 145,935	$ 144,984
b. Employer contributions	5.50%	5.50%	145,935	144,984
c. Total	11.00%	11.00%	$ 291,870	$ 289,967
2. Required contributions – Chapter 356				
a. Normal Cost				
i. Retirement benefits	5.29%	4.93%	$ 140,363	$ 130,034
ii. Disability benefits	0.38%	0.35%	10,083	9,253
iii. Survivors	0.14%	0.13%	3,715	3,336
iv. Deferred retirement benefits	1.14%	1.04%	30,248	27,490
v. Refunds	0.42%	0.43%	11,144	11,319
vi. Total	7.37%	6.88%	$ 195,553	$ 181,432
b. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2014	5.13%	5.16%	$ 136,118	$ 135,968
c. Allowance for expenses	0.32%	0.32%	8,491	8,491
d. Total	12.82%	12.36%	$ 340,162	$ 325,891
3. Contribution Sufficiency/(Deficiency): (1c) – (2d)	(1.82%)	(1.36%)	$ (48,292)	$ (35,924)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $2,653,367

*Includes non-vested refunds and non-married survivor benefits only.

Special Groups – Military Affairs Calculation

Section 352.85 of Chapter 352 of Minnesota Statutes provides that certain military affairs personnel may retire, with an unreduced benefit, at age 60. In addition, they may receive disability benefits upon being found disqualified for retention in active military duty. To fund these special benefits, employees and employers contribute an extra 1.60% of payroll.

Because of the limited number of participants in this group, the liability was not matched. A summary of the participants impacted is below.

Table 6

	Active Members	
	GRS Valuation	Deloitte Replication Valuation
1. Number of Active Members	4	4
2. Average Age (Years)	41.9	41.9
3. Average Service (Years)	9.3	9.3

Special Groups – Pilots Calculation

Section 352.86 of Chapter 352 of Minnesota Statutes provides that certain transportation department pilots may retire, with an unreduced benefit, at age 62. In addition, they may receive disability benefits upon being found disqualified for retention as pilots. To fund these special benefits, employees and employers contribute an extra 1.60% of payroll.

This group is closed to new entrants effective June 1, 2008. Because of the limited number of participants in this group, the liability was not matched. A summary of the participants impacted is below.

Table 7

		Active Members	
		GRS Valuation	Deloitte Replication Valuation
1.	Number of Active Members	2	2
2.	Average Age (Years)	68.0	68.0
3.	Average Service (Years)	21.7	21.7

Special Groups – Fire Marshals Calculation

Section 352.87 of Chapter 352 of Minnesota Statutes provides that deputy state fire marshals may retire, with an unreduced benefit (with respect to service after July 1, 1999), at age 55. Credited Service after July 1, 1999 accrues retirement benefits at a rate of 2.00% per year, and disability benefits are based on a minimum of 15 years of service (20 years if duty related). To fund these special benefits, members contribute an extra 2.78% of payroll and employers contribute an extra 4.20% of payroll.

Because of the limited number of participants in this group, the liability was not matched. A summary of the participants impacted is below.

Table 8

		Active Members	
		GRS Valuation	Deloitte Replication Valuation
1.	Number of Active Members	11	11
2.	Average Age (Years)	53.5	53.5
3.	Average Service (Years)	13.6	13.6

Special Groups – Unclassified Plan Contingent Liability Calculation

Section 352D.02 of Chapter 352D of Minnesota Statutes provides that members credited with employee shares in the Unclassified Plan may elect to terminate participation in the Unclassified Plan and be covered by the State Employees Retirement Fund (General Plan) prior to termination of covered employment assuming that the member has acquired at least 10 years of allowable state service if hired prior to July 1, 2010 and has no more than 7 years of service if hired after June 30, 2010. Unclassified Plan members contribute 5.5% of payroll and employers contribute 6% of payroll. Certain members (Judges and Legislators) are not eligible to elect coverage under the State Employees Retirement Fund.

To recognize the effect of the option to elect coverage under the General Plan, all eligible Unclassified Plan members are assumed to elect coverage under the General Plan if such election provides the member with a greater economic present value than the accumulated contribution balance under the Unclassified Plan. The liabilities were measured using the actuarial assumptions that are applied to the State Employees Retirement Fund.

Table 9

		Active Members	
		GRS Valuation	Deloitte Replication Valuation
1.	Number of Active Members	1,172	1,172
2.	Average Age (Years)	45.8	45.8
3.	Average Service (Years)	10.3	10.3

Table 10 (Dollars in Thousands)

		Year ending June 30, 2014	
		GRS Valuation	Deloitte Replication Valuation
1.	Number of active eligible members	1,172	1,172
2.	Account balances for active members	$166,726	$166,726
3.	Accrued liability for active members	$175,379	$172,679
4.	Contingent liability: (3) – (2)	$8,653	$5,953

Basis for the Valuation

Membership Data – Active Members

The following table displays the distribution of active participants valued by Deloitte by age and service* and includes average compensation (in dollars) as of June 30, 2014.

Table 11

Years of Service	< 3*		3-4		5-9		10-14		15-19		20-24		25-29		30-34		35+		Total	
Age Group	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.	No.	Avg. Comp.
0 – 24	1,065	27,885	22	34,815	3	19,265	0	-	0	-	0	-	0	-	0	-	0	-	1,090	28,001
25 – 29	2,811	35,372	577	40,073	443	42,031	4	45,054	0	-	0	-	0	-	0	-	0	-	3,835	36,858
30 – 34	2,345	39,574	739	42,865	1,729	46,458	271	48,637	9	52,341	0	-	0	-	0	-	0	-	5,093	42,893
35 – 39	1,592	41,119	481	47,198	1,611	50,022	917	55,362	235	56,752	3	57,583	0	-	0	-	0	-	4,839	48,156
40 – 44	1,258	41,835	444	48,370	1,352	52,985	965	56,303	672	62,727	109	59,616	4	46,465	0	-	0	-	4,804	51,813
45 – 49	1,199	43,992	435	47,760	1,279	52,692	1,032	56,942	992	62,712	628	65,658	241	62,266	14	58,504	0	-	5,820	54,802
50 – 54	1,196	42,187	434	48,504	1,377	52,343	1,110	56,658	1,028	60,507	940	63,427	1,028	64,740	558	60,626	29	60,476	7,700	55,900
55 – 59	940	42,740	387	47,812	1,203	51,917	1,086	55,631	981	60,735	962	62,584	1,169	64,354	1,056	61,953	589	59,560	8,373	56,977
60 – 64	528	40,252	249	46,396	775	51,189	819	57,135	730	58,753	674	61,700	772	62,019	623	62,908	911	63,766	6,081	57,377
65 – 69	126	30,252	73	37,352	245	49,923	212	56,434	227	60,102	202	59,152	188	65,919	101	66,026	298	65,166	1,672	56,702
70+	65	13,907	27	18,661	46	33,191	72	50,822	33	59,543	39	57,343	19	58,323	14	54,505	41	62,536	356	42,782
Total	13,125	38,809	3,868	45,206	10,063	50,341	6,488	55,941	4,907	60,822	3,557	62,834	3,421	63,827	2,366	62,001	1,868	62,585	49,663	51,500

*Annualized in first year of service.

Membership Data – Service Retirees

The following table displays the distribution of service retirees valued by Deloitte by age and years since retirement and includes average benefits (in dollars) as of June 30, 2014.

Table 12

Years Retired	< 1		1-4		5-9		10-14		15-19		20-24		25+		Total	
Age Group	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.
< 50	3	6,436	17	4,080	1	5,177	0	-	0	-	0	-	0	-	21	4,469
50 – 54	9	10,894	18	8,083	0	-	0	-	0	-	0	-	0	-	27	9,020
55 – 59	374	16,746	710	15,266	30	11,839	0	-	0	-	0	-	0	-	1,114	15,671
60 – 64	868	19,224	2,433	20,375	1,133	16,009	16	12,708	0	-	0	-	0	-	4,450	19,011
65 – 69	685	17,934	3,835	19,276	2,684	19,613	1,072	16,203	17	16,907	0	-	0	-	8,293	18,872
70 – 74	94	17,462	938	17,822	2,335	17,875	2,004	19,009	633	16,525	1	32,079	0	-	6,005	18,099
75 – 79	14	12,872	150	15,525	443	15,394	1,727	16,956	1,229	18,532	398	23,956	4	25,209	3,965	17,913
80 – 84	5	16,876	27	14,879	78	11,656	262	15,205	1,160	17,755	965	25,137	97	23,639	2,594	20,249
85 – 89	1	910	9	13,495	20	7,852	54	12,256	198	16,843	949	21,120	495	23,237	1,726	20,754
90+	0	-	0	-	2	24,544	12	12,120	21	10,168	174	19,830	821	18,626	1,030	18,592
Total	2,053	18,149	8,137	18,940	6,726	17,962	5,147	17,436	3,258	17,701	2,487	23,047	1,417	20,598	29,225	18,686

Membership Data – Survivors

The following table displays the distribution of survivors valued by Deloitte by age and years since member death and includes average benefits (in dollars) as of June 30, 2014.

Table 13

Years Since Death	< 1		1-4		5-9		10-14		15-19		20-24		25+		Total	
Age Group	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.
< 45	9	7,188	48	8,899	28	10,870	6	7,014	0	-	1	19,879	1	11,750	93	9,354
45 – 49	4	9,222	19	8,489	6	7,140	5	4,559	3	6,736	0	-	0	-	37	7,676
50 – 54	9	11,364	31	8,195	24	12,361	10	7,001	7	8,421	3	3,530	0	-	84	9,435
55 – 59	13	16,556	58	13,254	47	15,023	33	12,085	15	5,509	0	-	2	7,235	168	13,012
60 – 64	33	16,553	123	16,997	106	14,435	62	10,326	30	10,578	6	8,394	3	5,760	363	14,303
65 – 69	38	13,919	131	16,993	154	16,071	88	14,244	38	15,486	6	13,948	4	12,150	459	15,695
70 – 74	31	20,510	144	16,620	146	13,598	84	13,398	52	16,194	32	14,637	6	13,808	495	15,219
75 – 79	39	18,262	141	18,908	142	18,105	112	17,395	63	18,837	42	16,004	7	12,332	546	18,027
80 – 84	38	22,512	145	20,173	119	18,442	108	22,204	68	20,042	50	21,198	32	13,840	560	20,069
85 – 89	28	18,923	109	20,040	118	22,720	97	19,893	73	22,904	69	21,103	30	13,979	524	20,749
90+	14	21,437	44	19,318	93	16,417	72	19,557	66	21,849	47	15,210	21	15,972	357	18,424
Total	256	17,686	993	17,066	983	16,596	677	16,598	415	18,249	256	17,719	106	13,764	3,686	16,981

Membership Data – Disability Retirements

The following table displays the distribution of service disability retirements valued by Deloitte by age and years disabled and includes average benefits as of June 30, 2014.

Table 14

Years Disabled	< 1		1-4		5-9		10-14		15-19		20-24		25+		Total	
Age Group	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.	No.	Avg. Ben.
< 45	1	6,505	7	6,811	8	3,782	3	2,579	0	-	0	-	0	-	19	4,852
45 – 49	7	8,128	18	7,992	9	7,937	5	7,621	2	8,744	0	-	0	-	41	7,995
50 – 54	17	10,626	47	12,589	44	9,344	22	8,335	7	6,923	2	4,574	2	3,105	141	10,146
55 – 59	28	15,590	99	16,010	91	13,144	58	9,661	29	10,017	5	10,530	1	7,223	311	13,274
60 – 64	23	13,249	138	16,928	160	16,165	99	12,547	39	13,514	12	8,034	1	4,451	472	15,037
65 – 69	4	25,496	54	11,734	147	16,095	131	15,860	42	13,235	29	14,651	5	9,908	412	15,072
70 – 74	0	-	1	7,978	26	8,907	100	13,835	63	16,727	19	14,721	6	13,906	215	14,139
75+	0	-	0	-	0	-	28	13,489	69	16,808	67	14,279	43	13,660	207	14,887
Total	80	13,591	364	14,687	485	14,212	446	13,163	251	14,553	134	13,578	58	12,728	1,818	13,975

Membership Data – Terminated Members

The following table displays statistics for terminated members as of June 30, 2014.

Table 15

		Deferred Vested		Other Non-Vested		Total	
		GRS Valuation	Deloitte Replication Valuation	GRS Valuation	Deloitte Replication Valuation	GRS Valuation	Deloitte Replication Valuation
1.	Number	16,472	16,472	5,818	5,818	22,290	22,290
2.	Average age	50.4	50.4	37.1	37.1	46.9	46.9
3.	Average service	7.9	7.9	1.0	1.0	6.1	6.1
4.	Average annual benefit, with augmentation to Normal Retirement Date and 40% CSA load	$15,112	$ 14,668	N/A	N/A	$15,112	$14,668
5.	Average refund value, with 40% CSA load	$36,066	$36,068	$2,752	$2,752	$27,371	$27,372

Statement of Actuarial Methods

The actuarial methods below were documented by the retained actuary, and we agree with their application without any changes. They are documented here for illustrative purposes only, and reflect exactly what was provided in the retained actuary's report.

Actuarial Cost Method

Actuarial accrued liability and required contributions in this report are computed using the Entry Age Normal Cost method. This method is prescribed by Minnesota Statute. Under this method, a normal cost is developed by amortizing the actuarial value of benefits expected to be received by each active participant (as a level percentage of pay) over the total working lifetime of that participant, from hire to termination. Age as of the valuation date was calculated based on the dates of birth provided by the Fund. Entry age for valuation purposes was calculated as the age on the valuation date minus the provided years of service on the valuation date.

To the extent that current assets and future normal costs do not support participants' expected future benefits, an Unfunded Actuarial Accrued Liability ("UAAL") develops. The UAAL is amortized over the statutory amortization period using level percent of payroll assuming payroll increases. The total contribution developed under this method is the sum of the normal cost, expenses, and the payment toward the UAAL.

Select and Ultimate Discount Rate Methodology

The select and ultimate discount rate methodology is applied to the entry age normal results as follows:

- The present value of projected benefits is calculated using the prescribed select and ultimate discount rates.
- An equivalent single interest rate that produces approximately the same present value of projected benefits is determined.
- The equivalent single interest rate is used to determine the entry age normal accrued liability and normal cost.

The equivalent single interest rate used in this valuation is 8.40% (8.37% last year).

Valuation of Future Post-Retirement Benefit Increases

If the plan has reached the funding ratio threshold required to pay a 2.5% benefit increase, Minnesota Statutes require the 2.5% benefit increase rate to be reflected in the liability calculations. If the plan has not yet reached the funding ratio threshold required to pay a 2.5% benefit increase, Minnesota Statutes require a projection to be performed to determine the expected attainment of the funding ratio threshold, and the expected reversion to a 2.5% benefit increase rate must be reflected in the liability calculations.

Funding Objective

The fundamental financing objective of the fund is to establish contribution rates which, when expressed as a percentage of active member payroll, will remain approximately level from generation to generation and meet the required deadline for full funding.

Statement of Actuarial Methods

Decrement Timing

All decrements are assumed to occur mid-fiscal year.

Asset Valuation Method

The assets are valued based on a five-year moving average of expected and market values (five-year average actuarial value) determined as follows:

- At the end of each plan year, an average asset value is calculated as the average of the market asset value at the beginning and end of the fiscal year net of investment income for the fiscal year;
- The investment gain or (loss) is taken as the excess of actual investment income over the expected investment income based on the average asset value as calculated above;
- The investment gain or (loss) so determined is recognized over five years at 20% per year; and
- The asset value is the sum of the market asset value plus the scheduled recognition of investment gains or (losses) during the current and the preceding four fiscal years.

Payment on the Unfunded Actuarial Accrued Liability

Payment equals a level percentage of payroll each year to the statutory amortization date of June 30, 2041 assuming payroll increases of 3.75% per annum. If there is a negative Unfunded Actuarial Accrued Liability, the surplus amount is amortized over 30 years as a level percentage of payroll. If the unfunded liability increases due to changes in benefits, assumptions, or methods, the statutory amortization date will be re-determined. Projected payroll is multiplied by 0.959 in the determination of the present value of future payroll to account for timing differences (as required by the Standards for Actuarial Work).

Changes in Methods since Prior Valuation

The methodology for valuing future post-retirement increases was clarified in Minnesota Statutes.

Plan Provisions Summary

The plan provisions below were documented by the retained actuary, and we agree with their application without any changes, with a single exception noted in bold below (see #13). They are documented here for illustrative purposes only, and reflect exactly what was provided in the retained actuary's report.

<table>
<tr><td>1. Plan year</td><td>July 1 through June 30.</td></tr>
<tr><td>2. Eligibility</td><td>State employees, non-academic staff of the University of Minnesota and employees of certain Metro level government units, unless excluded by law.</td></tr>
<tr><td>3. Contributions</td><td>Shown as a percent of salary:
<table><tr><td>Effective Date</td><td>Member</td><td>Employer</td></tr><tr><td>July 1 2010 to June 30, 2014</td><td>5.00%</td><td>5.00%</td></tr><tr><td>July 1, 2014*</td><td>5.50%</td><td>5.50%</td></tr></table>Member contributions are “picked up” according to the provisions of Internal Revenue Code 414(h).
*Increase is effective the first day of the first full pay period beginning after July 1, 2014.</td></tr>
<tr><td>4. Allowable Service</td><td>Service during which member contributions were made. May also include certain leaves of absence, military service and periods while temporary Worker's Compensation is paid. Excludes lump sum vacation and severance pay at termination.</td></tr>
<tr><td>5. Average Salary</td><td>Average of the five highest successive years of Salary. Average Salary is based on all Allowable Service if less than five years.</td></tr>
<tr><td>6. Salary</td><td>Includes wages, allowances and fees. Excludes lump sum payments at separation, employer contributions to deferred compensation and tax-sheltered annuity plans and benevolent vacation and sick leave donation programs.</td></tr>
<tr><td>7. Retirement</td><td></td></tr>
<tr><td>a. Normal Retirement</td><td></td></tr>
<tr><td>i. Age/Service requirement</td><td><u>First hired before July 1, 1989:</u>
a. Age 65 and three years of Allowable Service.
b. Proportionate Retirement Annuity is available at age 65 and one year of Allowable Service.
<u>First hired after June 30, 1989:</u>
a. The greater of age 65 or the age eligible for full Social Security retirement benefits (but not higher than age 66) and three years of Allowable Service (five years if hired after June 30, 2010).
b. Proportionate Retirement Annuity is available at normal retirement age and one year of Allowable Service.</td></tr>
<tr><td>ii. Amount</td><td>1.70% of Average Salary for each year of Allowable Service.</td></tr>
<tr><td>b. Early Retirement</td><td></td></tr>
</table>

Plan Provisions Summary

i. Age/Service requirement	First hired before July 1, 1989: a. Age 55 and three years of Allowable Service. b. Any age with 30 years of Allowable Service; c. Rule of 90: Age plus Allowable Service totals 90. First hired after June 30, 1989: Age 55 and three years (five years if hired after June 30, 2010) of Allowable Service
ii. Amount	First hired before July 1, 1989: The greater of (a) and (b): a. 1.20% of Average Salary for each of the first ten years of Allowable Service and 1.70% of Average Salary for each subsequent year with reduction of 0.25% for each month the member is under age 65 at time of retirement or under age 62 if 30 or more years of Allowable Service. No reduction if age plus years of Allowable Service totals 90. b. 1.70% of Average Salary for each year of Allowable Service assuming augmentation to age 65 at 3.00% per year and actuarial reduction for each month the member is under age 65. First hired after June 30, 1989: 1.70% of Average Salary for each year of Allowable Service assuming augmentation to the age eligible for full Social Security retirement benefit (but not higher than age 66) at 3.00% (2.50% if hired after June 30, 2006) per year and actuarial reduction for each month the member is under the normal retirement age..
iii. Form of payment	Life annuity with return on death of any balance of member contributions over aggregate monthly payments. Actuarially equivalent options are: a. 50%, 75%, or 100% Joint and Survivor with bounce back feature without additional reduction. b. 15-year Certain and Life.
iv. Benefit Increases	Since 2011, benefit recipients have received annual 2.0% benefit increases. When the funding ratio reaches 90% (actuarial accrued liability ratio on a Market Value of Assets basis) for two consecutive years, the benefit increase will revert to 2.5%. A benefit recipient who has been receiving a benefit for at least 18 full months as of the January 1 increase will receive a full increase. Members receiving benefits for at least six months but less than 18 full months as of the January 1 increase will receive a pro rata increase. Prior to 2002, members who retired under the laws in effect before July 1, 1973 received an additional lump sum payment each year. In 1989, this lump sum payment was the greater of $25 times each full year of Allowable Service or $400 per full year of service less any Social Security benefits received or annuity from a Minnesota public employee pension plan. In each following year, the lump sum payment was increased by the same percentage increase that was applied to regular annuities paid from the Minnesota Post Retirement Investment Fund. Effective January 1, 2002, the annual lump sum payment was divided by 12 and paid as a monthly life annuity in the annuity form elected.
8. Disability	
a. Disability Benefit	
i. Age/Service requirement	Total and permanent disability before normal retirement age with three years of Allowable Service (five years if hired after June 30, 2010).
ii. Amount	Normal Retirement benefit based on Allowable Service and Average Salary at disability without reduction for commencement before normal retirement age.

Plan Provisions Summary

ii. Amount (continued)	Payments stop if disability ceases or death occurs. Payments revert to a retirement annuity at normal retirement age. Benefits may be reduced on resumption of partial employment.
b. Retirement after disability	
i. Age/Service requirement	Normal retirement age with continued disability.
ii. Amount	Any optional annuity continues. Otherwise, a normal retirement benefit equal to the disability benefit paid before normal retirement age, or an actuarially equivalent optional annuity.
iii. Form of payment	Same as for retirement.
iv. Benefit Increases	Same as for retirement.
9. Death	
a. Surviving Spouse Optional Benefit	
i. Age/Service requirement	Member or former member who dies before retirement or disability benefits commence with three years of Allowable Service (five years if hired after June 30, 2010). If a former member dies before age 55 and has less than 30 years of Allowable Service, benefits commence when the former member would have been age 55. If an active member dies, benefits may commence immediately, regardless of age.
ii. Amount	Surviving spouse receives the 100% joint and survivor benefits using the Normal Retirement formula above. If commencement is prior to age 55, the appropriate early retirement formula described above applies except that one-half the monthly reduction factor is used from age 55 to the commencement age and the Rule of 90 does not apply. In lieu of this benefit, the surviving spouse may elect a refund of member contributions with interest or an actuarially equivalent term certain annuity. If a member dies prior to July 1, 1997 and the beneficiary was not eligible to commence a survivor benefit as of July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
iii. Benefit Increases	Same as for retirement.
b. Surviving Dependent Children's Benefit	
i. Age/Service requirement	If no surviving spouse, all dependent children (biological or adopted) below age 20 who are dependent for more than half of their support on deceased member.
ii. Amount	Actuarially equivalent 100% joint and survivor annuity to surviving spouse payable to the later of age 20 or five years. The amount is proportionally divided among surviving children.
iii. Benefit Increases	Same as for retirement.
c. Refund of Contributions	
i. Age/Service requirement	Active member dies and survivor benefits are not payable or a former member dies before annuity begins or former member who is not entitled to an annuity dies.
ii. Amount	Member's contributions with 6.00% interest through June 30, 2011 compounded daily. Beginning July 1, 2011, a member's contributions will increase at 4.00% interest compounded daily.
iii. Age/Service requirement	Retired or disabled annuitant who did not select an optional annuity dies, or the remaining recipient of an option dies.
iv. Amount	The excess of the member's contributions over all benefits paid.

Plan Provisions Summary

10. Unclassified Plan Provision	Eligible members credited with employee shares in the Unclassified Plan may elect to terminate participation in the Unclassified Plan and be covered by the State Employees Retirement Fund prior to termination of covered employment assuming that the member has acquired at least 10 years of allowable state service (no more than seven years of service if hired after June 30, 2010).
11. Termination	
a. Refund of contribution	
i. Age/Service requirement	Termination of state service.
ii. Amount	Member's contributions with 6.00% interest through June 30, 2011 compounded daily. Beginning July 1, 2011 a member's contributions will increase at 4.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.
b. Deferred Benefit	
i. Age/Service requirement	Three years of Allowable Service if hired prior to June 30, 2010, five years of Allowable Service if hired after June 30, 2010.
ii. Amount	Benefit computed under law in effect at termination and increased by the following annual augmentation percentage: a. 0.00% before July 1, 1971; b. 5.00% from July 1, 1971 to January 1, 1981; c. 3.00% thereafter (2.50% if hired after June 30, 2006) until January 1 of the year following attainment of age 55 or January 1, 2012, whichever is earlier; d. 5.00% thereafter until the annuity begins (2.50% if hired after June 30, 2006), but before January 1, 2012. Amount is payable as a normal or early retirement; e. 2.00% from January 1, 2012 thereafter. Amount is payable at normal or early retirement. If a member terminated employment prior to July 1, 1997 but was not eligible to commence their pension before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.
12. Combined Service Annuity	Members are eligible for combined service benefits if they: a. Have sufficient allowable service in total that equals or exceeds the applicable service credit vesting requirement of the retirement plan with the longest applicable service credit vesting requirement; b. Have at least six months of allowable service credit in each plan worked under; c. Are not in receipt of a benefit from another plan, or have applied for benefits with an effective date within one year. Members who meet the above requirements must have their benefit based on the following: a. Allowable service in all covered plans is combined in order to determine eligibility for early retirement. b. Average salary is based on the high five consecutive years during their entire service in all covered plans.

Plan Provisions Summary

13. Optional Form Conversion Factors	Actuarially equivalent factors based on RP-2000 mortality for healthy annuitants, white collar adjustment, projected to 2025 using scale AA, blended 55% males, and **7.5% interest pre-decrement, 6.5% interest post-decrement.**
14. Contribution Stabilizer	The following is a summary of contribution stabilizer provisions in Minnesota Statute 352.045: a. If a contribution sufficiency of at least 1.0% has existed for two consecutive years, member and employer contributions are decreased by at most 0.25% to a level that is necessary to maintain a 1.0% sufficiency. A contribution rate decrease under this section must not be made until at least two years have passed since fully implementing a previous decrease. b. If a contribution deficiency of at least 0.5% has existed for two consecutive years, the member and employer contribution rates are increased as follows: i. If the contribution deficiency is less than 2.0%, member and employer contributions are each increased by 0.25%. ii. If the contribution deficiency is greater than 1.99% and less than 4.01%, member and employer contributions are each increased by 0.50%. iii. If the contribution deficiency is greater than 4.0%, member and employer contributions are each increased by 0.75%.
15. Changes in Plan Provisions	Member and employer contribution rates increased from 5.0% to 5.5% of pay effective the first day of the first full pay period beginning after July 1, 2014. Effective July 1, 2014, the funding ratio threshold that must be attained to pay a 2.5% post-retirement benefit increase to benefit recipients was changed from 90% for one year to 90% for two consecutive years.

Actuarial Assumptions

The actuarial assumptions below were documented by the retained actuary, and we agree with their application without any changes. They are documented here for illustrative purposes only, and reflect exactly what was provided in the retained actuary's report.

1. Investment Return

Select and Ultimate Rates:

a. July 1, 2014 to June 30, 2017 8.00% per annum
b. July 1, 2017 and later 8.50% per annum

2. Benefit increases after retirement

2.00% per annum through 2015 and 2.5% per annum thereafter

3. Salary increases

Reported salary at valuation date increased according to the rate table, to current fiscal year and annually for each future year. Prior fiscal year salary is annualized for members with less than one year of service.

Salary Scale	
Year	**Increase**
1	10.50%
2	8.10
3	6.90
4	6.20
5	5.70
6	5.30
7	5.00
8	4.70
9	4.50
10	4.40
11	4.20
12	4.10
13	4.00
14	3.80
15	3.70
16	3.60
17+	3.50

4. Inflation

3.00% per year.

5. Payroll growth

3.75% per year.

6. Mortality rates

Healthy Pre-retirement:

RP-2000 employee generational mortality table projected with mortality improvement scale AA, white collar adjustment, set forward three years for males and set back one year for females.

Healthy Post-retirement:

RP-2000 annuitant generational mortality table projected with mortality improvement scale AA, white collar adjustment. The RP-2000 employee mortality table as published by the Society of Actuaries (SOA) contains mortality rates for ages 15 to 70 and the annuitant mortality table contains mortality rates for ages 50 to 95. We have applied the annuitant mortality table for active members beyond age 70 until the assumed retirement age and the employee mortality table for annuitants younger than age 50.

Disabled:

RP-2000 disabled mortality table with no setback for males and set forward five years for females.

Actuarial Assumptions

6. Mortality rates (Continued)

Rate (%)						
	Healthy Post-Retirement Mortality		Healthy Pre-Retirement Mortality		Disability Mortality	
Age	Male	Female	Male	Female	Male	Female
20	0.03%	0.02%	0.04%	0.02%	2.26%	0.75%
25	0.04	0.02	0.04	0.02	2.26	0.75
30	0.04	0.03	0.05	0.02	2.26	0.75
35	0.06	0.05	0.08	0.04	2.26	0.75
40	0.09	0.06	0.11	0.06	2.26	0.75
45	0.13	0.10	0.17	0.09	2.26	1.15
50	0.60	0.24	0.24	0.15	2.90	1.65
55	0.54	0.35	0.35	0.22	3.54	2.18
60	0.66	0.56	0.56	0.34	4.20	2.80
65	1.16	0.91	0.85	0.54	5.02	3.76
70	1.93	1.52	2.67	0.82	6.26	5.22

7. Retirement

Members retiring from active status are assumed to retire according to the age related rates shown in the rate table. Members who have attained the highest assumed retirement age are assumed to retire in one year.

Retirement (%)		
Age	Rule of 90 Eligible	All Others
55	20	5
56	15	5
57	15	5
58	15	5
59	20	6
60	20	7
61	22	12
62	40	22
63	30	16
64	30	18
65	40	40
66	30	30
67	25	25
68	25	25
69	25	25
70	30	30
71+	100	100

8. Withdrawal

Select and Ultimate rates based on actual experience. Select rates in the first three years are:

	First Year	Second Year	Third Year
Male	0.45	0.14	0.09
Female	0.48	0.15	0.10

Actuarial Assumptions

8. Withdrawal (Continued)

Ultimate rates after the third year are shown below:

	Withdrawal Rates After Third Year	
Age	Male	Female
20	6.90%	8.55%
25	5.90	7.80
30	4.90	7.05
35	3.90	5.10
40	3.20	4.38
45	2.70	3.75
50	2.20	3.05
55	0.00	0.00
60	0.00	0.00
65	0.00	0.00

9. Disability

Age-related rates based on experience; see table of sample rates:

	Disability Retirement	
Age	Male	Female
20	0.01%	0.01%
25	0.01	0.01
30	0.01	0.01
35	0.03	0.03
40	0.08	0.08
45	0.13	0.13
50	0.29	0.29
55	0.50	0.43
60	0.78	0.62
65	0.00	0.00

10. Allowance for Combined Service Annuity

Liabilities for active members are increased by 1.20% and liabilities for former members are increased by 40.00% to account for the effect of some participants having eligibility for a Combined Service Annuity.

11. Administrative expenses

Prior year administrative expenses expressed as percentage of prior year projected payroll.

12. Refund of contributions

Account balances accumulate interest until normal retirement date and are discounted back to the valuation date. All employees withdrawing after becoming eligible for a deferred benefit take the larger of their contributions accumulated with interest or the value of their deferred benefit.

13. Commencement of deferred benefits

Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at normal retirement age.

14. Percentage married

85% of active male members and 70% of female members are assumed to be married. Actual marital status is used for members in payment status.

15. Age of spouse

Male members are assumed to have a beneficiary three years younger and female members are assumed to have a beneficiary two years older.

Actuarial Assumptions

16. Form of payment	Married members retiring from active status are assumed to elect subsidized joint and survivor form of annuity as follows: <u>Males:</u> 15% elect 50% Joint & Survivor option 10% elect 75% Joint & Survivor option 50% elect 100% Joint & Survivor option <u>Females:</u> 15% elect 50% Joint & Survivor option 0% elect 75% Joint & Survivor option 25% elect 100% Joint & Survivor option Remaining married members and unmarried members are assumed to elect the Straight Life option. Members receiving deferred annuities (including current terminated deferred members) are assumed to elect a life annuity.
17. Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
18. Decrement operation	Withdrawal decrements do not operate during retirement eligibility.
19. Service credit accruals	It is assumed that members accrue one year of service credit per year.
20. Unknown data for certain members	In cases where submitted data was missing or incomplete, the following assumptions were applied: <u>Data for active members:</u> There were 88 members reported with zero or invalid salary. We used prior year salary (51 members), if available, otherwise, high five salary with a 10% load to account for salary increases (24 members). If neither pay nor high five salary was available, we assumed a value of $35,000 (13 members). There were 19 members reported with zero or negative service. Due to the small number of members with zero service, and based on direction from MSRS, we used service of 0 years for these members. There were also 33 members reported without a gender and 19 members reported with an invalid date of birth. We assumed a date of birth of July 1, 1976 and female gender. <u>Data for terminated members:</u> There were 708 members reported with a missing or invalid benefit. If available, we calculated benefits for these members using the reported Average Salary, Credited Service and Termination Date provided. If Average Salary was not reported (689 members), we assumed a value of $30,000. If termination date was not reported (15 members), we assumed the member terminated at age 40 (or current age if younger than 40). If credited service was either not reported or invalid (14 members), we assumed a value of 7.5 years. There were no members with an invalid gender or date of birth.

Actuarial Assumptions

20. Unknown data for certain members (continued)	<u>Data for members receiving benefits:</u> There were 51 members reported without a gender. We assumed female gender for the valuation. No retired members were reported with an invalid date of birth. There were 2 members reported without a benefit. In addition, there was 1 member who was reported with a joint & survivor election but was reported without a survivor benefit. Due to the small number of members with missing benefits, we made no adjustment to the reported data for members receiving benefits. There were 383 retirees reported with a survivor option and a survivor date of death. We assumed no benefit was payable to the survivor, and the member benefit already reflected the increase to the life annuity value (i.e., "bounce back"), if applicable. There were 371 retirees reported with a bounce back annuity but were not reported with a reasonable reduction factor. A factor of 0.80, 0.85 and 0.90 was assumed for the 100%, 75% and 50% joint and survivor annuity, respectively. There were retired members reported with a survivor option and an invalid or missing survivor gender (4,961 members) and/or survivor date of birth (4,465 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid. At MSRS' direction, we changed the status of 785 members who were reported with a disabled status at the beginning of the year and a retired status at the end of the year back to disabled status.
21. Changes in actuarial assumptions	Separate pre-retirement and post-retirement investment return rates which implicitly valued the post-retirement benefit increases were changed to a single investment return assumption and an explicit assumption for post-retirement benefit increases. The assumed post-retirement benefit increase rate was changed from 2.0% per year to 2.0% per year through 2015 and 2.5% per year thereafter.