Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

October 21, 2016

Public Employees' Retirement Board
100 North Park, Suite 200
Helena, MT 59620-0139

Members of the Board:

We are submitting the results of the annual valuation of the assets and liabilities of the Highway Patrol Officers' Retirement System of the State of Montana (HPORS), prepared as of June 30, 2016. The purpose of this letter is to disclose differences between the valuation report issued on October 3, 2016, which was presented at the October 6, 2016 Board meeting, and the valuation report issued October 21, 2016. These differences reflect changes made by Cavanaugh MacDonald LLC and such changes are made through no fault of the Montana Public Employee Retirement Administration (MPERA).

The first step in any actuarial valuation is to perform a data reconciliation to catch any data discrepancies that exist in the current year's valuation data provided by MPERA staff from what would have been expected from the prior year's valuation data. As a result, it is not uncommon for final valuation data to have participant counts that do not exactly match the participant counts in the data provided by the MPERA staff. This is especially true in a year when transitioning from one actuarial firm to another. As a result, the participant demographic information disclosed in the Summary of Results, Appendix D and Appendix E has been updated to reflect the participant counts provided by MPERA, without adjustment for data processing, and to correct any inconsistencies in the demographic information between tables.

The changes mentioned above have no material impact. The funded ratio and the remaining amortization period of the unfunded actuarial accrued liability were unchanged.

Respectfully submitted,

Edward A. Macdonald, ASA, FCA, MAAA
President

Todd B. Green, ASA, FCA, MAAA
Principal and Consulting Actuary

Cavanaugh Macdonald
CONSULTING, LLC

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Highway Patrol Officers' Retirement System of the State of Montana

Actuarial Valuation
As of June 30, 2016

Issued as of October 21, 2016

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October 21, 2016

Public Employees' Retirement Board
100 North Park, Suite 200
Helena, MT 59620-0139

Members of the Board:

In this report are submitted the results of the annual valuation of the assets and liabilities of the Highway Patrol Officers' Retirement System of the State of Montana (HPORS), prepared as of June 30, 2016.

The purpose of this report is to provide a summary of the funded status of the System as of June 30, 2016. While not verifying the data at source, the actuary performed tests for consistency and reasonability. The valuation indicates that the statutory contribution rate reflecting all anticipated contribution increases are sufficient to amortize the unfunded accrued liability within a 28-year period.

The promised benefits of the System are included in the actuarially calculated contribution rates, which are developed using the Entry Age Normal Cost Method. Four-year market related value of assets is used for actuarial valuation purposes. Gains and losses are reflected in the unfunded accrued liability that is being amortized by regular annual contributions as a level percentage of payroll, on the assumption that payroll will increase by 4.00% annually. The assumptions recommended by the actuary and adopted by the Board are, in the aggregate, reasonably related to the experience under the Fund and to reasonable expectations of anticipated experience under the Fund.

This is to certify that Edward Macdonald and Todd Green, Principal and Consulting Actuaries for Cavanaugh Macdonald Consulting, are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. This also certifies that the undersigned have experience in performing valuations for public retirement systems, that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions that are internally consistent and reasonably based on the actual experience of the System.

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Future actuarial results may differ significantly from the current results 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 operation 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. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

The Table of Contents, which immediately follows, outlines the material contained in the report.

Respectfully submitted,

Edward A. Macdonald, ASA, FCA, MAAA
President

Todd B. Green, ASA, FCA, MAAA
Principal and Consulting Actuary

Joseph A. Nichols, ASA, EA, FCA, MAAA, MSPA
Senior Actuary

Matthew Yonz, ASA
Senior Actuarial Analyst

Highway Patrol Officers' Retirement System of the State of Montana

Table of Contents

Section I: Summary of Results

For convenience of reference, the principal results of the valuation and a comparison with the preceding year's results are summarized below:

VALUATION DATE	June 30, 2016	June 30, 2015
Active members*	228	241
Disabled Members**	6	7
Retirees and Beneficiaries**	323	320
Terminated Vested Members	16	11
Terminated Non-Vested Members	18	13
Total***	591	592
Annual Covered Payroll of Active Members	$ 15,275,964	$ 14,502,510
Average Salaries from Covered Payroll	$ 67,000	$ 60,176
Annual Retirement Allowances for Retired Members and Beneficiaries	$ 10,452,952	$ 9,891,640
Assets		
Actuarial value	$ 133,868,650	$ 125,675,791
Market value	128,972,920	129,067,319
Actuarial Accrued Liability (AAL)	$ 203,325,693	$ 192,982,843
Unfunded Actuarial Accrued Liability (UAAL)	$ 69,457,043	$ 67,307,052
Funded Ratio	65.84%	65.12%
Market Value Rate of Return	2.04%	4.60%
Annual Cost		
Statutory Funding Rate	51.38%	50.38%
Total Normal Rate	24.95%	25.26%
Employee Contribution Rate****	13.05%	12.05%
Employer Normal Rate	11.90%	13.21%
Employer Contribution Rate		
Normal Rate	11.90%	13.21%
Administrative Expense Load	0.23%	0.23%
UAAL Rate	26.20%	24.89%
Total Rate	38.33%	38.33%
Amortization Period	28 years	29 years
Employer Contribution Rate Necessary to Amortize UAAL over 30 Years		
Normal Rate	11.90%	13.21%
Administrative Expense Load	0.23%	0.23%
UAAL Rate (30-Year Rate)	25.02%	24.17%
Total Rate	37.15%	37.61%
Shortfall/(Surplus)	(1.18%)	(0.72%)

* Includes 0 DROP members as of June 30, 2015 and 6 DROP members as of June 30, 2016.

** Based on PERB categorization for the annual report. For actuarial purposes, 18 members in 2015 and 20 members in 2016 were valued as disabled members with offsetting reductions to the number of retired members.

*** A reconciliation between participant counts used for the annual report and counts for the valuation appears at the beginning of Appendix D.

**** Rates shown are for the fiscal year following the valuation date.

As a result of this actuarial valuation of the benefits in effect under the Highway Patrol Officers' Retirement System as of June 30, 2016, the statutory employer contributions are sufficient to amortize the Unfunded Actuarial Accrued Liability (UAAL) of the Retirement System within 28 years. The Funded Ratio is 65.84%.

Calculations based on the Market Value of Assets

MCA 19-2-407 requires this report to show how market performance is affecting the actuarial funding of the Retirement System. The June 30, 2016, market value of assets is $4,895,730 less than the actuarial value of assets. This is due to the smoothing of investment gains and losses over a four-year period. If the market value of assets was used, the amortization period would be 32 years, and the Funded Ratio would be 63.48%.

Additional Details

MCA 19-6 sets the employer contribution at 28.15% of salary, the state contribution at 10.08% and the employee contribution at 12% for non-GABA actives (13% effective July 1, 2016) and 12.05% for GABA actives (13.05% effective July 1, 2016). The employee rates have increased 1% per year since 2013, but are not currently scheduled to increase after July 1, 2016.

The actuarial costs are calculated using the entry age actuarial cost method. This is the method used by most public plans. It is designed to provide a stable contribution rate as a percent of member pay. This actuarial valuation measures the adequacy of the contribution rates set in Montana State Law.

Investment Experience

The market assets earned 2.04% net of investment expenses. As a result of prior years' unrecognized gains, the actuarial assets earned 8.76%, which is 1.01% more than the actuarial assumption of 7.75%. The return on the actuarial assets differs from the return on market assets because the actuarial value of assets spreads gains and losses over four years. The chart below shows the annual returns for the past ten years.

Year	Market Return	Actuarial Return	Assumed Investment Return	Market Return over Assumption	Actuarial Return over Assumption
7/1/2006 to 6/30/2007	18.07%	12.07%	8.00%	10.07%	4.07%
7/1/2007 to 6/30/2008	(4.83)	7.73	8.00	(12.83)	(0.27)
7/1/2008 to 6/30/2009	(20.98)	(0.15)	8.00	(28.98)	(8.15)
7/1/2009 to 6/30/2010	13.04	(1.16)	7.75	5.29	(8.91)
7/1/2010 to 6/30/2011	21.79	(0.04)	7.75	14.04	(7.79)
7/1/2011 to 6/30/2012	2.24	3.32	7.75	(5.51)	(4.43)
7/1/2012 to 6/30/2013	12.88	11.86	7.75	5.13	4.11
7/1/2013 to 6/30/2014	17.10	13.13	7.75	9.35	5.38
7/1/2014 to 6/30/2015	4.60	9.61	7.75	(3.15)	1.86
7/1/2015 to 6/30/2016	2.04	8.76	7.75	(5.71)	1.01

Asset gains and losses result when the return on the actuarial value of assets differs from the assumed actuarial investment return.

Amortization of the UAAL

The June 30, 2015, actuarial valuation calculated a 29-year amortization period for the UAAL. The resulting amortization period at June 30, 2016, is 28 years.

Funding and Benefits Policy

The Public Employees' Retirement Board has adopted a Funding and Benefits Policy to provide general guidelines to help ensure decisions are made based on sound, consistent, and thoroughly examined criteria. The Funding and Benefits Policy includes guidance on the following topics:

1) Funding Requirement
   a) The Funding and Benefits Policy states:
      1. The Entry Age Normal Cost Method shall be applied to the projected benefits in determining the Normal Cost and Actuarial Accrued Liability.
      2. Asset smoothing can be used in the valuation process to spread the recognition of investment gains and losses over a four-year period.
      3. The unfunded actuarial accrued liability should be amortized over a reasonable period of time and should not exceed 30 years on a rolling basis. Generally, the funding period should be constant or decreasing.
   b) Analysis: The liabilities of the System are determined using the Entry Age Normal Cost Method and are compared to the actuarial value of assets, which are developed using asset smoothing that recognizes gains and losses over a four-year period. Finally, the amortization period as of June 30, 2016 is 28 years based on actuarial value of assets. The current employer and employee statutory rates keep the System's funding within Board policy guidelines.
2) Funding Objectives
   a) The Funding and Benefits Policy states: "The primary objectives are to: 1) ensure that the systems are financially sound and pay all benefits promised using assets accumulated from required employer and member contributions and investment income; and 2) achieve a well-funded status with a range of safety to absorb market volatility without creating a UAL."
   b) Analysis: The employer and employee contributions provided for in statute are sufficient to amortize the unfunded actuarial accrued liability within a 30-year period. This ensures that the System is financially sound and will be able to pay all promised benefits and eventually achieve a well-funded status with a range of safety to absorb market volatility without creating and UAL.
3) Benefit Enhancements
   a) The Funding and Benefits Policy states: "Proposals must provide funding from sources sufficient to cover future costs. Unfunded liabilities created by the proposal must be amortized over a period of time appropriate to the retirement system, but not more than 30 years."
   b) Analysis: Without supplemental funding, a benefit enhancement would increase the amortization period of the unfunded actuarial accrued liability and further delay the goal of achieving a well-funded status with a range of safety to absorb market volatility without creating a UAL.

Sensitivity to Future Experience

The valuation results are projections based on the actuarial assumptions. Actual experience will differ from these assumptions, either increasing or decreasing the ultimate cost. The following illustrations provide simple analyses on how the costs are sensitive to changes in the assumed rate of return.

Investment Return – The investment return generally has the largest impact on the funding of the System.

Impact of Assuming 1.00% Lower Investment Return	
	Funded Ratio
Current Assumption 7.75%	65.84%
Lower Assumption 6.75%	58.07%
Decrease	(7.77)%
	Amortization Period Increase / (Decrease)
Current Assumption 7.75%	28 Years
Lower Assumption 6.75%	Does not amortize
Increase	N/A
Impact of Assuming 1.00% Higher Investment Return	
	Funded Ratio
Current Assumption 7.75%	65.84%
Higher Assumption 8.75%	73.96%
Increase	8.12%
	Amortization Period Increase / (Decrease)
Current Assumption 7.75%	28 Years
Higher Assumption 8.75%	13 Years
Decrease	(15) Years

The future funding status of the System will be determined by the System's experience. The System's actual asset returns and retirement rates, as well as member longevity, salary increases, withdrawal rates, disability rates and future legislation will all impact the funding status of the System. The entry age normal cost method and four-year smoothing of asset gains and losses will help to provide a more orderly funding of the System's liabilities, but will not change the actual experience. The amortization period of the UAAL is not likely to decrease by the expected 1.0 year with each passing actuarial valuation. Instead, the amortization period is expected to decrease more or less than 1.0 years each year, reflecting gains and losses due to experience different than the actuarial assumptions.

Initial Valuation

This is the first actuarial valuation report prepared by Cavanaugh Macdonald Consulting (CMC) for HPORS. As part of our transition work, we replicated the June 30, 2015, actuarial valuation. Results were well within acceptable limits. Based on our experience, these differences are neither unusual nor significant.

Assumption Changes

There have been no assumption changes since the previous valuation.

Benefit Changes

There have been no benefit changes since the previous valuation.

Contribution Changes

There have been no contribution changes since the previous valuation, except the scheduled employee contribution increases.

Method Changes

There have been no method changes since the previous valuation.

Impact of Changes

The following table summarizes how experience has changed the UAAL since the June 30, 2015, Actuarial Valuation. Further detail can be found in Table 10.

Changes in the Unfunded Actuarial Accrued Liability (UAAL)

June 30, 2015 Valuation UAAL	$67,307,052
Normal Cost	3,525,339
Contributions	(8,075,880)
Interest	5,176,570
Expected June 30, 2016 UAAL	$67,933,081
Experience Loss on Actuarial Liabilities	$2,778,850
Experience Gain on Actuarial Assets	(1,254,888)
Assumption & Method Changes	0
Plan Changes	0
Total (Gain) / Loss	$1,523,962
June 30, 2016 Valuation UAAL	$69,457,043

Summary

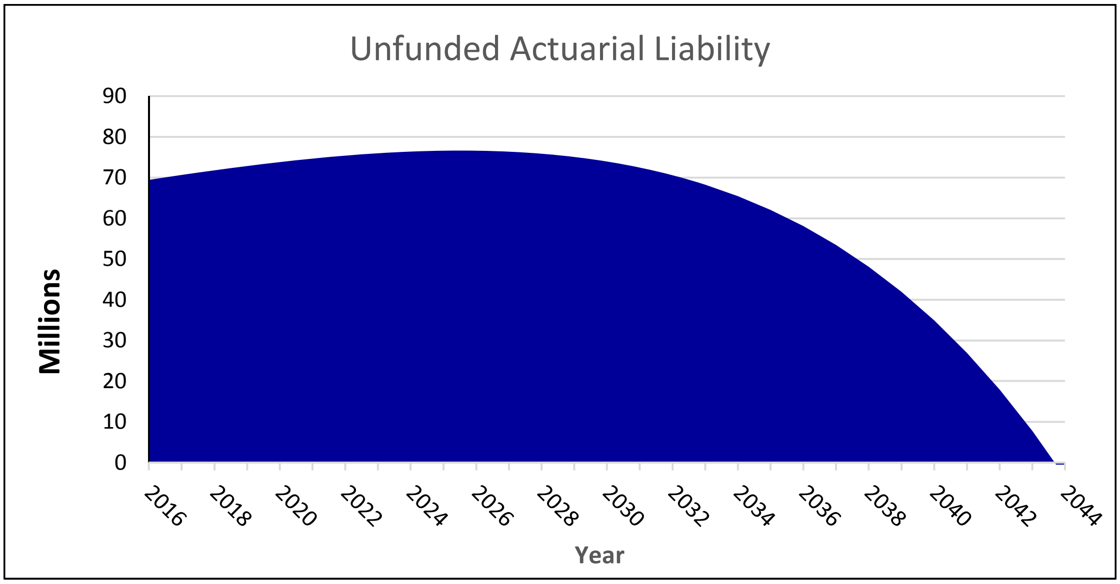
* The System's actuarial value investment return of 8.76% for the year ended June 30, 2016 is 1.01% more than the actuarial assumption of 7.75%. This represents an asset gain of $1,254,888 due to investment return more than anticipated. As of June 30, 2016, the market value of assets was $128,972,920. As of June 30, 2016 the actuarial value of assets was $133,868,650. The June 30, 2016, market value of assets will be recognized in future actuarial valuations unless it is offset by returns greater than the 7.75% assumption.

* As of June 30, 2016, the amortization period of the UAAL is 28 years. Prior to this valuation, the funding period was 29 years. The ultimate goal of the Board's Funding and Benefits Policy is to increase the funded status to a level such that the amortization period is below 30 years. The System is currently being funded within the parameters defined by the Board.

* The funding of the retirement system will be impacted by future experience, which will sometimes be more favorable than the actuarial assumptions and sometimes less favorable. In particular, investment returns larger and smaller than the 7.75% assumption are expected to have significant impacts on the System's funding progress. In the long term, the favorable experience is needed to offset the less favorable experience. This is the reason for using an actuarial value of assets that allows gains and losses to be smoothed over four years.

Projected Progress toward 100% Funding

The table below shows the projected progress toward reaching 100%. When the System is 100% funded, the Unfunded Actuarial Accrued Liability will be fully amortized. This is scheduled to occur within 28 years. The ultimate goal of the HPORS System is to become at least 100% funded and to establish a reserve.



Assets

In many respects, an actuarial valuation can be regarded as an inventory process. The inventory is taken as of the actuarial valuation date, which for this valuation is June 30, 2016. On that date, the assets available for the payment of benefits are appraised. These assets are compared with the actuarial liabilities. The actuarial process thus leads to a method of determining what contributions by members and their employers are needed to strike a balance.

The asset valuation method being used is a four-year smoothing method. The expected return is determined each year based on the beginning of year market value and actual cash flows during the year. Any difference between the expected market value return and the actual market value return is recognized evenly over a period of four years.

Table 1 lists the assets held and their market value for the past two years. Table 2 summarizes the fund’s activity during the past two years. Table 3 summarizes the determination of the actuarial value of assets. Table 4 summarizes historical asset returns for the last 10 years including the amount recognized by the actuarial asset valuation method which was greater or lesser than the actuarial investment return assumption. Table 5 summarizes the historical asset values on a market value and actuarial value basis, to the extent it was available. Additional data can be included in this table for future reports, if provided by the System.

Table 1:
Statement of Fiduciary Net Assets
Fiscal Year Ended June 30

	2016	2015
ASSETS		
Cash and Short Term Investments	$ 4,152,841	$ 2,554,774
Securities Lending Collateral	$ 3,567,655	$ 4,912,058
Receivables:		
Interest Receivable	$ 174,444	$ 174,457
Accounts Receivable	-	-
Due from Other Funds	-	-
Due from Primary Government	-	-
Notes Receivable	-	-
Total Receivables	$ 174,444	$ 174,457
Investments, at fair value:		
Investment Pools	124,426,889	126,244,671
Other Investments	-	-
Total Investments	$ 124,426,889	$ 126,244,671
Capital Assets		
Property and Equipment, at cost, net of Accumulated Depreciation	$ 451	$ 1,011
Equipment	297,701	240,048
Total Capital Assets	$ 298,152	$ 241,059
TOTAL ASSETS	$ 132,619,981	$ 134,127,019
LIABILITIES		
Securities Lending Liability	$ 3,567,655	$ 4,912,058
Accounts Payable	13,684	90,322
Unearned Revenue	680	4,549
Due to Other Funds	40,370	38,434
Compensated Absences	18,975	10,349
OPEB Implicit Rate Subsidy LT	5,697	3,988
TOTAL LIABILITIES	$ 3,647,061	$ 5,059,700
NET ASSETS HELD IN TRUST FOR PENSION BENEFITS	$ 128,972,920	$ 129,067,319

Table 2:
Statement of Changes in Fiduciary Net Assets
Fiscal Year Ended June 30

	2016	2015
ADDITIONS		
Contributions:		
Employer	$ 5,915,644	$ 5,577,785
Plan Member	1,917,487	1,624,327
Other	242,749	261,551
Total Contributions	$ 8,075,880	$ 7,463,663
Misc Income	$ -	$ -
Investment Income:		
Net Appreciation/(Depreciation) in Fair Value of Investments	$ (2,466,259)	$ 2,047,192
Investment Earnings	5,819,339	4,373,376
Security Lending Income	37,116	31,376
Investment Income/(Loss)	$ 3,390,196	$ 6,451,944
Investment Expense	(773,190)	(707,894)
Security Lending Expense	(11,750)	(5,677)
Net Investment Income/(Loss)	$ 2,605,256	$ 5,738,373
Total Additions	$ 10,681,136	$ 13,202,036
DEDUCTIONS		
Benefit Payments	$ 10,482,414	$ 9,932,134
Refunds/Distributions	93,811	68,722
Refunds to Other Plans	-	-
Transfers to DCRP	-	-
Transfers to MUS-RP	-	-
OPEB Expense	2,276	1,695
Administrative Expense	197,034	144,590
Total Deductions	$ 10,775,535	$ 10,147,141
NET INCREASE (DECREASE) IN PLAN NET ASSETS	$ (94,399)	$ 3,054,895
NET ASSETS HELD IN TRUST FOR PENSION BENEFITS BEGINNING OF YEAR	$ 129,067,319	$ 126,012,210
ADJUSTMENT	-	$ 214
END OF YEAR	$ 128,972,920	$ 129,067,319

Table 3:
Determination of Actuarial Value of Assets

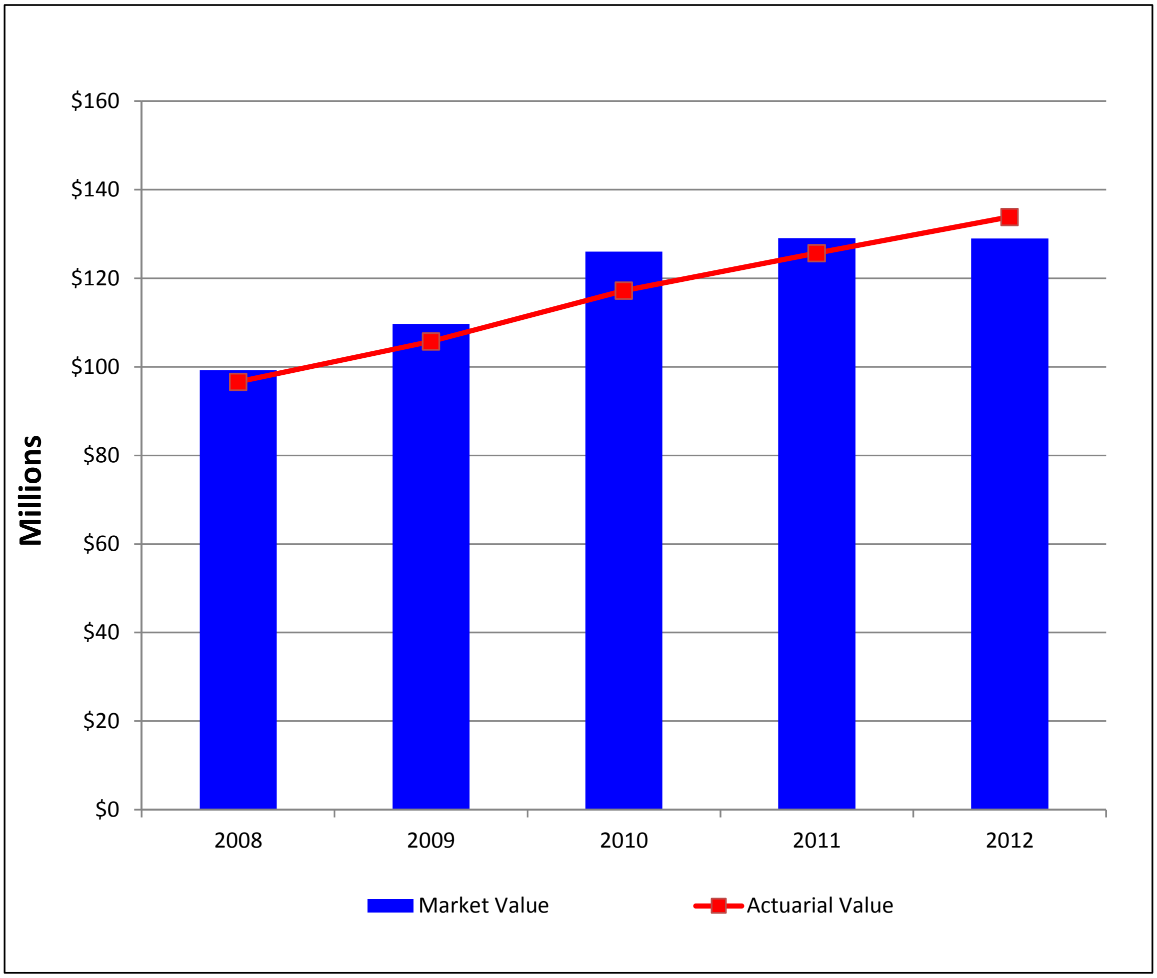
Valuation Date June 30:	2015	2016	2017	2018	2019
A. Actuarial Value Beginning of Year	$ 117,226,278	$ 125,675,791			
B. Market Value End of Year	129,067,319	128,972,920			
C. Market Value of Beginning of Year	126,010,392	129,067,319			
D. Cash Flow					
D1. Contributions	7,463,663	8,075,880			
D2. Benefit Payments	(10,000,856)	(10,576,225)			
D3. Administrative Expenses	(144,253)	(197,034)			
D4. Investment Expenses	-	(784,940)			
D5. Net	$ (2,681,446)	$ (3,482,319)			
E. Investment Income					
E1. Market Total: B. - C. - D5.	$ 5,738,373	$ 3,387,920			
E2. Assumed Rate	7.75%	7.75%			
E3. Amount for Immediate Recognition C.*E2. + ((D1.+D2.+D3.)*E2.*0.5) - D4.	9,663,838	10,683,134			
E4. Amount for Phased-in Recognition E1. - E3.	(3,925,465)	(7,295,214)			
F. Phased-in Recognition of Investment Income					
F1. Current Year: 0.25 * E4.	$ (981,366)	$ (1,823,804)	$ -	$ -	$ -
F2. First Prior Year	2,538,414	(981,366)	(1,823,804)	-	-
F3. Second Prior Year	1,258,800	2,538,414	(981,366)	(1,823,804)	-
F4. Third Prior Year	(1,348,727)	1,258,800	2,538,414	(981,366)	(1,823,804)
F5. Total Recognized Investment Gain	$ 1,467,121	$ 992,044	$ (266,756)	$ (2,805,170)	$ (1,823,804)
G. Actuarial Value End of Year A. + D5. + E3. + F5.	$ 125,675,791	$ 133,868,650			

Table 4:
Historical Investment Returns*

Fiscal Year Ending	Market Returns	Actuarial Returns	Assumed Rate of Return	Actuarial Return Over Assumption
June 30, 2007	18.07%	12.07%	8.00%	4.07%
June 30, 2008	(4.83)%	7.73%	8.00%	(0.27)%
June 30, 2009	(20.98)%	(0.15)%	8.00%	(8.15)%
June 30, 2010	13.04%	(1.16)%	7.75%	(8.91)%
June 30, 2011	21.79%	(0.04)%	7.75%	(7.79)%
June 30, 2012	2.24%	3.32%	7.75%	(4.43)%
June 30, 2013	12.88%	11.86%	7.75%	4.11%
June 30, 2014	17.10%	13.13%	7.75%	5.38%
June 30, 2015	4.60%	9.61%	7.75%	1.86%
June 30, 2016	2.04%	8.76%	7.75%	1.01%
10 Year Average	5.84%	6.38%		(1.45)%

* Returns reflect all investment returns, including investment income and realized and unrealized investment gains and losses, and are net of investment expenses and administrative expenses paid by the System.

Table 5:
Market Value of Assets vs. Actuarial Value of Assets



Actuarial Present Value of Future Benefits

In the previous section, an actuarial valuation was related to an inventory process, and an analysis was given of the inventory of assets of the System as of the valuation date. In this section, the discussion will focus on the commitments of the System, which will be referred to as its actuarial liabilities.

Table 6 contains an analysis of the actuarial present value of all future benefits for active members, for retirees, and for beneficiaries. The analysis is given by type of benefit.

The actuarial liabilities summarized in Table 6 include the actuarial present value of all future benefits expected to be paid with respect to each member covered as of the valuation date. For an active member, this value includes a measure of both benefits already earned and future benefits to be earned. Thus, for all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives and, if an optional benefit is chosen, for the lives of their surviving beneficiaries.

The actuarial valuation does not recognize liabilities for employees who become members and participate in the System after the valuation date.

Table 6:
Actuarial Present Value of Future Benefits for Actives, Retirees, and Beneficiaries

	June 30, 2016 Total	June 30, 2015 Total
A. Active Members Liability Due to Probability of		
Service Retirement	$ 74,877,576	$ 78,671,337
Disability Retirement	$ 2,737,420	$ 2,850,406
In-Service Death	$ 1,129,259	$ 1,181,436
Termination	$ 3,307,752	$ 3,400,902
Total	$ 82,052,007	$ 86,104,081
B. Inactive Members and Annuitants		
Service Retirement	$ 119,295,382	$ 105,452,052
Disability Retirement	$ 10,718,407	$ 9,751,133
Beneficiaries*	$ 16,253,066	$ 18,425,155
Vested Terminated Members	$ 1,972,065	$ 1,320,902
Refund of Member Contributions	$ 85,709	$ 49,207
Total	$ 148,324,629	$ 134,998,449
C. Grand Total	$ 230,376,636	$ 221,102,530

* Includes survivors of active and retired members

Employer Contributions

In the previous two sections, attention has been focused on the assets and the present value of all future benefits of the System. A comparison of Tables 3 and 7 indicates that there is a shortfall in current actuarial assets to meet the present value of all future benefits for current members and beneficiaries.

In an active system, there will always be a difference between the assets and the present value of all future benefits. An actuarial valuation sets a schedule of future contributions that will deal with this funding in an orderly fashion.

The method used to determine the incidence of the contributions in various years is called the actuarial cost method. For this valuation, the entry age actuarial cost method has been used. A description of the entry age actuarial cost method is provided in Appendix A. Under this method, or essentially any actuarial cost method, the contributions required to meet the difference between current assets and the present value of all future benefits are allocated each year between three elements:

- A normal cost amount, which ideally is relatively stable as a percentage of salary over the years;
- A load for administrative expenses; and
- An amount which is used to amortize the UAAL.

The two items described above, normal cost and UAAL, are the keys to understanding the actuarial cost method. Let us first discuss the normal cost.

The normal cost is the theoretical contribution rate, which will meet the ongoing costs of a group of average new employees. Suppose that a group of new employees were covered under a separate fund from which all benefits and to which all contributions and associated investment return were to be paid. Under the entry age actuarial cost method, the normal cost contribution rate is that level percentage of pay which would be exactly right to maintain this fund on a stable basis. If experience were to follow the actuarial assumptions exactly, the fund would be completely liquidated with the last payment to the last survivor of the group.

The assumed investment rate of return is 7.75%, net of investment expenses only. As a result, the actuarially determined contribution must include an amount for administrative expenses expected to occur during the year.

We have determined the normal cost rates separately by type of benefit under the System. These are summarized in Table 7. In Table 7 we also provide a summary of the member and employer statutory contributions.

The term "fully funded" is often applied to a system where contributions for everyone at the normal cost rate will fully pay for the benefits of existing as well as new employees. Often, systems are not fully funded, either because of benefit improvements in the past that have not been completely paid for or actuarial deficiencies that have occurred because experience has not been as anticipated. Under these circumstances, a UAAL exists.

Table 8 shows how the UAAL was derived for the System. Lines A and B show, respectively, the total present value of future benefits and the portion of the future liability that is expected to be paid from future normal cost contributions, both employer and employee. The future normal cost contributions are the portion of the present value of future benefits that are attributed to future years of service that have not been earned yet by the active membership. Line C shows the actuarial accrued liability. Line D shows the amount of assets available for benefits. Line E shows the UAAL.

The UAAL at any date after establishment of a system is affected by any actuarial gains or losses arising when the actual experience of the system varies from the experience anticipated by the actuarial assumptions used in the valuations. To the extent actual experience as it develops differs from the assumptions used, so also will the actual emerging costs differ from the estimated costs. The impact of these differences in actual experience from the assumptions is included in Section 1, the Summary of Findings.

Table 7:
Normal Cost Contribution Rates
As Percentages of Salary

	June 30, 2016 Total	June 30, 2015 Total
Service retirement	20.04%	20.18%
Disability retirement	1.63%	1.68%
In Service Death	0.64%	0.67%
Vested retirement	2.64%	2.73%
Total Normal Rate	24.95%	25.26%
Employee Normal Rate	13.05%	12.05%
Employer Normal Rate	11.90%	13.21%
Administrative Expense Load	0.23%	0.23%
Rate Available to Amortize Unfunded Actuarial Accrued Liability	26.20%	24.89%
Statutory Funding Rate*	51.38%	50.38%

* The rates shown are for the fiscal year following the valuation date.

Table 8:
Unfunded Actuarial Accrued Liability

	June 30, 2016	June 30, 2015
A. Actuarial present value of all future benefits for present members, retirees, and their survivors (Table 6)	$ 230,376,636	$221,102,530
B. Less actuarial present value of total future normal costs for present members	$ 27,050,943	$ 28,119,687
C. Actuarial accrued liability	$ 203,325,693	$192,982,843
D. Less assets available for benefits	$ 133,868,650	$ 125,675,791
E. Unfunded actuarial accrued liability	$ 69,457,043	$ 67,307,052

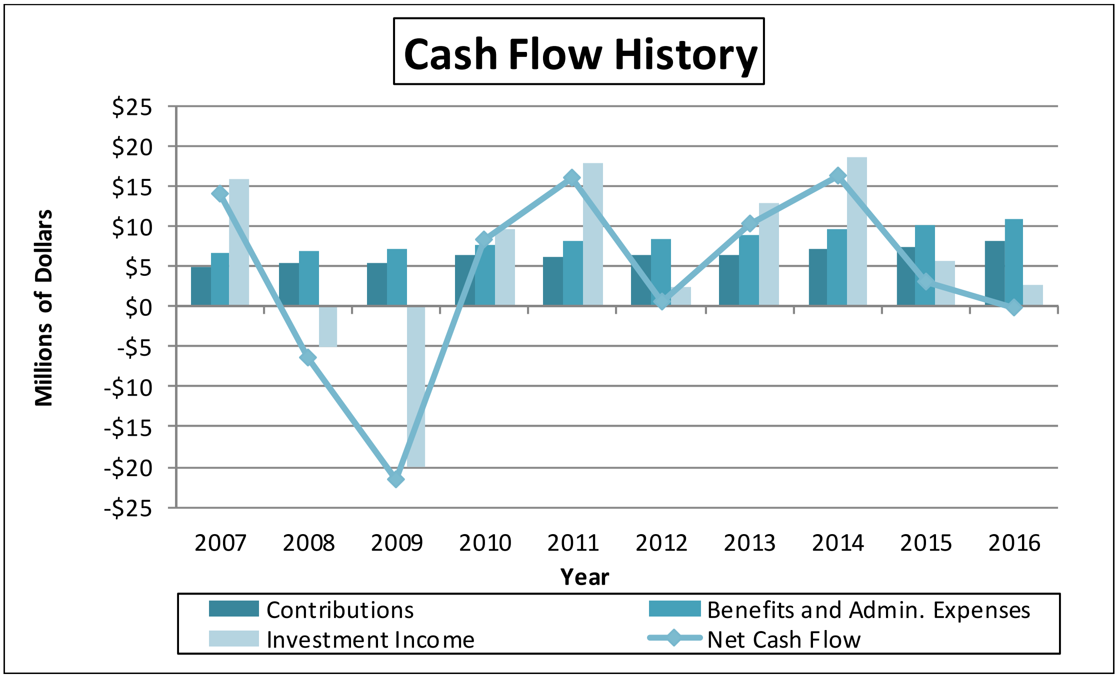
Cash Flows

The fundamental equation for funding a retirement system is that benefits and administrative expenses must be provided for by contributions (past and future) and investment income. When a retirement system matures, benefits and administrative expenses often exceed contributions. In this case we say the system has a “negative cash flow.” Mature systems are characterized by negative cash flows and large pools of assets. This is natural. Actuarial funding is designed to accumulate large pools of assets which will in turn provide investment income and finance negative cash flows when systems mature. If the fund is looked at as a whole, investment income is usually larger than the difference between contributions and benefit payments. The retirement system’s investment strategy should maximize potential returns at a prudent level of risk while providing for needed cash flows.

Table 9 shows the System had a negative cash flow for the year ended June 30, 2016. The System’s total cash flow including benefits payments, administrative expenses and investment earnings was $(0.1) million. Of the $(0.1) million, $2.6 million was due to investment returns.

If the System had a positive cash flow, there would be no need to plan where the funds would come from to pay benefits since benefits could be paid by incoming contributions. A negative cash flow, as defined above, requires planning what funds will be used to pay the difference between benefits and contributions.

Table 9:
Cash Flow History
(Dollar amounts in millions)



	Historical Cash Flows			
Year Ended June 30	Contributions	Benefits & Administrative Expenses	Investment Income	Net Cash Flow
2007	$ 4.9	$ 6.8	$ 15.9	$ 14.0
2008	5.3	6.9	(4.9)	(6.5)
2009	5.5	7.2	(20.0)	(21.7)
2010	6.3	7.7	9.7	8.3
2011	6.1	8.0	17.9	16.0
2012	6.5	8.4	2.3	0.4
2013	6.5	8.9	12.8	10.4
2014	7.2	9.6	18.7	16.3
2015	7.5	10.1	5.7	3.1
2016	8.1	10.8	2.6	(0.1)

Actuarial Gains or Losses

An analysis of actuarial gains or losses is performed in conjunction with all regularly scheduled valuations.

The results of our analysis of the financial experience of the System in the three most recent regular actuarial valuations are presented in Table 10. Each gain or loss shown represents our estimate of how much the given type of experience caused the Unfunded Actuarial Accrued Liability or Funding Reserve to change in the period since the previous actuarial valuation.

Gains and losses shown due to demographic sources are approximate. Demographic experience is analyzed in greater detail in our periodic experience studies.

Non-recurring gains and losses result from changes in the actuarial assumptions and benefit improvements.

Table 10:
Analysis of Actuarial (Gains) or Losses*
($ in thousands)

	UAAL (Gain)/Loss		
	June 30, 2016	June 30, 2015	June 30, 2014
Investment Income			
Investment income was (greater) less than expected based on actuarial value of assets.	$ (1,254.9)	$ (2,147.9)	$ (5,532.5)
Pay Increases			
Pay increases were (less) greater than expected.	837.6	(1,666.9)	681.2
Age & Service Retirements			
Members retired at (older) younger ages or with (less) greater final average pay than expected	1,016.5	(925.3)	66.6
Disability Retirements			
Disability claims were (less) greater than expected	18.0	151.0	(30.6)
Death-in-Service Benefits			
Survivor claims were (less) greater than expected	(32.1)	(33.6)	(12.8)
Withdrawal From Employment			
(More) less reserves were released by withdrawals than expected	(380.7)	551.3	(395.4)
Death After Retirement			
Retirees (died younger) lived longer than expected	443.7	328.8	(219.6)
Data Adjustments and Benefit Payment Timing			
Service purchases, data corrections, etc.	178.4	-	-
Other			
Miscellaneous (gains) and losses	697.5	1,775.6	641.4
Total (Gain) or Loss During Period From Financial Experience	$ 1,524.0	$ (1,967.0)	$ (4,801.6)
Non-Recurring Items.			
Changes in actuarial assumptions and methods	-	-	-
Changes in benefits caused a (gain) loss	-	1,691.7	-
Composite (Gain) Loss During Period	$ 1,524.0	$ (275.3)	$ (4,801.6)

* Effects related to gains are shown in parentheses. Numerical results are expressed as a (decrease) increase in the Unfunded Actuarial Accrued Liability (UAAL). Gains decrease the UAAL and losses increase the UAAL.

The actuarial assumptions (other than the administrative expense rate) were adopted by the Board based upon the results of an actuarial experience study covering the period July 1, 2003, through June 30, 2009.

Tables B-3 through B-7 give rates of decrement for service retirement, disablement, mortality, and other terminations of employment.

Actuarial Cost Method

The actuarial valuation was prepared using the entry age actuarial cost method. Under this method, the actuarial present value of the projected benefits of each individual included in the valuation is allocated as a level percentage of the individual's projected compensation between entry age and assumed exit. The portion of this actuarial present value allocated to a valuation year is called the normal cost. The normal cost was first calculated for each individual member. The normal cost rate is defined to equal the total of the individual normal costs, divided by the total pay rate.

The portion of this actuarial present value not provided for at a valuation date by the sum of (a) the actuarial value of the assets and (b) the actuarial present value of future normal costs is called the UAAL. The UAAL is amortized as a level percentage of the projected salaries of present and future members of the System.

Records and Data

The data used in the valuation consist of financial information; records of age, sex, service, salary, contribution rates, and account balances of contributing members; and records of age, sex, and amount of benefit for retired members and beneficiaries. All of the data were supplied by the System and are accepted for valuation purposes without audit.

Replacement of Terminated Members

The ages at entry and distribution by sex of future members are assumed to average the same as those of the present members they replace. If the number of active members should increase, it is further assumed that the average entry age of the larger group will be the same, from an actuarial standpoint, as that of the present group. Under these assumptions, the normal cost rates for active members will not vary with the termination of present members.

Administrative and Investment Expenses

The investment expenses of the System are assumed to be funded by investment earnings in excess of 7.75% per year.

The administrative expense rate is based upon actual recurring administrative expenses during the period July 1, 2008, through June 30, 2013.

Administrative expenses are assumed to equal 0.23% of payroll.

Valuation of Assets

The actuarial asset valuation method spreads asset gains and losses over four years. The expected return is determined each year based on the beginning of year market value and actual cash flows during the year. Any difference between the expected market value return and the actual market value return is recognized evenly over a period of four years.

Investment Earnings

The annual rate of investment earnings of the assets of the System is assumed to be 7.75% per year net of investment expenses, compounded annually.

Interest on Member Contributions

Interest on member contributions is assumed to accrue at a rate of 3.50% per annum, compounded annually.

Future Salaries

The rates of annual salary increase assumed for the purpose of the valuation are illustrated in Table B-2. In addition to increases in salary due to merit and longevity, this scale includes an assumed 4.0% annual rate of increase in the general wage level of the membership.

Service Retirement

Table B-3 shows the annual assumed rates of retirement for actives members meeting the service retirement eligibilities.

Disablement

The rates of disablement used in this valuation are illustrated in Table B-4.

Mortality

The mortality rates used in this valuation are illustrated in Table B-5. A written description of each table used is included in Table B-1.

There is sufficient margin in the current mortality tables for possible future improvement in mortality rates and that margin will be reviewed again when the next experience investigation is conducted.

Other Terminations of Employment

The rates of assumed future withdrawal from active service for reasons other than death, disability or retirement are shown for representative ages in Table B-6.

Benefits for Terminating Members

Members terminating with less than five years of service are assumed to request an immediate withdrawal of their contributions with interest. Table B-7 shows the assumed probability of retaining membership in the System for vested members terminating their service with the System. For members hired prior to July 1, 2013, vesting is 5 years of service. For members hired on or after July 1, 2013, vesting is 10 years of service.

We estimated the present value of future benefits for terminated vested members based on the greater of the present value of their deferred benefit at age 60 or their available contribution account.

Probability of Marriage & Dependent Children

If death occurs in active status, all members are assumed to have an eligible surviving spouse with no dependent children. Female spouses are assumed to be three years younger than their male spouse.

Records with no Birth Date

New records with no birth date are assumed to be 37 years old. Records that are not new and have no birth date used the same birth date as the prior year's valuation.

Changes Since Prior Valuation

1. DROP accounts are assumed to earn the actuarial rate of return.

2. An additional 15% of active members are assumed to elect DROP for each of the first six years following DROP eligibility. These members are assumed to elect to participate in the DROP for five years or until age 60 if earlier.

Table B-1

Summary of Valuation Assumptions

I.	Economic assumptions		
	A.	General wage increases	4.00%
	B.	Investment return	7.75%
	C.	Price inflation assumption	3.00%
	D.	Growth in membership	0.00%
	E.	Interest on member accounts	3.50%
	F.	Interest on DROP accounts	7.75%
	G.	Administrative expense as a percentage of payroll	0.23%
II.	Demographic assumptions		
	A.	Individual salary increase due to promotion and longevity	Table B-2
	B.	Retirement	Table B-3
	C.	Disablement	Table B-4
	D.	Mortality among contributing members, service retired members, and beneficiaries. The tables include margins for mortality improvement which is expected to occur in the future. For Males and Females: RP 2000 Combined Mortality Table projected to 2015 using Scale AA.	Table B-5
	E.	Mortality among disabled members For Males and Females: RP 2000 Combined Mortality Table.	Table B-5
	F.	Other terminations of employment	Table B-6
	G.	Probability of retaining membership in the System upon vested termination	Table B-7

Table B-2

Future Salaries

Years of Service	Individual Merit & Longevity	General Wage Increase	Total Salary Increase
1	7.30%	4.00%	11.30%
2	5.60	4.00	9.60
3	4.40	4.00	8.80
4	3.50	4.00	7.50
5	2.80	4.00	6.80
6	2.20	4.00	6.20
7	1.70	4.00	5.70
8	1.30	4.00	5.30
9	1.00	4.00	5.00
10	0.70	4.00	4.70
11	0.40	4.00	4.40
12	0.40	4.00	4.40
13	0.40	4.00	4.40
14	0.40	4.00	4.40
15	0.40	4.00	4.40
16	0.20	4.00	4.20
17	0.20	4.00	4.20
18	0.20	4.00	4.20
19	0.20	4.00	4.20
20	0.20	4.00	4.20
21	0.00	4.00	4.00
22 & Up	0.00	4.00	4.00

Table B-3

Retirement
Annual Rates

Age	20 or More Years of Service
Less than 50	12.0%
50	16.0%
51	16.0
52	16.0
53	16.0
54	16.0
55	20.0
56	20.0
57	20.0
58	20.0
59	20.0
60 & Over	100.0

Vested terminations are assumed to retire at their earliest unreduced eligibility.

An additional 15% are assumed to retire and enter the DROP for each of the first six years following DROP eligibility.

Table B-4

Disablement
Annual Rates

Age	All Members
22	.00%
27	.10
32	.10
37	.10
42	.40
47	.40
52	.40
57	.40
62	.00

75% of disabilities are assumed to be duty-related. All disabilities are assumed to be permanent and without recovery.

Table B-5

Mortality
Annual Rates

Age	Contributing Members, Service Retired Members and Beneficiaries		Disabled Members	
	Men	Women	Men	Women
25	0.0323%	0.0168%	0.0376%	0.0207%
30	0.0412	0.0227	0.0444	0.0264
35	0.0717	0.0402	0.0773	0.0475
40	0.0957	0.0563	0.1079	0.0706
45	0.1239	0.0882	0.1508	0.1124
50	0.1628	0.1296	0.2138	0.1676
55	0.2718	0.2409	0.3624	0.2717
60	0.5297	0.4689	0.6747	0.5055
65	1.0309	0.9003	1.2737	0.9706
70	1.7702	1.5529	2.2206	1.6742
75	3.0622	2.4916	3.7834	2.8106
80	5.5360	4.1291	6.4368	4.5879
85	9.9680	7.0761	11.0757	7.7446
90	17.2706	12.5879	18.3408	13.1682
95	25.9578	18.8755	26.7491	19.4509

70% of all member deaths are assumed to be duty-related.

Table B-6

Other Terminations of Employment
Among Members Not Eligible to Retire
Annual Rates

Years of Service	All Members
0	12.0%
1	7.5
2	7.5
3	7.5
4	7.5
5	5.0
6	5.0
7	5.0
8	5.0
9	5.0
10	3.0
11	3.0
12	3.0
13	3.0
14	3.0
15	1.0
16	1.0
17	1.0
18	1.0
19	1.0

Table B-7

Probability of Retaining Membership in the System
Upon Vested Termination

Age	Probability of Retaining Membership
Under 35	60%
35	60
36	60
37	60
38	60
39	60
40	60
41	60
42	60
43	60
44	60
45	70
46	70
47	70
48	70
49	70
50 & Over	100

Service Credit	• Service credit is used to determine the amount of a member's retirement benefit. • One month of service credit is earned for each month where the member is paid for 160 hours. This includes certain transferred and purchased service.
Membership Service	• Membership service is used to determine eligibility for vesting, retirement or other benefits. • One month of membership service is earned for any month member contributions are made, regardless of the number hours worked. • Members may purchase service that counts toward membership service.
Contributions	• Member contributions are made through an "employer pick-up" arrangement which result in deferral of taxes on the contributions.
Compensation	• Compensation generally means all remuneration paid, excluding certain allowances, benefits, and lump sum payments. Compensation is specifically defined in law and differs amongst the systems. • Bonuses paid on or after July 1, 2013 to any member will not be treated as compensation for retirement purposes. No member or employer contributions will be paid on bonuses.
Withdrawal of employee contributions	• A member is eligible for a withdrawal of their contributions when they terminate service and are either not eligible for or have not taken a retirement benefit. • The member receives the accumulated member contributions which consists of member contributions and regular interest. • Upon receipt of a refund of accumulated contributions a member's vested right to a monthly benefit is forfeited.
Member contributions interest credited (regular interest)	• Interest is credited to member accounts at the rates determined by the Board. • The current interest rate credited to member accounts is 0.25%.
Type of Plan	• Single-employer cost sharing

Membership eligibility	• All members of the Montana highway patrol including supervisors and assistant supervisors
Member contributions	• 12% of member's compensation, not covered by Guaranteed Annual Benefit Adjustment (GABA) • 12.05% of members compensation, covered by GABA • Effective July 1, 2014, member contributions increase 1% annually through the fiscal year ending 2017.
Employer contributions State contributions	• 28.15% of member's compensation • 10.18% of each member's compensation paid from the General Fund
Compensation period used in benefit calculation	• HAC = Highest Average Compensation • HAC is average of the highest 36 consecutive months (or shorter period of total service) of compensation paid by member. • **Hired on or after July 1, 2013:** 110% annual cap on compensation considered as part of a member's HAC.
Service retirement Eligibility	• 20 years of membership service • 2.6% of HAC x years of service credit
Early retirement eligibility and benefit	• **Hired before July 1, 2013:** Any age with 5 years of membership service; if discontinued from service other than for cause. • **Members hired on or after July 1, 2013:** Any age with 10 years of membership service; if discontinued from service other than for cause. • Normal retirement benefit calculated using HAC and service credit at early retirement, and reduced to the actuarial equivalent of a service retirement benefit based on a retirement age of 60.

Disability eligibility and benefit	**Duty-related disability:** • Any active member • Less than 20 years of membership service: 50% of HAC • 20 year or more of membership service: 2.6% of HAC x years of service credit **Regular disability:** • Any vested member • The actuarial equivalent of the normal retirement benefit based on retirement age of 60.
Survivor's eligibility and benefit	**Duty-related deaths**: • Active member • A monthly survivor benefit to the surviving spouse or dependent child: 50% of HAC of the member **Non-duty-related death** • Active or inactive member • Member's spouse will receive (or if there is no surviving spouse or after the surviving spouse dies, each dependent child for as long as they remain dependent children) will equally receive a benefit: The actuarial equivalent of the early retirement benefit. • A beneficiary may elect to receive the present value of the benefit as a single lump sum. • For retired members without a surviving spouse or dependent child, the member's designated beneficiary will receive a payment equal to the retired member's accumulated contributions reduced by any retirement benefits already paid.
Retirement benefit - form of payment	• The retirement benefit is paid for the retired member's life. • Upon the death of the retired member, the benefit is paid to the surviving spouse. • If there is no surviving spouse, or after the death of a surviving spouse, benefits are paid to the dependent children, if any, for as long as they remain dependent children.

Vesting Eligibility and Benefit	**Hired Prior to July 1, 2013** • 5 years of membership service **Hired on or after July 1, 2013** • 10 years of membership service • Accrued normal retirement benefit, payable when eligible for retirement. • In lieu of a pension, a member may receive a refund of accumulated contributions. • Upon receipt of a refund of contributions, a member's vested right to a monthly benefit is forfeited.
Post retirement benefit increases	• For retired members who either became active members on or after July 1, 1997 and before July 1, 2013, or who were hired before July 1, 1997 and elected to be covered under GABA will be paid each year in January equal to 3%. • For retired members who were hired prior to July 1, 1997 and did not elect GABA, the minimum monthly benefit provided is equal to 2% x service credit x the current base compensation of a probationary highway patrol officer. Such benefit may not exceed 60% of the current base compensation of a probationary highway patrol officer and the annual increase may not exceed 5% of the current benefit. • For retired members who became active members on or after July 1, 2013, and who have been retired at least 36 months, a GABA will be paid each year in January equal to 1.5%: • For non-GABA members who retired prior to July 1, 1991 and meet eligibility requirements, a supplemental lump sum payment will be made each year based on the increase in the consumer Price Index.
Changes since last valuation	• HPORS DROP effective October 1, 2015

HPORS Deferred Retirement Option Plan (DROP)

Eligibility	• Active members of HPORS with at least 20 years of membership service
Period	• Minimum of one month up to a maximum of five years. The member will not earn additional membership service or service credit.
Member Contributions	• While a member is working the member's contributions go into the DROP participant's DROP account.
Member contributions interest credited	• A member's DROP account will earn an interest rate equal to the actuarial assumed rate of return. Currently, the rate of return is 7.75%.

Employer Contributions	• While a member is working the member's employer and the State will pay the regular contributions to HPORS.
Terminate Employment	• When the member terminates employment at the end of the DROP period, the member will begin receiving the HPORS monthly retirement benefit. At this time, members will receive the DROP benefit as a lump sum payment or a direct rollover to another eligible retirement plan (as allowed by the IRS). If the member does not designate a distribution method within 60 days after termination of employment, the DROP benefit will be paid as a taxable lump sum.

Valuation Data

This chart is presented for informational purposes only. The counts shown in the valuation line were used for preparation of the liabilities disclosed within this report. The counts disclosed for the Annual Financial Report and the Summary of Results (page 1) match the Financial Statements at the request of the Board. The differences between counts, if any, have no material effect upon the liability calculation.

	Active	Disabled	Retirees and Beneficiaries	Terminated Vested Members	Terminated Non-Vested Members	Total
Participant Counts Used for Valuation	222	26	309	16	18	591
Disabled Members having attained normal retirement age		(20)	20			0
Beneficiaries of Disabled Members						0
Beneficiaries with less than one year of certain payments remaining						0
DROP Members	6		(6)			0
Other Adjustments						0
Participant Counts shown in the Annual Financial Report	228	6	323	16	18	591

Appendix D: Valuation Data

This valuation is based upon the membership of the System as of June 30, 2016. Membership data were supplied by the System and accepted for valuation purposes without audit. However, tests were performed to ensure that the data are sufficiently accurate for valuation purposes.

The salaries used in the tables and charts which follow are different than the salaries used for the Summary of Results on page 1. The valuation salaries are anticipated to be paid for the following fiscal year, whereas the Summary of Results salaries are applicable in the year ending on the valuation date.

Active Members	Number	Valuation Projected Salaries
Full-Time Members	213	$ 14,366,252
Part-Time Members	9	$ 484,063
Total Active Members*	222	$ 14,850,315

* Data from the 6 DROP participants are excluded from the table above.

Table D-1 contains summaries of the data for active members. For full-time members, values shown in the tables are the numbers of members and their total and average annual salaries. For part-time members, only the numbers of members are shown.

Table D-2 presents distributions of the following:

- Members receiving service retirement benefits.
- Members receiving disability retirement benefits.
- Survivors of deceased retired members receiving benefits.
- Survivors of deceased active members.
- Terminated vested members.

Table D-3 is a reconciliation of membership data from June 30, 2015 to June 30, 2016.

The following is a summary of retired members and beneficiaries currently receiving benefits. The chart reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 40 for an explanation of the number of annuitants used for valuation purposes.

Type of Annuitant	Number	Annual Benefits	Average Annual Benefits
Service Retirement	234	$ 8,153,659	$ 34,845
DROP Members	6	270,076	45,013
Total Service Retired Members	240	$ 8,423,735	$ 35,099
Survivors of Deceased Retired Members	57	$ 1,409,310	$ 24,725
Survivors of Deceased Active Members	12	229,614	19,134
Total Survivors and Beneficiaries	69	$ 1,638,924	$ 23,753
Disability Retirement	26	660,369	25,399
Total Annuitants	335	$ 10,723,028	$ 32,009

Terminated Members with Contributions Not Withdrawn	Number
Vested Terminated Members	16
Non-Vested Terminated Members	18
Total Terminated Members	34

Table D-1:
Active Members Distribution of
Full-Time Employees and Salaries
as of June 30, 2016

Number of Employees

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25			2										2
25 to 29		8	10	4	1								23
30 to 34		2	11	8	14	3							38
35 to 39		8	1	5	8	15	4						41
40 to 44				5	10	13	13						41
45 to 49		1		2	6	9	9	9					36
50 to 54					4	7	6	2	2				21
55 to 59					1	2	4	1	1				9
60 to 64					1					1			2
65 to 69													
70 and up													
Totals	-	19	24	24	45	49	36	12	3	1	-	-	213

* Data from the 6 DROP participants are excluded form the table above.

Table D-1:
Active Members Distribution of
Full-Time Employees and Salaries
as of June 30, 2016

Annual Salaries in Thousands

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25			121										121
25 to 29		458	601	235	72								1,365
30 to 34		115	654	485	939	250							2,443
35 to 39		479	69	309	534	1,024	296						2,712
40 to 44				301	651	867	1,013						2,831
45 to 49		55		119	399	645	660	753					2,633
50 to 54					259	491	396	163	171				1,479
55 to 59					62	139	292	70	71				634
60 to 64					61					87			148
65 to 69													-
70 and up													-
Totals	-	1,107	1,446	1,449	2,978	3,416	2,656	986	242	87	-	-	14,366

* Data from the 6 DROP participants are excluded form the table above.
The salary shown in the above chart was used for valuation purposes and assumes pay increases for the year.

Table D-1:
Active Members Distribution of
Full-Time Employees and Salaries
as of June 30, 2016

Average Annual Salary

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25			60,705										60,705
25 to 29		57,212	60,076	58,682	72,269								59,367
30 to 34		57,469	59,452	60,588	67,082	83,393							64,288
35 to 39		59,906	69,406	61,878	66,809	68,254	73,896						66,144
40 to 44				60,149	65,059	66,687	77,912						69,052
45 to 49		55,267		59,720	66,577	71,713	73,366	83,696					73,143
50 to 54					64,682	70,083	65,991	81,273	85,468				70,416
55 to 59					62,302	69,558	72,912	69,700	70,832				70,400
60 to 64					61,265					86,676			73,970
65 to 69													
70 and up													
Totals		58,271	60,231	60,375	66,183	69,715	73,787	82,126	80,589	86,676			67,447

* Data from the 6 DROP participants are excluded form the table above.
The salary shown in the above chart was used for valuation purposes and assumes pay increases for the year.

Table D-1:
Active Members Distribution of
Part-Time Employees
as of June 30, 2016

Number of Employees

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25	2												2
25 to 29	3	1											4
30 to 34	1		1		1								3
35 to 39													
40 to 44													
45 to 49													
50 to 54													
55 to 59													
60 to 64													
65 to 69													
70 and up													
Totals	6	1	1	-	1	-	-	-	-	-	-	-	9

Table D-2:
Distribution of Inactive Lives

The chart reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 40 for an explanation of the number of annuitants used for valuation purposes.

Members Receiving Service Retirement Benefits as of June 30, 2016

Age	Number of Persons	Annual Benefits	Average Annual Benefits
<50	12	$ 458,850	$ 38,238
50 to 54	28	1,072,834	38,315
55 to 59	21	748,308	35,634
60 to 64	18	632,036	35,113
65 to 69	48	1,790,171	37,295
70 to 74	37	1,373,416	37,119
75 to 79	32	1,075,219	33,601
80 to 84	28	709,735	25,348
85 to 89	8	240,029	30,004
90 and up	2	53,062	26,531
Totals	234	$ 8,153,659	$ 34,845

Members Receiving Disability Retirement Benefits as of June 30, 2016

Age	Number of Persons	Annual Benefits	Average Annual Benefits
<50	6	$ 166,990	$ 27,832
50 to 54	7	161,548	23,078
55 to 59	2	54,979	27,490
60 to 64	5	128,462	25,692
65 to 69	2	51,157	25,579
70 to 74	2	47,785	23,893
75 to 79	2	49,448	24,724
80 to 84	-	-	-
85 to 89	-	-	-
90 and up	-	-	-
Totals	26	$ 660,369	$ 25,399

Table D-2:
Distribution of Inactive Lives

The chart reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 40 for an explanation of the number of annuitants used for valuation purposes.

Survivors of Deceased Retired Members as of June 30, 2016

Age	Number of Persons	Annual Benefits	Average Annual Benefits
<50	-	$ -	$ -
50 to 54	2	67,230	33,615
55 to 59	4	68,063	17,016
60 to 64	2	62,150	31,075
65 to 69	6	117,386	19,564
70 to 74	5	128,966	25,793
75 to 79	13	366,247	28,173
80 to 84	11	236,346	21,486
85 to 89	10	278,593	27,859
90 and up	4	84,329	21,082
Totals	57	$ 1,409,310	$ 24,725

Survivors of Deceased Active Members as of June 30, 2016

Age	Number of Persons	Annual Benefits	Average Annual Benefits
<50	7	$ 105,424	$ 15,061
50 to 54	1	6,863	6,863
55 to 59	1	24,926	24,926
60 to 64	-	-	-
65 to 69	1	12,253	12,253
70 to 74	2	80,148	40,074
75 to 79	-	-	-
80 to 84	-	-	-
85 to 89	-	-	-
90 and up	-	-	-
Totals	12	$ 229,614	$ 19,134

Table D-2:
Distribution of Inactive Lives

The chart reflects the counts and benefits used for valuation purposes as a result of data processing. Please refer to the chart on page 40 for an explanation of the number of annuitants used for valuation purposes.

DROP Members as of June 30, 2016

Age	Number of	Annual Benefits	Average Annual
<50	2	$ 80,013	$ 40,007
50 to 54	2	76,338	38,169
55 to 59	1	48,861	48,861
60 to 64	1	64,863	64,863
65 to 69	-	-	-
70 to 74	-	-	-
75 to 79	-	-	-
80 to 84	-	-	-
85 to 89	-	-	-
90 and up	-	-	-
Totals	6	$ 270,076	$ 45,013

Terminated Vested Members as of June 30, 2016
Number of Persons

Age	Number
<25	
25 to 29	
30 to 34	1
35 to 39	
40 to 44	4
45 to 49	6
50 to 54	2
55 to 59	3
60 to 64	
65 to 69	
70 and above	
Total	16

Table D-3:
Data Reconciliation

The following table shows a reconciliation of the participants used in the previous valuation to this valuation. This chart reflects the counts used for valuation purposes as a result of data processing.

	Active Members*	Terminated Vested Members	Service Retired Members**	Disabled Members	Survivors and Beneficiaries
June 30, 2015 Valuation	241	11	222	25	80
Refunds and Non-Vested Terminations	(7)				
Vested Terminations	(5)	5			
Service Retirements	(14)		19		(5)
Disability Retirements	(1)			1	
Deaths			(2)		(4)
New Entrants	8				
Rehires					
Other			1		*(2)*
June 30, 2016 Valuation	222	16	240	26	69

* Excludes members in DROP
** Includes members in DROP

Comparative Schedules

This section contains tables that summarize the experience of the System shown in present and past valuation reports.

Table E-1 shows a summary of the active members covered as of the various valuation dates.

Table E-2 shows a summary of the retired and inactive members as of the various valuation dates.

Table E-3 summarizes the contribution rates determined by each annual actuarial valuation.

Table E-1:
Active Membership Data

Valuation Date (June 30)	Actives	Annual Salaries in Thousands	Average Annual Salary	Average Age	Average Years of Service	Average Hire Age
2016*	228	15,276	67,000	40.2	10.0	30.2
2015	241	14,503	60,176	40.4	10.0	30.4
2014	229	13,901	60,704			
2013	219	13,000	59,362			
2012	218	13,514	61,990			

* Number of actives members includes members in DROP

Table E-2:
Members in Receipt of Annuities and Inactive Membership Data

		All Annuitants					Terminated Members	
Valuation Date (June 30)	Number	Annual Benefits in Thousands	Average Annual Benefit	Average Current Age	Average Age at Retirement	Average Service at Retirement	Number Vested Terminated	Number Non-Vested Terminated
2016*	329	10,453	31,772	68.1	50.7	22.8	16	18
2015	327	9,892	30,251	67.6	48.8	22.2	11	13
2014	322	9,336	28,994				11	14
2013	310	8,782	28,329				14	11
2012	305	8,085	26,508				11	10

* Number of members in receipt of annuities excludes members in DROP.

Table E-3:
Contribution Rates

Valuation Date (June 30)	Contribution Rates*** Employee	Employer/State	Total	Normal Cost Rate*	UAAL Rate**
2016	13.05%	38.33%	51.38%	25.18%	26.20%
2015	12.05	38.33	50.38	25.49	24.89
2014	11.05	38.33	49.38	24.69	24.69
2013	10.05	38.33	48.38	25.23	23.15
2012	9.05	36.33%	45.38	23.60	21.78

* Includes administrative expenses starting with the 2014 Valuation Date
** The UAAL rate is the amount available to amortize the UAAL. It is equal to the total contribution rate, minus the normal cost rate.
*** Rates shown below are for the fiscal year following the valuation date.

Appendix E: Financial Statement Information

The information presented in the required supplementary schedules was determined as part of the actuarial valuation as of June 30, 2016. Additional information as of the latest actuarial valuation follows.

Valuation date	June 30, 2016
Actuarial cost method	Entry Age Normal
Amortization method	Open
Remaining amortization period	30 Years
Asset valuation method	Four-year smoothed market
Actuarial assumptions:	
Investment rate of return*	7.75%
General wage growth*	4.00%
Merit salary increases	0.0% - 7.3%
*Includes inflation	3.00%

Gain and Loss in Accrued Liability During Years Ended June 30 Resulting from Differences Between Assumed Experience and Actual Experience						
	Gain or (Loss) for Year Ending June 30, (expressed in thousands)					
Type of Activity	2011	2012	2013	2014	2015	2016
Investment Income on Actuarial Value of Assets	$ (7,496)	$ (4,179)	$ 3,921	$ 5,631	$ 2,148	$ 1,255
Combined Liability Experience	2,128	(5,603)	1,648	(267)	(181)	(2,779)
(Loss)/Gain During Year from Financial Experience	$ (5,368)	$ (9,782)	$ 5,569	$ 5,364	$ 1,967	$ (1,524)
Non-Recurring Items	0	0	(2,179)	0	(1,692)	0
Composite Gain or (Loss) During Year	$ (5,368)	$ (9,782)	$ 3,390	$ 5,364	$ 275	$ (1,524)

Schedule of Funding Progress (expressed in thousands)						
Valuation Date June 30,	Actuarial Value of Assets	Actuarial Accrued Liability (AAL)	Funded Ratio	Unfunded AAL (UAAL)	Covered Payroll	UAAL as a Percentage of Covered Payroll
2016	$ 133,869	$ 203,326	66%	$ 69,457	$ 15,276	455%
2015	125,676	192,983	65%	67,307	14,549	463%
2014	117,226	183,400	64%	66,174	14,149	468%
2013	105,736	175,594	60%	69,858	13,484	518%
2012	96,655	167,824	58%	71,169	13,618	523%
2011	95,274	155,742	61%	60,468	12,472	485%

Solvency Test
Aggregate Accrued Liabilities for
(expressed in thousands)

Valuation Date June 30,	Active Member Contributions (1)	Retirees & Beneficiaries (2)	Active Member Employer Financed Contributions (3)	Actuarial Value of Reported Assets	Portion of Accrued Liability Covered by Reported Assets (1)	(2)	(3)
2016	$ 12,535	$ 146,267	$ 44,524	$ 133,869	100%	83%	0%
2015	12,102	133,628	47,252	125,676	100%	85%	0%
2014	11,507	126,478	45,416	117,226	100%	84%	0%
2013	11,339	117,914	46,341	105,736	100%	80%	0%
2012	11,455	110,876	45,493	96,655	100%	77%	0%
2011	10,795	107,035	37,911	95,274	100%	79%	0%

The following definitions are largely excerpts from a list adopted in 1981 by the major actuarial organizations in the United States. In some cases the definitions have been modified for specific applicability to the Highway Patrol Officers' Retirement System. Defined terms are capitalized throughout this Appendix.

Accrued Benefit

The amount of an individual's benefit (whether or not vested) as of a specific date, determined in accordance with the terms of a pension plan and based on compensation and service to that date.

Actuarial Accrued Liability

That portion, as determined by a particular Actuarial Cost Method, of the Actuarial Present Value of pension plan benefits and expenses which is not provided for by future Normal Costs.

Actuarial Assumptions

Assumptions as to the occurrence of future events affecting pension costs, such as: mortality, withdrawal, disablement, and retirement; changes in compensation, rates of investment earnings, and asset appreciation or depreciation; procedures used to determine the Actuarial Value of Assets; and other relevant items.

Actuarial Cost Method

A procedure for determining the Actuarial Present Value of pension plan benefits and expenses and for developing an actuarially equivalent allocation of such value to time periods, usually in the form of a Normal Cost and an Actuarial Accrued Liability.

Actuarial Gains and Losses

A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions during the period between two Actuarial Valuation dates, as determined in accordance with a particular Actuarial Cost Method.

Actuarial Present Value

The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions.

Actuarial Valuation

The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a pension plan.

Actuarial Value of Assets

The value of cash, investments and other property belonging to a pension plan, as used by the actuary for the purpose of an Actuarial Valuation.

Actuarially Equivalent

Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.

Amortization Payment

That portion of the pension plan contribution which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Entry Age Actuarial Cost Method

A method under which the Actuarial Present Value of the Projected Benefits of each individual included in an Actuarial Valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit ages. The portion of this Actuarial Present Value allocated to a valuation year is called the Normal Cost. The portion of this Actuarial Present Value not provided for at a valuation date by the Actuarial Present Value of future Normal Costs is called the Actuarial Accrued Liability.

Market Value of Assets

The fair value of cash, investments and other property belonging to a pension plan that could be acquired by exchanging them on the open market.

Normal Cost

That portion of the Actuarial Present Value of pension plan benefits and expenses which is allocated to a valuation year by the Actuarial Cost Method.

Projected Benefits

Those pension plan benefit amounts which are expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age and past and anticipated future compensation and service credits.

Unaccrued Benefit

The excess of an individual's Projected Benefits over the Accrued Benefits as of a specified date.

Unfunded Actuarial Accrued Liability

The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.