

Michigan State Employees' Retirement System and Michigan Judges' Retirement System

October 1, 2012 – September 30, 2017

Experience Studies



Agenda

- Introduction
- Experience Study Process
- Demographic Assumptions
- Economic Assumptions
- Actuarial Methods
- Effect on Valuation Results

Introduction

Introduction

- Each year the actuarial liabilities of SERS and JRS are calculated as part of the September 30th valuation
- In order to perform the valuation, we must make assumptions about the future experience of the Systems with regard to various risk areas
- The results of the liability calculations depend upon those assumptions

Introduction - Risk Areas

- Demographic Risk Areas
 - Rates of withdrawal
 - Rates of disability
 - Rates of retirement
 - Rates of mortality
- Economic Risk Areas
 - Investment return
 - Inflation
 - Patterns of salary increases
 - Payroll growth

Introduction

- Assumptions should be carefully chosen and continually monitored
 - Continued use of outdated assumptions can lead to ...

Introduction

- Understated costs resulting in:
 - Sharp increases in required contributions at some point in the future leading to a large burden on future taxpayers
 - In extreme cases, an inability to pay benefits when due

Introduction

- Overstated costs resulting in:
 - Benefit levels that are kept below the level that could be supported by the employer and member contribution rates
 - An unnecessarily large burden on the current generation of members, employers and taxpayers

Introduction

- No single set of assumptions will be suitable indefinitely
- Things change, and our understanding of things (whether or not they are changing) also changes
- In general, the suggested time period for reviewing assumptions is about every 4 or 5 years
- A systematic review of assumptions is called an “Experience Study”

Experience Study Process

Experience Study Process

- Our analysis was based upon data submitted for the 2012 through 2017 annual valuations
- We compared trends with those observed in prior studies
- Generally, we give confirmed trends more credibility than non-confirmed trends
- Philosophy: Do not overreact to results from any single experience period
 - It is better to make a series of small changes in the right direction, rather than a single large change that could turn out with hindsight to be in the wrong direction

Experience Study Process – Liability Weighting

- Decrement assumptions have traditionally been developed based on population weighted crude rates
- In a plan with two members the same age, if one of them leaves, the rate of withdrawal at that age is 50% (very simplified example)
- However, certain decrements have continued to generate small gains or losses despite adjusting rates in previous experience studies
- This year, we analyzed the data to see if this could be due to a tendency for human behavior to be influenced by the relative value of liabilities
- This concept is called Liability Weighting

Experience Study Process – Liability Weighting Example

- Consider the same plan with only two members (who are both the same age) and the withdrawal rate of 50%
- Suppose one member has liability of \$10k and the other has liability of \$90k
- Even though the decrement rate of withdrawal is 50%, the net gain or loss to the system will be less if the \$10k liability member leaves than if the \$90k liability member leaves
- Perhaps if the person with \$10k liability leaves, we should set the withdrawal rate at 10% since only 10% of the liability has left

Experience Study Process – Liability Weighting

- The analysis seemed to indicate that people with lower accrued benefit levels and lower liabilities are more likely to quit than other people of the same age
- In recognition of these results, we developed age-based withdrawal rates based on relative liability weighting in addition to pure population statistics

Experience Study Process – Benefits Weighting

- An analogous benefits-weighted approach was employed in the analysis of post-retirement mortality
- The analysis seemed to indicate that people with higher accrued benefit levels generally live longer than other people of the same age
- In recognition of these results, we developed post-retirement mortality rates based on a benefits weighting analysis

Experience Study Process

- Per Subsection 38(1) of the MSERS statute (Act 240 of the Public Acts of 1943, as amended) and Section 301(1)(a) of the MJRS statute (Act 234 of the Public Acts of 1992, as amended) the actuarial assumptions are adopted by the Retirement Board and the Department of Technology, Management and Budget after consultation with the actuary and the State Treasurer
- The recommended changes are proposed for the September 30, 2018 and later valuations

Demographic Assumptions

Demographic Assumptions – Rates of Retirement

- The retirement assumptions were analyzed both for unreduced and reduced retirements:
 - Reduced retirements were analyzed as one group for both SERS and JRS
 - Unreduced retirements were analyzed separately for SERS as Conservation Officers, Corrections Officers and Other Members
 - Unreduced retirements were analyzed as one group for JRS
- Generally speaking, more retirements being observed over the 5-year period than anticipated by the actuarial assumptions results in an actuarial loss

Demographic Assumptions – Rates of Retirement

- For unreduced retirements, the following experience was observed over the past 5 years
 - SERS Conservation Officers:
 - First year of eligibility, there were fewer retirements than expected
 - After the first year of eligibility, there were fewer retirements than expected
 - SERS Corrections Officers: More retirements than expected
 - SERS Other Members: Fewer retirements than expected
 - JRS: More retirements than expected

Demographic Assumptions – Rates of Retirement

- For reduced retirements, there were fewer retirements than expected over the past 5 years for both SERS and JRS
- The following changes are being recommended:
 - No change to the unreduced retirement rates for SERS Conservation Officers and SERS Other Members
 - Increase the unreduced retirement rates for SERS Corrections Officers and JRS
 - No change to the reduced retirement rates for JRS
 - Decrease the reduced retirement rates for SERS

Demographic Assumptions – Withdrawal

- The withdrawal assumption is analyzed based both on age and service
 - Since the SERS plan has been closed to new hires for over 15 years, the OPEB plan membership was analyzed for members with 5 or fewer years of service
- The use of a select (i.e., first 5 years of service) and ultimate (i.e., age-based for service greater than 5 years) approach is still reasonable
- Generally speaking, more withdrawals being observed over the experience period than anticipated by the actuarial assumptions results in an actuarial gain (SERS)
- Currently, population-weighted select and ultimate withdrawal rates have been used in the SERS and JRS actuarial valuations

Demographic Assumptions – Withdrawal

- For the current experience study, we recommend that ultimate withdrawal rates be developed based on a population-weighted approach
- For withdrawals in the first 5 years, the following experience was observed over the past 5 years
 - SERS (OPEB population only): more withdrawals than expected
 - JRS: no withdrawals experienced by the plan during the 5-year period
- For withdrawals after 5 years of service, the following experience was observed over the past 5 years (liability-weighted approach)
 - SERS (OPEB population): more withdrawals than expected
 - SERS (Pension population): fewer withdrawals than expected
 - JRS: no withdrawals experienced by the plan during the 5-year period

Demographic Assumptions – Withdrawal

- The following changes are recommended for the select withdrawal rates:
 - Increase the withdrawal rates for SERS
 - No change in the withdrawal rates for JRS
- The following changes are recommended for the ultimate withdrawal rates:
 - No change in the withdrawal rates for SERS
 - No change in the withdrawal rates for JRS
- The same withdrawal rates will be used for both the pension and retiree health actuarial valuations

Demographic Assumptions – Disability

- Experience related to disabilities was close to assumed experience
- Therefore, no changes are being recommended to the disability rates for SERS and JRS

Demographic Assumptions

Summary of Changes (# Counts) - SERS

Decrement Risk Area	Actual Number	Expected		
		Present Assumptions	Proposed Assumptions	Change
<i>Age and Service Retirement</i>				
Conservation Officers 1st Year Eligible	7	9.2	9.2	0.0
Conservation Officers After 1st Year Eligible	17	25.4	25.4	0.0
Corrections Officers	2,213	1,468.2	1,895.7	427.5
Others	4,095	4,117.4	4,117.4	0.0
<i>Early Retirement</i>				
	259	583.2	272.1	(311.1)

Demographic Assumptions

Summary of Changes (# Counts) - SERS

<i>Withdrawal</i>				
First 5 Years of Service - <i>Population-Weighted Results</i>	6,396	3,949.0	5,180.3	1,231.3
Over 5 Years of Service - <i>Population-Weighted Results</i>	2,538	1,868.8	1,868.8	0.0
Over 5 Years of Service - <i>Liability-Weighted Results*</i>	989	1,197.4	1,197.4	0.0
<i>Disability</i>				
Non-Duty Disability	211	177.2	177.2	0.0
Duty-Disability	29	19.7	19.7	0.0

** Actual and expected results and exposures for benefits-weighted and liability-weighted involve a scaling factor of \$100,000.*

Demographic Assumptions

Summary of Changes (# Counts) - JRS

Decrement Risk Area	Actual	Expected		
		Present Assumptions	Proposed Assumptions	Change
<i>Age and Service Retirement</i>	98	74.3	100.3	26.0
<i>Early Retirement</i>	0	0.1	0.1	0.0
<i>Withdrawal</i>				
<i>Population-Weighted Results</i>	0	1.1	1.1	0.0
<i>Liability-Weighted Results*</i>	0	3.7	3.7	0.0
<i>Disability</i>	0	0.1	0.1	0.0

* Actual and expected results and exposures for benefits-weighted and liability-weighted involve a scaling factor of \$100,000.

Demographic Assumptions – Retiree Mortality

- Post-retirement mortality is an important, but relatively stable ingredient in cost calculations. This assumption should be updated from time to time to reflect longevity improvements.
- ASOP No. 35 states with regard to the mortality assumption:
 - “The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement.”
- Based on the previous experience study, the current, assumed mortality rates assume 9% fewer deaths for SERS males, 13% fewer deaths for SERS females (used for JRS females), and 13% fewer deaths for JRS males than those observed during the period 2007-2012 on a population-weighted basis.

Demographic Assumptions – Retiree Mortality

- The proposed rates take a different approach and assume that future mortality rates will continue to decline with each generation
 - For this “generational” approach, we remove any static margin from the base tables and apply a mortality improvement scale to project rates getting lower each year in the future. This means that next year’s 65-year-old will have a slightly longer life expectancy than this year’s, etc.
- The approach we have taken is based on the RPEC_2014 model described by the Society of Actuaries (SOA). The base mortality tables we select from are the RP-2014 mortality tables. That is, our starting point was the RP-2014 tables adjusted for mortality improvement back to the observation period base year of 2006. The improvement scales we consider are the 2-dimensional MP-2017 mortality improvement scales.

Demographic Assumptions – Retiree Mortality

- It is anticipated that the SOA will release new improvement scales annually. For purposes of SERS and JRS valuations, we recommend maintaining the MP-2017 improvement scales until the next experience study.
- The first step in this procedure is to select the appropriate version of the RP-2014 mortality tables:
 - We compared the experience of the healthy retiree to the RP-2014 adjusted tables.
 - Using limited fluctuation credibility, we scale the RP-2014 mortality tables to better fit the SERS and JRS mortality experience during 2012-2017.
 - For SERS, we recommend adopting 93% of the male and 98% of the female RP-2014 Healthy Annuitant Mortality Tables, adjusted for mortality improvement using projection scale MP-2017 from 2006.
 - For JRS, we recommend adopting 100% of the male and 100% of the female RP-2014 Healthy Annuitant Mortality Tables, adjusted for mortality improvement using projection scale MP-2017 from 2006.

Demographic Assumptions – Retiree Life Expectancy – SERS

Sample Attained Ages	Future Life Expectancy (years)							
	Present		Proposed 2017*		Proposed 2022*		Proposed 2027*	
	Men	Women	Men	Women	Men	Women	Men	Women
45	37.15	39.85	39.87	41.99	40.37	42.46	40.87	42.94
50	32.44	35.09	34.93	36.98	35.43	37.45	35.93	37.92
55	27.83	30.41	30.17	32.06	30.65	32.51	31.13	32.96
60	23.39	25.85	25.60	27.32	26.03	27.72	26.48	28.15
65	19.21	21.52	21.26	22.78	21.63	23.15	22.04	23.54
70	15.34	17.51	17.15	18.45	17.49	18.80	17.85	19.16
75	11.83	13.87	13.33	14.41	13.64	14.74	13.96	15.07
80	8.79	10.64	9.92	10.80	10.20	11.08	10.47	11.36

* Life expectancy in future years are determined by the fully generational MP-2017 projection scale.

Demographic Assumptions – Retiree Life Expectancy – JRS

Sample Attained Ages	Future Life Expectancy (years)							
	Present		Proposed 2017*		Proposed 2022*		Proposed 2027*	
	Men	Women	Men	Women	Men	Women	Men	Women
45	37.70	40.35	39.09	41.78	39.58	42.25	40.09	42.73
50	32.99	35.59	34.18	36.78	34.68	37.25	35.17	37.71
55	28.37	30.90	29.45	31.86	29.93	32.31	30.41	32.77
60	23.94	26.34	24.92	27.13	25.36	27.53	25.81	27.97
65	19.74	21.98	20.64	22.61	21.01	22.97	21.42	23.37
70	15.83	17.93	16.59	18.29	16.92	18.65	17.28	19.00
75	12.26	14.25	12.83	14.27	13.14	14.60	13.45	14.93
80	9.13	10.95	9.49	10.67	9.76	10.95	10.03	11.24

* Life expectancy in future years are determined by the fully generational MP-2017 projection scale.

Demographic Assumptions – Disabled and Active Mortality

- Disabled mortality experience during the study period was not sufficient to be fully credible. We recommend adopting 100% of the male and female RP-2014 Disabled Annuity Mortality Tables, adjusted for mortality improvement using projection scale MP-2017 from 2006 for SERS and JRS.
- Active mortality experience during the study period was not sufficient to be fully credible. We recommend adopting 100% of the male and female RP-2014 Employee Mortality Tables, adjusted for mortality improvement using projection scale MP-2017 from 2006 for SERS and JRS.

Demographic Assumptions – Summary of Mortality Experience Results - SERS

Decrement Risk Area	Actual	Expected		
		Present Assumptions	Proposed Assumptions	Change
<i>Mortality - Population-Weighted Results</i>				
Non-Disabled Retired Lives - Male	3,034	2,878.6	2,642.6	(236.0)
- Female	3,282	2,940.4	2,996.9	56.5
Disabled Retired Lives - Male	296	228.5	218.0	(10.5)
- Female	356	349.5	296.9	(52.6)
<i>Mortality - Benefits-Weighted Results*</i>				
Non-Disabled Retired Lives - Male	921	1,010.0	941.0	(69.0)
- Female	571	566.0	578.0	12.0
Disabled Retired Lives - Male	55	43.0	42.7	(0.3)
- Female	55	49.4	44.5	(4.9)

- Actual and expected results and exposures for benefits-weighted and liability-weighted involve a scaling factor of \$100,000.

Demographic Assumptions – Summary of Mortality Experience Results - JRS

Decrement Risk Area	Actual	Expected		
		Present Assumptions	Proposed Assumptions	Change
<i>Mortality - Population-Weighted Results</i>				
Non-Disabled Retired Lives - Male	77	74.8	75.9	1.1
- Female	10	6.0	6.6	0.6
Disabled Retired Lives - Male	0	0.3	0.3	0.0
- Female	0	0.5	0.3	(0.2)
<i>Mortality - Benefits-Weighted Results*</i>				
Non-Disabled Retired Lives - Male	31	32.0	32.7	0.7
- Female	7	3.4	3.6	0.2
Disabled Retired Lives - Male	0	0.1		(0.1)
- Female	0	0.2	0.2	0.0

- Actual and expected results and exposures for benefits-weighted and liability-weighted involve a scaling factor of \$100,000.

Demographic Assumptions – Impact of Demographic Changes on Liability – SERS

- Impact of proposed demographic changes on actuarial accrued liabilities

Decrement Risk Area	Relative Liability Impact
<i>Age and Service Retirement</i> Conservation Officers 1st Year Eligible Conservation Officers After 1st Year Eligible Corrections Officers Others	No Change No Change Small Increase No Change
<i>Early Retirement</i>	Small Decrease
<i>Withdrawal</i> First 5 Years of Service Over 5 Years of Service	Small Decrease No Change

Demographic Assumptions – Impact of Demographic Changes on Liability – JRS

- Impact of proposed demographic changes on actuarial accrued liabilities

Decrement Risk Area	Relative Liability Impact
<i>Age and Service Retirement</i>	Small Increase
<i>Early Retirement</i>	No Change
<i>Withdrawal</i>	No Change
<i>Disability</i>	No Change

Demographic Assumptions – Impact of Demographic Changes on Liability – JRS

- Impact of proposed demographic changes on actuarial accrued liabilities

Decrement Risk Area	Relative Liability Impact
<p><i>Mortality</i></p> <p>Non-Disabled Retired Lives - Male - Female</p> <p>Disabled Retired Lives - Male - Female</p> <p>Pre-Retirement Lives - Male - Female</p>	<p>Large Increase Large Increase</p> <p>Small Increase Small Increase</p> <p>Small Decrease Small Decrease</p>

Economic Assumptions

Economic Assumptions – Current

- The economic assumptions currently in place are presented below:
 - Investment Return (Pension):
 - 7.00% SERS and 6.75% JRS
 - Net of administrative and investment expenses
 - Wage Inflation – 3.50%
 - Price Inflation – 2.50%
 - Investment Return (Retiree Health):
 - 7.35% SERS and 7.50% JRS
 - Payroll Growth Assumption – 3.50%

Economic Assumptions – ASOP No. 27

- Guidance regarding the selection of economic assumptions is governed by Actuarial Standard of Practice (ASOP) No. 27
- ASOP No. 27 requires that the selected economic assumptions be individually reasonable and consistent with one another
- That is, the selection of the price inflation assumption should be consistent with the selection of the wage inflation and investment return assumptions

Economic Assumptions – Data

- Sources of information used to establish economic assumption recommendations:
 - Price Inflation
 - Cleveland Federal Reserve’s inflation expectations
 - Philadelphia Federal Reserve quarterly survey of Society of Professional Forecasters
 - Comparison of Treasury yields and TIPS
 - Capital market expectations of surveyed investment consultants
 - Investment Return
 - Capital market expectations of plan’s investment consultant
 - Capital market expectations of other investment consultants
 - Wage Inflation, Merit and Seniority and Payroll Growth
 - Actual SERS and JRS experience over the last 5 years (i.e., merit and seniority pay increases)
 - Historical observations of inflation statistics (both price and wage) both nationally and for SERS and JRS

Economic Assumptions – Price Inflation

- Cleveland Federal Reserve publishes inflation expectations over various time horizons
 - April 2018 expectations
 - 10-year inflation expectation is 1.98%
 - 20-year inflation expectation is 2.14%
 - 30-year inflation expectation is 2.26%
- Philadelphia Federal Reserve survey provides an expectation for the next 10 years
 - Most recent survey results (first quarter of 2018) indicates a 2.25% expectation
- As of April 2, 2018, comparison of 20-year Treasury yields and 20-year TIPS provide an approximation for market price inflation expectations over the next 20 years
 - Indicates a 2.04% expectation

Economic Assumptions – Price Inflation

- Average of eight investment consultants' price inflation expectations is 2.27%
- GRS' preferred price inflation assumption is 2.25%

Economic Assumptions – Wage Inflation

- Wage inflation consists of two components
 - A portion due to pure price inflation (i.e., increases due to changes in the CPI), and
 - Increases in average salary levels in excess of pure price inflation

Economic Assumptions – Wage Inflation

- Below shows the difference between the increase in National Average Earnings and price inflation over various 10-year periods:
 - December 31, 2017: 0.8%
 - December 31, 2007: 1.3%
 - December 31, 1997: 0.7%
 - December 31, 1987: 0.1%
 - December 31, 1977: 0.3%

Economic Assumptions – Wage Inflation

- We are generally comfortable with the wage inflation assumption exceeding the price inflation assumption by 0.50% to 1.00%
- Given our preferred price inflation assumption of 2.25%, our preferred assumption is for the wage inflation assumption to exceed the price inflation assumption by 0.50%
- This would result in a wage inflation assumption of 2.75%
 - Payroll growth assumption for amortization purposes for the OPEB plans would be set equal to the wage inflation assumption

Economic Assumptions – Ultimate Health Care Trend Rate

- For retiree health valuation purposes, the ultimate health care trend rate is sometimes set equal to the wage inflation assumption
- However, we are somewhat uncomfortable having an ultimate health care trend rate below 3.00%
- GRS' recommendation for an ultimate health care trend rate is 3.00%

Economic Assumptions – Merit and Seniority

- Total pay increases for an individual consist of a portion due to wage inflation and a portion due to an individual's on the job performance (i.e., merit and seniority)
- The merit and seniority portion of the pay increase assumption was analyzed over the 5-year period
- Continued use of the current age-based structure of the assumption was deemed to remain appropriate based upon the analysis performed
- No changes are being recommended to the merit and seniority assumptions based upon the experience of the last 5 years for SERS and JRS

Economic Assumptions – Investment Return

- The investment return assumption is the actuarial assumption that has the largest effect on actuarial valuation results
- As more of the actuarial accrued liabilities are related to non-active members, the nominal (as opposed to real) investment return assumption becomes a more prominent factor
- Since one of SERS' and JRS' fundamental financial objectives is the receipt of level contributions as a % of payroll over time to finance the additional benefits that members accrue, the discount rate assumption is based upon the investment return assumption

Economic Assumptions – Investment Return

- Based upon SERS' and JRS' current target asset allocations, future return expectations of various investment consultants (including SERS and JRS current investment consultant) were analyzed
- The next few slides show the results of the analysis
 - Capital market expectations are already net of passive investment expenses; going forward, administrative expenses are recommended to be funded through normal cost addition
 - \$6.5 million be included for SERS pension and \$350,000 be included for JRS pension
 - 0.02% of payroll for SERS retiree health and \$100,000 be included for JRS retiree health
 - Final expected nominal investment return results are based upon a 2.25% price inflation assumption

Economic Assumptions – Investment Return

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)-(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Plan Incurred Administrative and Active Management Expenses	Recognized Value for Active Management	Expected Nominal Return Net of Expenses (6)-(7)+(8)	Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	6.29%	2.20%	4.09%	2.25%	6.34%	0.00%	0.00%	6.34%	12.37%
2	6.56%	2.00%	4.56%	2.25%	6.81%	0.00%	0.00%	6.81%	11.70%
3	6.92%	2.26%	4.66%	2.25%	6.91%	0.00%	0.00%	6.91%	11.34%
4	7.23%	2.50%	4.73%	2.25%	6.98%	0.00%	0.00%	6.98%	13.91%
5	7.38%	2.50%	4.88%	2.25%	7.13%	0.00%	0.00%	7.13%	13.32%
6	8.18%	2.21%	5.97%	2.25%	8.22%	0.00%	0.00%	8.22%	14.41%
7	8.29%	2.25%	6.04%	2.25%	8.29%	0.00%	0.00%	8.29%	10.95%
8	8.58%	2.25%	6.33%	2.25%	8.58%	0.00%	0.00%	8.58%	17.27%
Average	7.43%	2.27%	5.16%	2.25%	7.41%	0.00%	0.00%	7.41%	13.16%

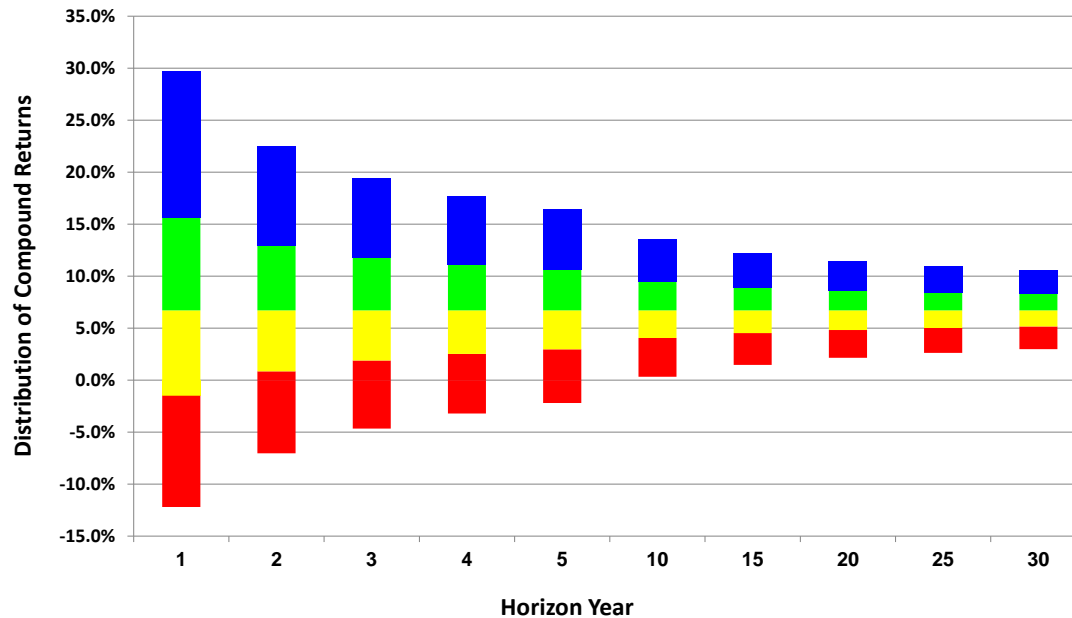
Economic Assumptions – Investment Return - SERS

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding 7.00%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.94%	5.63%	6.32%	30.92%
2	5.52%	6.18%	6.84%	37.60%
3	5.67%	6.31%	6.95%	39.22%
4	5.31%	6.09%	6.87%	38.40%
5	5.57%	6.32%	7.06%	40.84%
6	6.47%	7.27%	8.08%	53.42%
7	7.12%	7.74%	8.36%	61.98%
8	6.27%	7.23%	8.19%	52.39%
Average	5.86%	6.59%	7.33%	44.35%

Economic Assumptions – Investment Return - JRS

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding 6.75%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.94%	5.63%	6.32%	34.17%
2	5.52%	6.18%	6.84%	41.29%
3	5.67%	6.31%	6.95%	43.06%
4	5.31%	6.09%	6.87%	41.52%
5	5.57%	6.32%	7.06%	44.15%
6	6.47%	7.27%	8.08%	56.54%
7	7.12%	7.74%	8.36%	65.86%
8	6.27%	7.23%	8.19%	55.02%
Average	5.86%	6.59%	7.33%	47.70%

Economic Assumptions – Investment Return



Percentile	Year									
	1	2	3	4	5	10	15	20	25	30
95th	29.71%	22.50%	19.44%	17.65%	16.44%	13.51%	12.23%	11.47%	10.96%	10.58%
75th	15.60%	12.93%	11.76%	11.07%	10.60%	9.45%	8.94%	8.64%	8.43%	8.28%
50th	6.71%	6.71%	6.71%	6.71%	6.71%	6.71%	6.71%	6.71%	6.71%	6.71%
25th	-1.49%	0.84%	1.89%	2.53%	2.96%	4.05%	4.53%	4.82%	5.02%	5.16%
5th	-12.21%	-7.04%	-4.66%	-3.21%	-2.21%	0.33%	1.47%	2.16%	2.63%	2.98%
Geometric Average	7.47%	7.09%	6.96%	6.90%	6.86%	6.79%	6.76%	6.75%	6.74%	6.74%

Economic Assumptions – Investment Return – ASOP No. 27

- The preferred assumption in the actuarial community is the forward-looking expected geometric return (i.e., 50th percentile)
 - Based on the average of each of the investment consultants' expectations, this would lead to an investment return assumption of 6.59%
 - For BOI's investment consultant, this would lead to an investment return assumption of 6.71%
- A less preferred and more aggressive assumption is the forward-looking expected arithmetic return (i.e., expected nominal return)
 - Based on the average of each of the investment consultants' expectations, this would lead to an investment return assumption of 7.41%
 - For BOI's investment consultant, this would lead to an investment return assumption of 7.47%

Economic Assumptions – Investment Return

- Based upon the analysis performed, GRS' preferred investment return assumption would be 6.75%, based upon a price inflation assumption of 2.25%
 - Therefore, we have presented 6.75% as an investment return assumption for the Board's consideration
- For SERS
 - We believe that the current investment return assumptions remain reasonable for actuarial valuation purposes
- For JRS
 - We believe that the current investment return assumption of 6.75% remains reasonable for pension actuarial valuation purposes
 - We have presented 6.75% and 7.00% as an investment return assumption for the Board's consideration for OPEB actuarial valuation purposes

Economic Assumptions – Investment Return

- The Board has adopted the Dedicated Gains Policy which may result in an investment return assumption of 6.75% or below for actuarial valuation purposes
- The higher the selected investment return assumption by the Board, the less margin that would exist for actuarial standards reasonability purposes in future years if capital market assumptions are lowered from their current levels

Actuarial Methods

Actuarial Methods - Recommendations

- Continue use of the entry age actuarial cost method for all benefits for SERS and continue use of the entry age actuarial cost method for age and service normal and early retirement benefits for JRS
- Consider a legislative amendment to apply the entry age actuarial cost method to the calculation of the employer contributions for death-in-service and disability benefits for JRS
- Consider a legislative amendment to document the practice of the calculation of the employer contribution for Tier 2 member death-in-service and disability benefits for SERS
- Continue the practice of coordinating the annual actuarial valuation with the 5-year reconciliation process for SERS
- Continue use of the current amortization policy of reducing the amortization period each year by one year
- Continue use of the current asset valuation method with a 30% corridor for pension valuation purposes
 - Adopt the same asset valuation method for the OPEB valuation beginning with the September 30, 2018 valuation

Effect on Valuation Results

Effect on Valuation Results

- In this section, September 30, 2017 pension and retiree health (i.e., OPEB) actuarial valuation results are presented based on the proposed demographic assumptions and proposed alternate economic assumptions
- It is our expectation that the proposed set of actuarial assumptions would first be used for the September 30, 2018 valuation

Effect on Valuation Results - SERS

Pension Valuation as of September 30, 2017

	Present Assumptions	Alternate #1 Assumptions	Alternate #2 Assumptions
Investment Return Assumption	7.00%	7.00%	6.75%
Wage Inflation Assumption	3.50%	2.75%	2.75%
Mortality Assumptions	Present	Proposed	Proposed
All Other Assumptions	Present	Proposed	Proposed
Total Normal Cost of Benefits (as a % of member pay)	9.39%	8.62%	9.21%
Member Contribution %	<u>4.00%</u>	<u>4.00%</u>	<u>4.00%</u>
Employer Normal Cost %	5.39%	4.62%	5.21%
Tier 1 Employer Normal Cost \$	\$34,651,820	\$28,813,603	\$32,491,967
Tier 2 Employer Normal Cost \$	10,925,523	7,236,152	8,104,560
Administrative Expenses	<u>0</u>	<u>6,500,000</u>	<u>6,500,000</u>
Total Employer Normal Cost \$	45,577,343	42,549,755	47,096,527
Total Actuarial Accrued Liability	\$17,880,548,907	\$18,487,067,536	\$18,933,571,861
Funding Value of Assets	<u>11,883,784,188</u>	<u>11,883,784,188</u>	<u>11,883,784,188</u>
Unfunded Actuarial Accrued Liability	5,996,764,719	6,603,283,348	7,049,787,673
Funded Percentage	66.5%	64.3%	62.8%
Amortization Payment \$	555,020,167	623,765,587	660,156,809
Total Computed Employer Contribution ⁽¹⁾	\$ 600,597,510	\$ 666,315,342	\$ 707,253,336

⁽¹⁾ Contribution amounts presented above would be for the fiscal year (FY) 2020 but are illustrative only. Actual FY 2020 contribution amounts are based upon pre-experience study results. Our expectation is that the proposed set of actuarial assumptions would first be used for the September 30, 2018 valuation.

Effect on Valuation Results - SERS

OPEB Valuation as of September 30, 2017

	Present Assumptions	Alternate #1 Assumptions	Alternate #2 Assumptions	Alternate #3 Assumptions
Investment Return Assumption	7.35%	7.35%	7.00%	6.75%
Wage Inflation Assumption	3.50%	2.75%	2.75%	2.75%
Ultimate Trend Rate	3.50%	3.00%	3.00%	3.00%
Mortality Assumptions	Present	Proposed	Proposed	Proposed
All Other Assumptions	Present	Proposed	Proposed	Proposed
Employer Normal Cost \$	\$89,259,742	\$86,426,133	\$94,229,669	\$100,626,984
Total Actuarial Accrued Liability	\$9,595,426,153	\$9,860,471,945	\$10,239,446,170	\$10,524,879,222
Funding Value of Assets	<u>2,047,228,760</u>	<u>2,047,228,760</u>	<u>2,047,228,760</u>	<u>2,047,228,760</u>
Unfunded Actuarial Accrued Liability	7,548,197,393	7,813,243,185	8,192,217,410	8,477,650,462
Funded Percentage	21.3%	20.8%	20.0%	19.5%
Amortization Payment	\$592,137,058	\$649,083,248	\$664,713,280	\$676,132,086
Total Computed Employer Contribution ⁽¹⁾	\$681,396,800	\$735,509,381	\$758,942,949	\$776,759,070

⁽¹⁾ Contribution amounts presented above would be for the fiscal year (FY) 2020 but are illustrative only. Actual FY 2020 contribution amounts are based upon pre-experience study results. Our expectation is that the proposed set of actuarial assumptions would first be used for the September 30, 2018 valuation.

Effect on Valuation Results - JRS

Pension Valuation as of September 30, 2017

	Present Assumptions	Alternate #1 Assumptions
Investment Return Assumption	6.75%	6.75%
Wage Inflation Assumption	3.50%	2.75%
Mortality Assumptions	Present	Proposed
All Other Assumptions	Present	Proposed
Total Normal Cost of Benefits (as a % of member pay)	18.95%	20.93%
Member Contribution %	<u>5.56%</u>	<u>5.56%</u>
Employer Normal Cost %	13.39%	15.37%
Employer Normal Cost \$	\$1,562,446	\$1,744,161
Administrative Expenses	<u>0</u>	<u>350,000</u>
Total Employer Normal Cost	1,562,446	2,094,161
Total Actuarial Accrued Liability	\$269,743,165	\$274,385,726
Funding Value of Assets	<u>267,849,693</u>	<u>267,849,693</u>
Unfunded Actuarial Accrued Liabilities	1,893,472	6,536,033
Funded Percentage	99.3%	97.6%
Amortization Payment \$	173,971	600,528
Total Computed Employer Contribution ⁽¹⁾	\$1,736,417	\$2,694,689

(1) Contribution amounts presented above would be for the fiscal year (FY) 2018 but are illustrative only. Actual FY 2018 contribution amounts are based upon pre-experience study results. Our expectation is that the proposed set of actuarial assumptions would first be used for the September 30, 2018 valuation.

Effect on Valuation Results - JRS

OPEB Valuation as of September 30, 2017

	Present Assumptions	Alternate #1 Assumptions	Alternate #2 Assumptions
Investment Return Assumption	7.50%	7.00%	6.75%
Wage Inflation Assumption	3.50%	2.75%	2.75%
Ultimate Trend Rate	3.50%	3.00%	3.00%
Mortality Assumptions	Present	Proposed	Proposed
All Other Assumptions	Present	Proposed	Proposed
Employer Normal Cost \$	\$73,502	\$219,183	\$230,737
Total Actuarial Accrued Liability	\$7,492,687	\$8,183,945	\$8,385,482
Funding Value of Assets	<u>1,025,537</u>	<u>1,025,537</u>	<u>1,025,537</u>
Unfunded Actuarial Accrued Liabilities	6,467,150	7,158,408	7,359,945
Funded Percentage	13.7%	12.5%	12.2%
Amortization Payment	\$485,798	\$547,572	\$552,131
Total Computed Employer Contribution ⁽¹⁾	\$559,300	\$766,755	\$782,868

⁽¹⁾ Contribution amounts presented above would be for the fiscal year (FY) 2018 but are illustrative only. Actual FY 2018 contribution amounts are based upon pre-experience study results. Our expectation is that the proposed set of actuarial assumptions would first be used for the September 30, 2018 valuation.

Disclosures

- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- Mita Drazilov is a Member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.
- Additional information regarding actuarial assumptions and methods, and important additional disclosures are provided in the report titled “5-Year Experience Study – October 1, 2012 through September 30, 2017.”
- If you need additional information to make an informed decision about the contents of this presentation, or if anything appears to be missing or incomplete please contact us before using this presentation.