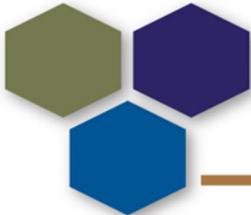


Michigan State Police Retirement System

October 1, 2007 – September 30, 2012
Experience Study

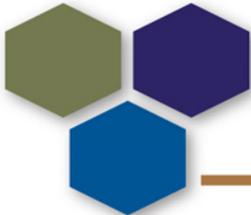
GRS

Gabriel Roeder Smith & Company
Consultants & Actuaries
www.gabrielroeder.com



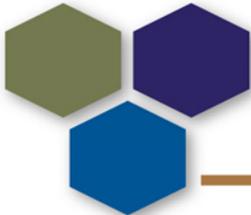
Agenda

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



Introduction

- ◆ Each year the actuarial liabilities of MSPRS 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 System with regard to various risk areas
- ◆ The results of the liability calculations depend upon those assumptions



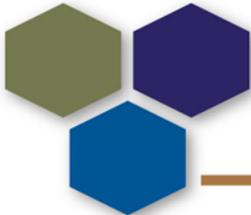
Introduction - Risk Areas

◆ Demographic Risk Areas

- ▶ Rates of withdrawal
- ▶ Rates of disability
- ▶ Rates of retirement
- ▶ Rates of mortality

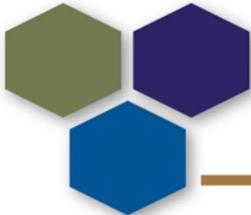
◆ Economic Risk Areas

- ▶ Investment return
- ▶ Inflation
- ▶ Patterns of salary increases



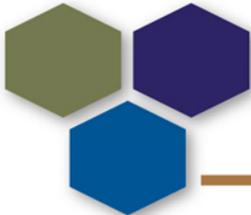
Introduction

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 - ▶ Continued use of outdated assumptions can lead to ...



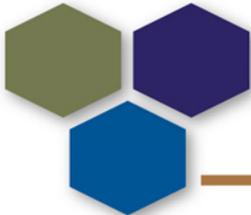
Introduction

- ◆ 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



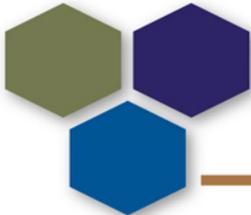
Introduction

- ◆ 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



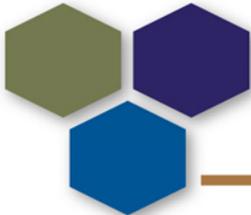
Introduction

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



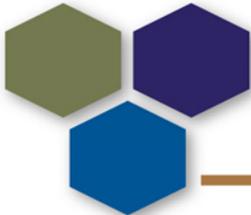
Experience Study Process

- ◆ Our analysis was based upon data submitted for the 2007 through 2012 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



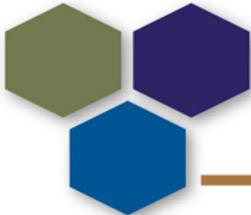
Experience Study Process

- ◆ Per Subsection 11(3) of the MSPRS statute (Act 182 of the Public Acts of 1986, 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, 2014 and later valuations



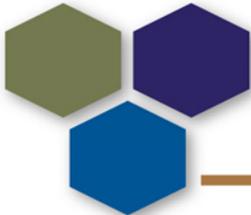
Demographic Assumptions

- ◆ A couple of special considerations should be noted with regard to the demographic assumptions review
 - ▶ The study was based on the retirement experience of the Tier 1 members (those hired before June 10, 2012)
 - ▶ Guidance regarding the selection of a post-retirement mortality assumptions is provided in Actuarial Standard of Practice (ASOP) No. 35
 - Requires the actuary to disclose the margin for future mortality improvement
 - Generally we try to incorporate a 10%-15% margin
 - This leads to the expectation of seeing more deaths than assumed for the 5-year period



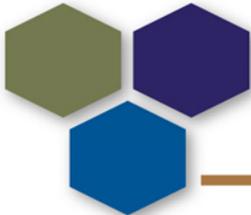
Demographic Assumptions Summary of Changes

| Decrement Risk Area | Actual Number | Expected Number | | |
|-------------------------------------|---------------|---------------------|----------------------|--------|
| | | Present Assumptions | Proposed Assumptions | Change |
| <i>Age and Service Retirement</i> | | | | |
| Age Based | 192 | 245.2 | 224.2 | (21.0) |
| Service Based - 25 Years of Service | 77 | 58.5 | 69.4 | 10.9 |
| <i>Withdrawal</i> | | | | |
| First 2 Years of Service | 26 | 22.4 | 22.4 | 0.0 |
| After 2 Years of Service | 78 | 36.9 | 54.6 | 17.7 |



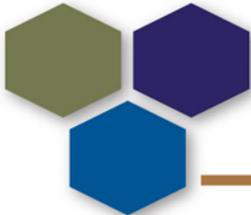
Demographic Assumptions Summary of Changes

| Decrement Risk Area | Actual Number | Expected Number | | |
|-----------------------------------|---------------|---------------------|----------------------|--------|
| | | Present Assumptions | Proposed Assumptions | Change |
| <i>Disability</i> | | | | |
| Non-Duty Disability | 16 | 8.4 | 12.6 | 4.2 |
| Duty-Disability | 11 | 18.9 | 13.9 | (5.0) |
| <i>Mortality</i> | | | | |
| Non-Disabled Retired Lives - Male | 175 | 196.9 | 165.1 | (31.8) |
| - Female | 2 | 2.5 | 2.3 | (0.2) |
| Disabled Retired Lives - Male | 11 | 19.9 | 18.8 | (1.1) |
| - Female | 0 | 1.6 | 0.6 | (1.0) |
| Active Members - Male | 7 | 6.5 | 4.0 | (2.5) |
| - Female | 0 | 0.8 | 0.4 | (0.4) |



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 consistent with one another
- ◆ That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions



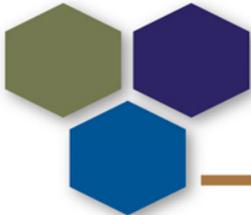
Economic Assumptions – Price Inflation

- ◆ Price inflation underlies both the wage inflation and investment return assumptions
- ◆ Over the past 50 years, price inflation has averaged 4.1%
 - ▶ Heavily affected by the high inflation period of the 1970s and early 1980s
- ◆ 2012 Social Security Trustees report uses 2.8% as the long-range intermediate price inflation assumption
 - ▶ Low-cost assumption is 1.8%, high-cost assumption is 3.8%



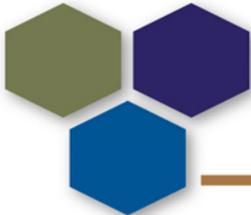
Economic Assumptions – Price Inflation

- ◆ Based upon the reviewed data, we suggest the Board adopt a price inflation assumption of 2.50%
 - ▶ Remember that the selected wage inflation and investment return assumptions should be consistent with the final selected price inflation assumption



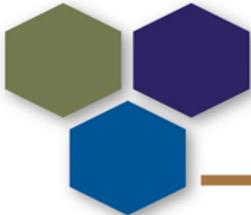
Economic Assumptions – Wage Inflation

- ◆ Wage inflation consists of two components
 - ▶ A portion due to pure price inflation (i.e., increases due to changes in the CPI)
 - ▶ Increases in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors)
- ◆ Over the past 50 years, wage inflation (as measured by increases in the National Average Earnings) has averaged 4.8%
 - ▶ This would imply a real growth rate of 0.7% over the past 50 years (i.e., 4.8% - 4.1%)



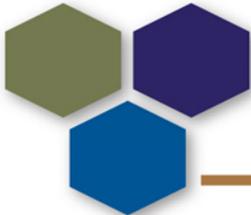
Economic Assumptions – Wage Inflation

- ◆ In the past five decades, we have experienced real growth rates of wages ranging from (1.3)% to 1.8%
- ◆ The past decade saw a real growth rate of wages of 0.6%
- ◆ 2012 Social Security Trustees report uses 1.12% as the long-range intermediate real-wage differential assumption
 - ▶ Low-cost assumption is 1.71%, high-cost assumption is 0.52%



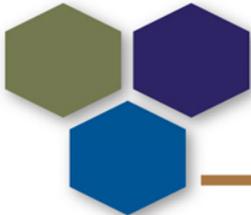
Economic Assumptions – Wage Inflation

- ◆ Based upon the reviewed data and considering our proposed price inflation of 2.50%, we suggest the Board maintain the current wage inflation assumption of 3.50%



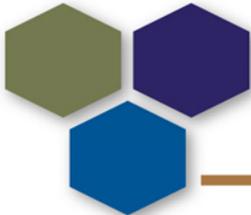
Economic Assumptions – Merit and Seniority

- ◆ Total pay increases for an individual consist of a portion due to wage inflation and a portion due to an individual's job performance (i.e., merit and seniority)
- ◆ The merit and seniority portion of the pay increase assumption was analyzed over the period 2007 through 2012
- ◆ We recommend no change to the merit/seniority pay increase assumption for the first 2 years of service
- ◆ We recommend a small decrease to the rates after 2 years of service



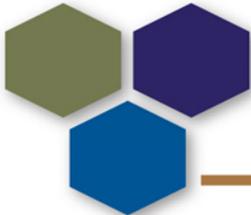
Economic Assumptions – Investment Return

- ◆ 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 MSPRS fundamental financial objectives is the receipt of level contributions from one year to the next, the discount rate assumption is set equal to the investment return assumption



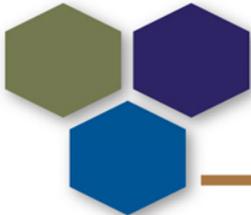
Economic Assumptions – Investment Return

- ◆ Based upon MSPRS' current target asset allocation, future return expectations of various investment consultants (including MSPRS current investment consultant) were analyzed
- ◆ The next few slides show the results of the analysis
 - ▶ Final expected nominal investment return results are based upon a 2.5% price inflation assumption
 - ▶ Investment results net of expenses are based upon an expense assumption of 40 basis points



Economic Assumptions – Investment Return

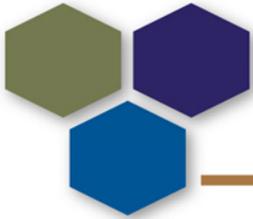
| Investment Consultant | Investment Consultant Expected Nominal Return | Investment Consultant Inflation Assumption | Expected Real Return (2)–(3) | Actuary Inflation Assumption | Expected Nominal Return (4)+(5) | Plan Incurred Expense Assumption | Expected Nominal Return Net of Expenses (6)–(7) | Standard Deviation of Expected Return (1-Year) |
|-----------------------|---|--|------------------------------|------------------------------|---------------------------------|----------------------------------|---|--|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 1 | 8.05% | 3.00% | 5.05% | 2.50% | 7.55% | 0.40% | 7.15% | 14.60% |
| 2 | 8.17% | 3.00% | 5.17% | 2.50% | 7.67% | 0.40% | 7.27% | 14.30% |
| 3 | 7.62% | 2.40% | 5.22% | 2.50% | 7.72% | 0.40% | 7.32% | 11.90% |
| 4 | 8.12% | 2.50% | 5.62% | 2.50% | 8.12% | 0.40% | 7.72% | 15.60% |
| 5 | 8.58% | 2.51% | 6.07% | 2.50% | 8.57% | 0.40% | 8.17% | 15.60% |
| 6 | 8.90% | 2.50% | 6.40% | 2.50% | 8.90% | 0.40% | 8.50% | 17.00% |
| 7 | 8.99% | 2.30% | 6.69% | 2.50% | 9.19% | 0.40% | 8.79% | 16.10% |
| 8 | 9.81% | 2.50% | 7.31% | 2.50% | 9.81% | 0.40% | 9.41% | 16.80% |
| Average | 8.53% | 2.59% | 5.94% | 2.50% | 8.44% | 0.40% | 8.04% | 15.24% |



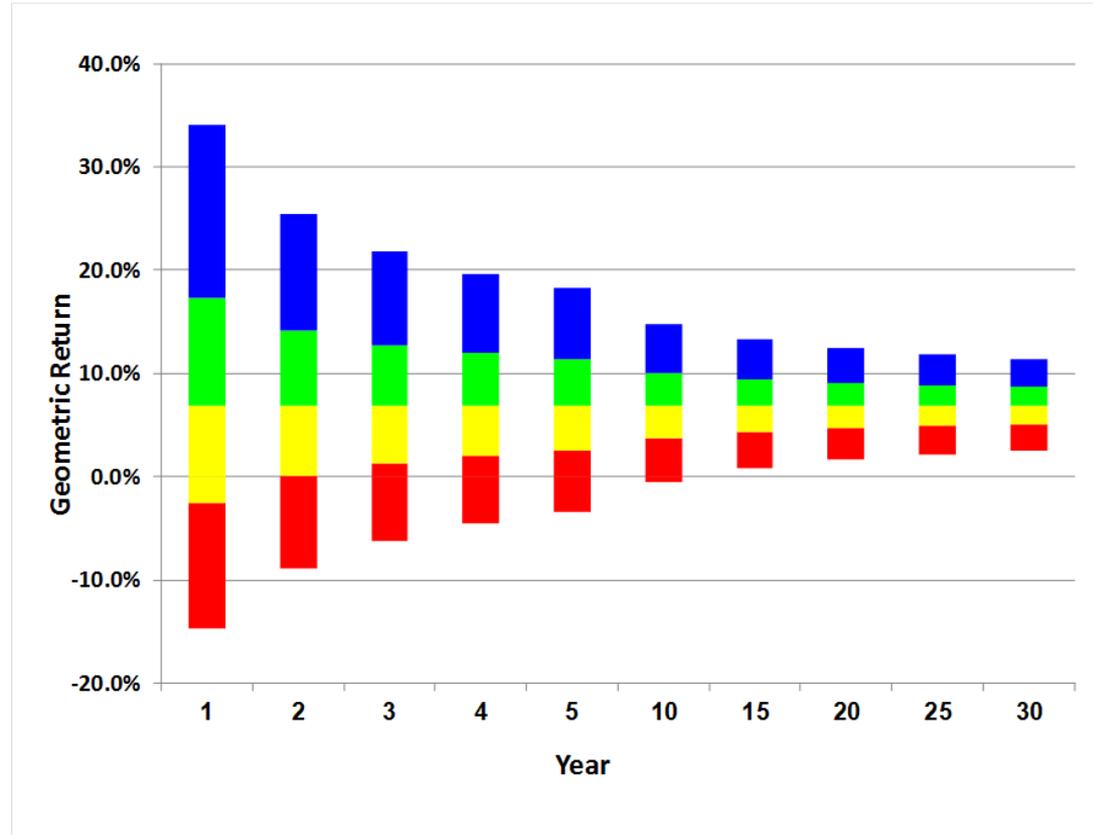
Economic Assumptions – Investment Return

| Investment Consultant | Distribution of 20-Year Average Geometric Net Nominal Return | | | Probability of exceeding 8.00% * |
|--------------------------|---|--------------|--------------|--|
| | 25th | 50th | 75th | |
| (1) | (2) | (3) | (4) | (5) |
| 1 | 4.01% | 6.16% | 8.34% | 28.4% |
| 2 | 4.22% | 6.32% | 8.46% | 29.8% |
| 3 | 4.89% | 6.65% | 8.45% | 30.6% |
| 4 | 4.29% | 6.58% | 8.93% | 34.1% |
| 5 | 4.75% | 7.04% | 9.38% | 39.1% |
| 6 | 4.67% | 7.16% | 9.71% | 41.2% |
| 7 | 5.23% | 7.60% | 10.01% | 45.5% |
| 8 | 5.66% | 8.12% | 10.64% | 51.3% |
| Average | 4.72% | 6.95% | 9.24% | 37.5% |

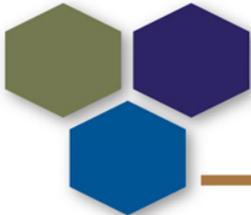
*Plan's current return assumption net of expenses.



Economic Assumptions – Investment Return

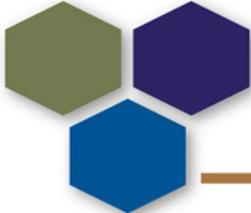


| | Year | | | | | | | | | |
|----------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Percentile | 1 | 2 | 3 | 4 | 5 | 10 | 15 | 20 | 25 | 30 |
| 95th | 34.05% | 25.43% | 21.80% | 19.68% | 18.26% | 14.80% | 13.30% | 12.42% | 11.82% | 11.38% |
| 75th | 17.27% | 14.12% | 12.75% | 11.95% | 11.40% | 10.05% | 9.46% | 9.11% | 8.87% | 8.70% |
| 50th | 6.87% | 6.87% | 6.87% | 6.87% | 6.87% | 6.87% | 6.87% | 6.87% | 6.87% | 6.87% |
| 25th | -2.58% | 0.10% | 1.31% | 2.03% | 2.53% | 3.79% | 4.35% | 4.68% | 4.91% | 5.08% |
| 5th | -14.71% | -8.89% | -6.19% | -4.54% | -3.40% | -0.50% | 0.82% | 1.61% | 2.15% | 2.55% |
| Geometric Avg | 7.91% | 7.39% | 7.22% | 7.13% | 7.08% | 6.98% | 6.94% | 6.92% | 6.91% | 6.91% |



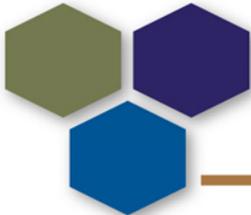
Investment Return – Current ASOP No. 27

- ◆ The current version of ASOP No. 27 defines a reasonable investment return assumption as an assumption in the “best-estimate” range
 - ▶ This is generally interpreted as an assumption between the 25th and 75th percentiles
 - ▶ Based on the average of each of the investment consultants’ expectations, this would result in a range of 4.72% to 9.24%
- ◆ There is some thought in the actuarial community that this range is too wide



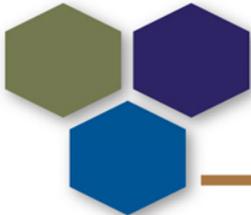
Economic Assumptions – Investment Return – Revised ASOP No. 27

- ◆ A revision to ASOP No. 27 lead some in the actuarial community to believe that a better range is between the expected geometric return (i.e., 50th percentile) and the expected arithmetic return
 - ▶ Based on the average of each of the investment consultants' expectations, this would result in a range of 6.95% to 8.04%



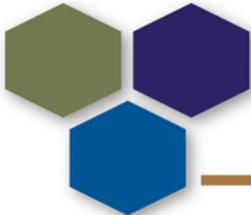
Economic Assumptions – Investment Return – Proposed Assumption

- ◆ Some public employee retirement systems across the country have recently lowered their investment return assumption
- ◆ Given that a possible objective of MSPRS is to not anticipate future actuarial gains or losses given the current asset allocation (which would suggest using the expected arithmetic return), but recognizing that a level of conservatism may be desirable (which would suggest using the expected geometric return), we suggest that the Board consider an investment return assumption in the range of 7.50% to 8.00%. The Board should note that the selection of an investment return assumption at the upper end of this range results in a higher risk of increased employer contributions in the future. No change to the investment return assumption for the Hybrid portion of the plan is recommended.



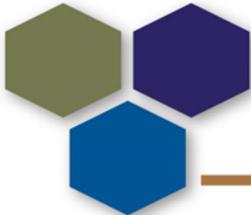
Actuarial Methods - Recommendations

- ◆ Continue use of the entry age actuarial cost method for all benefits
- ◆ Continue the practice of coordinating the annual actuarial valuation with the 5-year reconciliation process
- ◆ 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 the addition of a corridor (in the range of 20% to 30%)



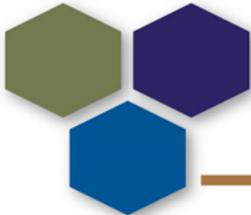
Effect on Valuation Results (as of September 30, 2012)

| | Present | | | Alternate # 1 | | |
|---|----------------------|---------------------|----------------------|----------------------|---------------------|----------------------|
| | Non-Hybrid | Hybrid (PPP) | Total | Non-Hybrid | Hybrid (PPP) | Total |
| Demographic Assumptions | Present | Present | Present | Proposed | Proposed | Proposed |
| Investment Return Assumption | 8.00% | 7.00% | | 8.00% | 7.00% | |
| Wage Inflation Assumption | 3.50% | 3.50% | | 3.50% | 3.50% | |
| Annual Employer Contribution for | | | | | | |
| Total Normal Cost of Benefits (as a % of pay) | 18.90% | 15.28% | 18.74% | 18.18% | 14.49% | 18.02% |
| Member Contribution % | <u>1.00%</u> | <u>4.00%</u> | <u>1.12%</u> | <u>1.00%</u> | <u>4.00%</u> | <u>1.13%</u> |
| Employer Normal Cost % | 17.90% | 11.28% | 17.62% | 17.18% | 10.49% | 16.89% |
| Unfunded Actuarial Accrued Liability | 35.49% | 35.49% | 35.49% | 37.62% | 37.62% | 37.62% |
| Total Employer Contribution (%) | 53.39% | 46.77% | 53.11% | 54.80% | 48.11% | 54.51% |
| Total Employer Contribution (\$) | \$ 55,651,878 | \$ 2,015,779 | \$ 57,667,657 | \$ 56,960,214 | \$ 2,215,228 | \$ 59,175,442 |
| Funded Percentage Based on Funding Value of Assets | | | 64.0% | | | 62.7% |



Effect on Valuation Results (as of September 30, 2012)

| | Alternate # 2 | | | Alternate # 3 | | |
|---|----------------------|---------------------|----------------------|----------------------|---------------------|----------------------|
| | Non-Hybrid | Hybrid (PPP) | Total | Non-Hybrid | Hybrid (PPP) | Total |
| Demographic Assumptions | Proposed | Proposed | Proposed | Proposed | Proposed | Proposed |
| Investment Return Assumption | 7.75% | 7.00% | | 7.50% | 7.00% | |
| Wage Inflation Assumption | 3.50% | 3.50% | | 3.50% | 3.50% | |
| Annual Employer Contribution for | | | | | | |
| Total Normal Cost of Benefits (as a % of pay) | 19.26% | 14.49% | 19.05% | 20.40% | 14.49% | 20.14% |
| Member Contribution % | <u>1.00%</u> | <u>4.00%</u> | <u>1.13%</u> | <u>1.00%</u> | <u>4.00%</u> | <u>1.13%</u> |
| Employer Normal Cost % | 18.26% | 10.49% | 17.92% | 19.40% | 10.49% | 19.01% |
| Unfunded Actuarial Accrued Liability | 39.44% | 39.44% | 39.44% | 41.26% | 41.26% | 41.26% |
| Total Employer Contribution (%) | 57.70% | 49.93% | 57.36% | 60.66% | 51.75% | 60.27% |
| Total Employer Contribution (\$) | \$ 59,973,275 | \$ 2,300,118 | \$ 62,273,393 | \$ 63,048,568 | \$ 2,385,089 | \$ 65,433,657 |
| Funded Percentage Based on Funding Value of Assets | | | 61.1% | | | 59.5% |



Disclosures

- ◆ Circular 230 Notice: Pursuant to regulations issued by the IRS, to the extent this presentation concerns tax matters, it is not intended or written to be used, and cannot be used, for the purpose of (i) avoiding tax-related penalties under the Internal Revenue Code or (ii) marketing or recommending to another party any tax-related matter addressed within. Each taxpayer should seek advice based on the individual's circumstances from an independent tax advisor.
- ◆ This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- ◆ Mita Drazilov and Louise Gates 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.
- ◆ 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.