Colorado Public Employees' Retirement Association

Results of Actuarial Audit

December 31, 2013 Actuarial Valuation

Presented by:

Mark C. Olleman, FSA, EA, MAAA

Nick J. Collier, ASA, EA, MAAA

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Purpose & Scope

- **Purpose**: Review actuarial valuation and confirm that the results of the valuation are accurate and based on reasonable assumptions.
- **Scope:**
  - Full independent replication of Actuarial Valuation (December 31, 2013)
  - Review of actuarial assumptions (2008 – 2011 Experience Investigation and Economic Assumptions adopted at November, 2013 Board meeting)
  - Evaluation of asset valuation method

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Bottom Line

- What you need to know
  - Close match on liabilities and normal cost rates
    - Using same normal cost method as valuation
  - Matched valuation assets
  - Package of assumptions is reasonable
  - General consensus in actuarial community is for shorter amortization periods
  - Recommended changes for future valuations and experience studies
    - Apply mid-year timing of contributions used in Normal Cost rate calculation
    - Make technical change in amortization calculation
    - Make several changes in liability calculations (small increase relative to total)
    - Include merit increases in first year compensation amounts
    - Add further disclosure of assumptions and methods in valuation report
  - Considerations for future valuations and experience studies
    - Increase margin for mortality assumption
    - Modify assumed timing of annual increase for active members

Replication of Actuarial Valuation

- Independent replication valuation performed
  - Components
    - ✓ Data
    - ✓ Assumptions & methods
    - ✓ Assets
    - ✓ Benefits
  - Exact match not expected, but results should have high level of consistency with valuation

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Membership Data

- Reviewed data supplied by PERA
  - Compared vs. CAFR
  - Confirmed that all necessary information was included
- Reviewed data used in valuation
  - Compared PERA-supplied data versus massaged valuation data
    - Checked individually and in aggregate
    - Only recommended change is to reflect merit increase in first year
      - Current approach takes individual’s compensation from prior year and increases by general wage growth and uses for compensation in valuation year on massaged data
  - Conclusion
    - Data used by Cavanaugh Macdonald in valuation is reasonable
    - Recommended change
      - apply merit increase in determination of valuation year compensation

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Membership Data (continued)

All Divisions in Aggregate	Cavanaugh Macdonald	Milliman	CM/M Ratio
Active Members			
Count	200,183	200,202	100.0%
Average Annual Compensation	$ 37,617	$ 37,767	99.6%
Retirees & Survivors			
Count	104,021	103,836	100.2%
Average Annual Benefit	$ 36,328	$ 36,393	99.8%

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Actuarial Value of Assets

- Smoothing method
  - 4-year recognition of asset gains and losses
  - Meets applicable actuarial standards of practice
- Confirmed calculation of actuarial value
- Smoothing of assets is less critical for a system with contribution rates set in statute
- Assets used in valuation are reasonable

Actuarial Liabilities

- Replication valuation results
  - Close match in total and by division
  - Some differences by benefit type
    - Overall match still within 1%
  - Actuarial Accrued Liability shown in millions of dollars

(in $Millions)	Cavanaugh Macdonald	Milliman	CM / M Ratio
Actuarial Accrued Liability			
State	$ 22,844	$ 23,033	99.2%
School	35,437	35,742	99.1%
Local Gov.	4,502	4,511	99.8%
Judicial	352	350	100.6%
DPS	3,786	3,762	100.6%
PERA HCTF	1,557	1,548	100.6%
DPS HCTF	77	77	100.0%

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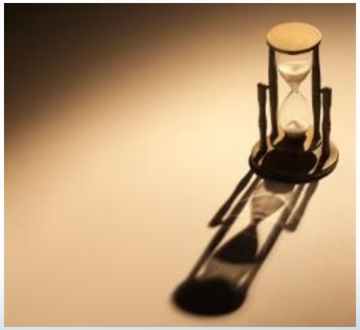
Normal Cost Method

- Contribution Timing Issue
  - In calculation of Normal Cost (NC) rate in valuation, NC contributions are assumed to be paid at the beginning of year
    - Effective assumption is NC contributions receive a full year of interest and are paid in full for all members active on the valuation date
  - In practice, Normal Cost contributions are paid throughout the year and are not received when a member separates or retires during the year
  - Overstates NC contributions in practice (understates NC rate)
    - ➔ the expected value of the Normal Cost contributions is less than the expected value of the benefits, if all assumptions are met
- Adjustment made to NC for separation benefit
  - Result is NC contributions < expected value of benefits
- Recommended changes of Normal Cost method
  - Use mid-year assumption for NC contribution rate
  - Remove adjustment to separation benefit normal cost



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Actuarial Liabilities – Differences by Benefit Type

- Present Value of Benefits by Benefit Type
  - Value of sum of the benefits earned and expected to be earned in the future for current members (all divisions in aggregate)

(in $Millions)	Cavanaugh Macdonald	Milliman	CM / M Ratio
Present Value All Future Benefits			
Active members			
Retirement	$ 26,044.4	$ 26,561.6	98.1%
Separation	3,097.4	3,351.9	**92.4%**
Death	248.6	257.9	96.4%
Disability	313.5	307.7	101.9%
Total Actives	$ 29,703.9	$ 30,479.1	**97.5%**
Inactive Members	$ 1,632.2	$ 1,652.6	**98.8%**
Retirees and Survivors			
Retired members	$ 43,601.6	$ 43,398.9	100.5%
Survivors	380.5	438.0	**86.9%**
Total In Payment	$ 43,982.1	$ 43,836.9	**100.3%**
Total for All Members	**$ 75,318.2**	**$ 75,968.6**	**99.1%**

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Actuarial Liabilities – Differences by Benefit Type

- Future service retirement benefit for current active members
  - 2% difference in many cases
- Future separation benefits for current active members
  - Match on first five years of service not being applied
- Benefits for current survivors
  - 15% reduction applied
- Future survivor benefits for current active members
  - Eligibility for annuity should be one year of service
- Total magnitude of these four recommended changes
  - Overall impact estimated to be less than 1% of total liabilities

Member Contribution Rates

- Member contribution rates used in the valuation are consistent with those specified in the Colorado Revised Statutes

Funding

- Individual Entry Age Actuarial Cost Method
  - Our preferred method
- Employer Contribution Rates
  - Contribution rates specified in statute
    - Increased in 2010 pursuant to Senate Bill 10-001
- Funding Adequacy
  - Growing consensus in actuarial community is that an appropriate amortization period is less than 30 years
    - Projections show two largest divisions have amortization periods longer than 30 years
  - Significant progress made in this direction (toward shorter amortization periods) since 2009
    - Reducing the investment return assumption has increased the likelihood that the target return will be met

Review of Assumptions

- Assumption types
  - Economic Assumptions
    - Set based on global forecasts
  - Demographic assumptions
    - Set based largely on PERA's recent experience

Economic Assumptions

- Price Inflation = 2.8%
  - Reasonable, in line with current long-term expectations
- Wage Inflation = 3.9% (Price inflation + 1.1%)
  - Reasonable
- Investment Return Assumption = 7.5%
  - Considerable analysis done at actuarial workshop
  - Milliman analysis confirms 7.5% is reasonable

Demographic Assumptions

- Reasonable overall
- Review assumption that 35% of future disabilities will elect a refund and forfeit their annuity benefit
- Continue to monitor mortality assumption for expected increases in life expectancy
- Review timing of annual increase for future retirees
  - Assumption for members currently active or in deferred status is that their annual increase will commence eighteen months after retirement, if eligible for the annual increase with no additional deferral.
  - In practice, there is about a 15-month delay for this group on average, since a significant portion of members retire in June.

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Conclusion

- Overall calculations are reasonable
  - Based on valuation assumptions and methods
- Recommended changes are summarized on page 7 of our report

Caveats and Disclaimers

This presentation is based on the data, methods, assumptions and plan provisions described in our actuarial audit report dated January 9, 2015. The statements of reliance and limitations on the use of this material is reflected in the actuarial report and still apply to this presentation.

These statements include reliance on data provided, on actuarial certification, and the purpose of the report.

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