



# MACRS

## ACTUARIAL ASSUMPTIONS



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MACRS 2017 SPRING CONFERENCE

## What Is An Actuarial Valuation?

- “Snapshot” at that date
- Estimated future cash flows
- Present value terms
- **Actuarial assumptions**
- How good are the assumptions?
  - Gains and losses

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## PERAC Valuation Methodology for Local Systems (Typical)

- Discuss valuation results with administrator
  - Determine alternative schedules for letter
- Present valuation results in letter and exhibits
  - Actuarial and investment gain/loss
  - **Assumption changes/recommendations**
  - Valuation results and comparison to prior valuation
  - Alternative funding schedules
- Often meet with Board to discuss alternatives

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### NOTES:

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## PERAC Valuation Methodology for Local Systems *(Continued)*

- May show results with two investment return assumptions
- May show only recommended assumption
- Alternative funding schedules reflect only recommended assumption

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## Board Ultimately Adopts a Revised Schedule

- Often some back and forth
  - Length or type of schedule
  - Assumptions
- By adopting, Board has approved the assumptions

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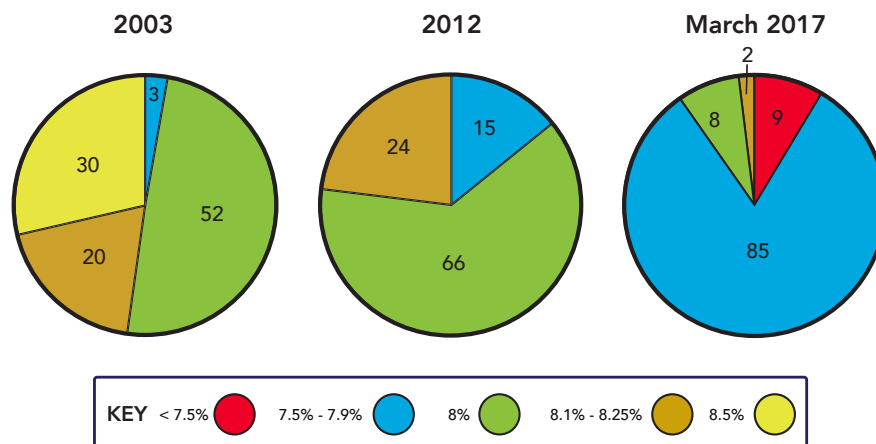
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## What Are the Basic Actuarial Assumptions?

| Membership Characteristics | Economic Characteristics |
|----------------------------|--------------------------|
| ▪ Longevity                | ▪ Investment return      |
| ▪ Termination              | ▪ Salary increases       |
| ▪ Disability               | ▪ Inflation              |
| ▪ Retirement               | ▪ COLA increases         |

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## Investment Return Assumptions



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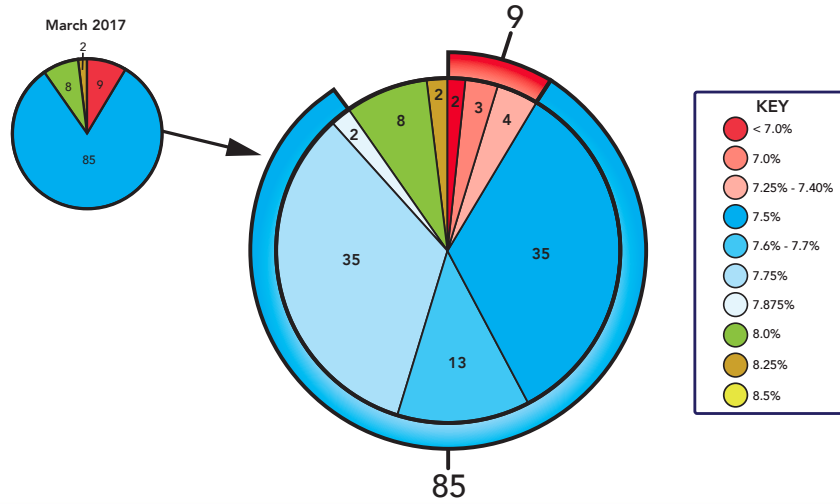
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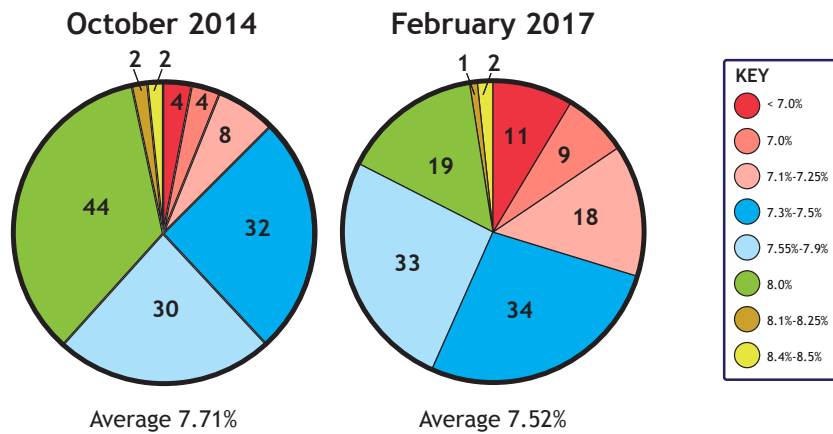
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## Current Investment Return Assumptions



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## Investment Return Assumptions — National State, Teacher and City Plans\*



\*Source: NASRA Public Fund Survey of 127 Large Plans

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## Cost Implications

- 25 basis point decrease increases actuarial liability about 2.5%
- Most systems reduced this assumption 50-75 basis points since 2012
  - 5% - 8% increase in liability
  - UAL increases more on a percentage basis

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## Cost Implications *(Continued)*

- If UAL increases based on reduction of assumption
  - Appropriation increases and/or
  - Amortization schedule is extended
- If assumption “too low”
  - Could burden current taxpayers

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## Investment Return Assumption

- Long term assumption
- Discount rate
  - Terms often used interchangeably
  - Short term assumption

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## Investment Return Assumption - PERAC

- Early 1990s - “standard” PERAC assumption 8.0%
  - Some variability
- Pressure to increase this assumption late 1990s
  - “We’re going to earn 15% every year”

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## Investment Return Assumption - Private Sector

- Private sector plans mid 1980's
  - 6.0% a common assumption - conservative
  - Assumptions reasonable in the **aggregate**
- Late 1980's each assumption must be "individually" reasonable
  - Assumption generally increased to 8.0%
  - Public sector follows

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## PERAC Guidance - PRIT Systems

|        |                                 |
|--------|---------------------------------|
| ▪ 2004 | 8.50% too high                  |
| ▪ 2010 | 8.25% too high                  |
| ▪ 2013 | 8.00% reduced to 7.75%          |
| ▪ 2015 | recommend reduce 7.75%          |
| ▪ 2016 | recommend 7.50%                 |
| ▪ 2017 | recommended range 7.25% - 7.50% |

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## PERAC Guidance - Non-PRIT Systems

- Generally lower
- More conservative asset allocation
  - Limited availability of some asset classes

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## PERAC Guidance - Private Actuary Valuation

- Rely on the actuary working with board
  - Usually call us with potential issues
- Comment in approval letters
  - 8.0% or above
  - More recently 7.75% or above

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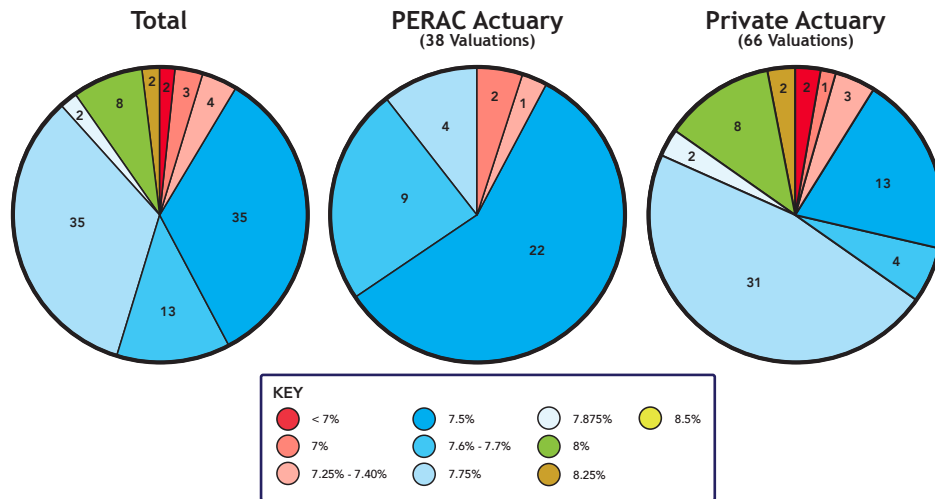
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## March 2017 Investment Return Assumptions



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## Development Of Long Term Assumption

- Rely on investment professionals
- Expected return by asset class
- Target allocation

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## Investment Professional Analysis

- Numerous asset classes
- Develop expected return by asset class
- Stochastic analysis
  - Numerous simulations
    - Range of possible outcomes

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## Expected Return - Simple Example

|              | Target Allocation | Expected Return | Total Return |
|--------------|-------------------|-----------------|--------------|
| Equities     | 60%               | 9.0%            | 5.4%         |
| Fixed Income | 40%               | 5.0%            | 2.0%         |
|              |                   |                 | 7.4%         |

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## NEPC Study for PRIT

|           | Average Expected Return |      |      |      |
|-----------|-------------------------|------|------|------|
|           | 2014                    | 2015 | 2016 | 2017 |
| 5-7 Years | 7.1%                    | 6.8% | 6.9% | 6.8% |
| 30 Years  | 8.2%                    | 7.9% | 7.8% | 7.8% |

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## Investment Expenses

- Investment return assumption generally net of investment expenses
- PERAC Annual Report shows gross returns
  - PRIT 2016 return 8.0%
  - If 40 basis points, PRIT net return 7.6%
- NEPC 30 year expected return 7.8%
  - Surmise 7.4% assumption on this basis (7.8% - .4%)

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### NOTES:

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## NEPC View

- Indexed or entirely passive investing
  - Negligible fees
- Active management
  - historically at least offset fees
  - should continue to do so
- On this basis, expected return already net of investment expenses

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## PERAC View

- Actuarial Standards of Practice (ASOPs)
  - ASOP 27- guidance for selecting investment return assumption
  - “Anticipating superior... performance may be unduly optimistic”
    - Implies avoiding such practice

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### NOTES:

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## PERAC View *(Continued)*

- “actuary should not assume that superior or inferior returns will be achieved net of investment expenses from an active investment management strategy compared to a passive management strategy unless the actuary believes... that such superior or inferior returns represent a reasonable expectation...”

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## PERAC View *(Continued)*

- Gray Area
- Prefer conservatism
  - View expectations as gross, not net of investment expenses
    - Or somewhere in between

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### NOTES:

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## Alternative Analyses/Considerations

- Real rate of return plus inflation
- Historical returns

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## Range of Reasonable Assumptions

- Varies by actuary
- Current assumptions
  - Ch. 32 plans 5.5% - 8.25%
  - National plans 6.5% - 8.50%
- Each board ultimately responsible
  - Some more conservative

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### NOTES:

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## Reasonable Range - PRIT Systems

- PERAC 6.75% - 7.75%
- 2017 preferred/expected range 7.25% - 7.50%
- Informal poll public sector actuaries April 2017
  - Most common assumptions 7.0% - 7.75%

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## Analysis for State and Teachers' 2017

- Maintain or reduce the 7.5% 2016 assumption?
- A case can be made for either

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### NOTES:

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## Maintain 7.50% Assumption

- No change in NEPC long term projection
- Already reduced 3 times in 4 years
  - 2012: 8.25%
  - 2013: 8.00%
  - 2015: 7.75%
  - 2016: 7.50%
- Comparable to national plan average of 7.52%

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## Reduce 7.50% Assumption

- More reliance on short term expectation
  - Between short and long term
- Other state systems announce reductions
  - CALPER 7.5% to 7.0% over 3 years
  - CALSTRS 7.5% to 7.0% over 2 years
  - If updated to 1/17, 7.52% average would be lower
- 7.50% could be seen as an outlier shortly
  - Whether justified or not

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## Conservative Actuaries?

- Investment return assumption
  - Does not reflect conservatism
  - Best estimate of long term expectation
  - Many argue 7.5% too high
    - Economists, media, etc.
    - Generally not actuaries
  - My view—6.0% is extremely conservative
  - Time will tell
    - We don't know the future

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## Salary Increase Assumption

- Like investment return, a long term assumption
- Most systems have had salary gains past 8 years
- Recent experience not that helpful in determining assumption

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### NOTES:

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## Salary Increase

- After investment return, greatest impact on liability
- Only affects active member liability

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## Investment Return and Salary Increase Assumptions

- Should move together over longer term
  - Both have inflation component
- Impact of reduction in investment return assumption
  - At least partially offset by decrease in salary assumption

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## Investment Return and Salary Increase Assumption

| Investment Return<br>Salary Increase | 8.0%<br>Current | 7.5%<br>Current | 7.5%<br>*    | 7.75%<br>*   |
|--------------------------------------|-----------------|-----------------|--------------|--------------|
| Actives                              | 2,800           | 3,000           | 2,900        | 2,790        |
| Retirees                             | <u>3,200</u>    | <u>3,300</u>    | <u>3,300</u> | <u>3,250</u> |
| Total Actuarial Liability            | 6,000           | 6,300           | 6,200        | 6,040        |
| Assets                               | 4,000           | 4,000           | 4,000        | 4,000        |
| Unfunded Liability                   | 2,000           | 2,300           | 2,200        | 2,040        |
| Funded Ratio                         | 66.7%           | 63.5%           | 64.5%        | 66.2%        |

\* Current reduced by 1% at all ages

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## PERAC Salary Increase Assumption

- Varies by job group and service
- Initial rate grades down to ultimate rate
- Based on experience analysis
  - Local - 2002 study with 2013 adjustment
  - State and Teachers
    - 3 studies, 2000, 2007, 2014

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### NOTES:

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## Notes on Experience Analysis Studies

- State and Teacher studies
  - Most significant changes 2000
  - Modest tweaks in 2007 and 2014
- Likewise expect locals to be similar
  - But less data and more cumbersome project

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## PERAC Local System Salary Increase Assumption *(at selected years)*

| Years of Service | Group 1 | Group 4 |
|------------------|---------|---------|
| 1                | 5.50%   | 6.50%   |
| 2                | 5.50%   | 6.00%   |
| 3                | 5.25%   | 5.75%   |
| 5                | 4.75%   | 5.25%   |
| 7                | 4.50%   | 4.75%   |
| 10+              | 4.25%   | 4.75%   |

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### NOTES:

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## State Retirement System Salary Increase Assumption *(at selected years)*

| Years of Service | Groups 1 & 2 | Group 3 | Group 4 |
|------------------|--------------|---------|---------|
| 1                | 6.50%        | 7.00%   | 8.00%   |
| 4                | 5.50%        | 6.75%   | 6.75%   |
| 7                | 4.75%        | 4.75%   | 5.25%   |
| 10               | 4.75%        | 4.75%   | 4.75%   |
| 15               | 4.50%        | 4.75%   | 4.75%   |
| 20+              | 4.00%        | 4.50%   | 4.50%   |

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## Massachusetts Teachers Retirement System Salary Increase Assumption *(at selected years)*

| Years of Service | MA Teachers |
|------------------|-------------|
| 1                | 7.1%        |
| 4                | 6.8%        |
| 7                | 6.5%        |
| 10               | 5.9%        |
| 15               | 4.2%        |
| 20+              | 4.0%        |

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### NOTES:

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## Mortality

- Old methodology (prior to 2011)
  - Update periodically
- 2012 valuations
  - Begin recognizing mortality improvement
    - Longer life expectancy
  - Static projection
    - Extend projection in 2013 and 2014
    - Toward “fully generational”

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## Mortality *(Continued)*

- 2015 valuations adopted fully generational
  - Currently 98 systems have adopted

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### NOTES:

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## Fully Generational Mortality

- Two dimensional table
  - Based on age and calendar year
    - Move down the diagonal
    - More realistic depiction

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## Fully Generational Mortality *(Continued)*

FOR ILLUSTRATION ONLY.  
NOT ACTUAL FIGURES.

| Age | 2017  | 2018  | 2019  | 2020  |
|-----|-------|-------|-------|-------|
| 65  | .0125 | .0124 | .0123 | .0122 |
| 66  | .0136 | .0135 | .0134 | .0133 |
| 67  | .0148 | .0147 | .0146 | .0145 |
| 68  | .0162 | .0161 | .0160 | .0159 |

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### NOTES:

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## Simple Illustration

- Does not reflect actual probabilities!
- Assume:
  - Currently
    - Age 75: 20 deaths per thousand
  - 5 years from now (with longer life expectancy)
    - Age 75: 18 deaths per thousand

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## Simple Illustration (Continued)

- Age 75
  - Static: assumes 18 deaths per thousand in all years
  - Fully generational

| Year | Deaths<br>(per thousand) |
|------|--------------------------|
| 2017 | 20.0                     |
| 2018 | 19.6                     |
| 2019 | 19.2                     |
| 2020 | 18.8                     |
| 2021 | 18.4                     |
| 2022 | 18.0                     |
| 2023 | 17.7                     |

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### NOTES:

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## Mortality

- Revised table released in 2014 (RP-2014)
  - Longer life expectancy
  - Projection scale modified several times since
  - Did not match our experience (except teachers)
  - Continued to use RP-2000 with modifications

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## Mortality (*Continued*)

- State retiree results 1/12-1/15 used as proxy for local systems
- Recent analysis 1/15 - 1/17 state retirees
  - Females - actual deaths same as expected [in total](#)
  - Males - actual deaths less than expected
    - Mismatches at individual ages
      - ✧ Actual < expected 65-75
      - ✧ Actual > expected 80+

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### NOTES:

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## Mortality (*Continued*)

- Compared versions of several tables
  - Two issues
    - Match base table for current year
    - Mortality improvement scale
- Currently assessing **blue collar** versions of RP-2014 (State)
- Likely maintain RP-2000 table for local systems for 2017
  - Local experience analysis

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## Disabled Retiree Mortality

- More difficult to assess
  - Smaller number of exposed lives
  - Generally use a modification of retiree mortality assumption
    - Assume slightly “older”
      - ✧ Set forward age
      - ✧ Different base year

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### NOTES:

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## Active Member Decrements

- Reasons for leaving service
- Retirement, disability, withdrawal, mortality
  - Active mortality difficult to assess
  - Assumption based on retiree analysis

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## Retirement

- Based on experience analyses
  - Local systems
    - Groups 1 and 2
      - ✧ Varies by age and gender
    - Group 4
      - ✧ Varies by age
      - ✧ Gender inconclusive, not enough data

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### NOTES:

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## Retirement *(Continued)*

- Local system Groups 1 and 2 rates at selected ages

| Age | Male  | Female |
|-----|-------|--------|
| 55  | 2.0%  | 5.5%   |
| 60  | 12.0% | 5.0%   |
| 62  | 30.0% | 15.0%  |
| 65  | 40.0% | 15.0%  |
| 70  | 100%  | 100%   |

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## Retirement *(Continued)*

- Local system Group 4 rates at selected ages

| Age | Group 4 |
|-----|---------|
| 50  | 2.0%    |
| 55  | 15.0%   |
| 60  | 20.0%   |
| 62  | 25.0%   |
| 65  | 100%    |

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### NOTES:

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## Retirement (Continued)

- State
  - Group 1 varies by age and gender
    - Rates at selected ages

| Age | Male  | Female |
|-----|-------|--------|
| 55  | 3.5%  | 5.0%   |
| 60  | 9.0%  | 7.5%   |
| 62  | 15.0% | 15.0%  |
| 65  | 20.0% | 20.0%  |
| 70  | 100%  | 100%   |

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## Retirement (Continued)

- State
  - Groups 2 - 4 varies by age
    - Gender inconclusive, not enough data
  - Groups 3 and 4 rates at selected ages

| Age | Group 3 | Group 4 |
|-----|---------|---------|
| 50  | 5.0%    | 6.0%    |
| 55  | 10.0%   | 25.0%   |
| 60  | 14.0%   | 20.0%   |
| 62  | 15.0%   | 20.0%   |
| 65  | 25.0%   | 50.0%   |
| 70  | 100%    | 100%    |

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### NOTES:

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## Retirement *(Continued)*

- Teachers
  - Varies by age, gender, service and Retirement Plus
    - Takes 2 pages of valuation report

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## Disability

- Based on experience analysis
- Varies by age and job group (all systems)

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### NOTES:

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## Withdrawal

- Also known as termination or turnover
  - Most difficult to assess past experience
    - “The catch all”

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## Withdrawal *(Continued)*

- Local systems
  - Groups 1 and 2: varies by service
  - Group 4: 1.5% each year up to 10 years

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### NOTES:

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## Withdrawal *(Continued)*

- State
  - Groups 1 and 2: varies by age and service
    - After 10 years of service, varies by age only
  - Groups 3 and 4: varies by service
- Teachers
  - Varies by age and service
    - After 10 years of service, varies by age only

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## Other Assumptions

- Accidental and Ordinary Disability
- Expenses
- Net 3(8)(c)
- Hires after 4/1/12
- Loadings
- Family Composition
- COLA

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### NOTES:

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## Accidental and Ordinary Disability

- Percentage of job-related disabilities
  - Local systems
    - Groups 1 and 2: 55%
    - Group 4: 90%
  - State
    - Groups 1 and 2: 75%
    - Groups 3 and 4: 95%
  - Teachers: 35%

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## Expenses

- Administrative and investment related expenses
- Administrative expenses included in normal cost
- Reflecting a portion of investment expenses
  - Increased in each valuation
    - Ultimately 100%
  - Alternatively, reduce investment return assumption

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### NOTES:

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## Net 3(8)(c)

- Most local systems have net 3(8)(c) outflow
- PERAC includes in funding schedule
  - Reimbursing trust like expenses
  - Some private actuaries do as well
    - Sometimes included in liability as present value

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## Hires After 4/1/12

- No change to rates at eligible ages
  - Group 1, age 60
- Expect over time, we will adjust rates

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### NOTES:

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## Loadings

- Increases for items not readily able to value
  - PERAC attempts to value all death, disability, and withdrawal benefits
  - Generally State provisions
    - 28M and 28N - corrections employees
    - 65D - judges
      - ◇ Periodic analysis

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## Family Composition

- 80% of active members married
- Males 3 years older than female spouse
- Number of children assume 0 if not provided

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## COLA

- 3% up to assessed COLA base granted each year
  - \$420 maximum for \$14,000 COLA base
- COLA base is a plan provision, not an assumption
  - Rough rule of thumb
    - Actuarial liability and total normal cost increase  $\frac{1}{2}$  of 1% per \$1,000 increase in base
    - ✧ UAL and employer normal cost increase more

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*James Lamenzo is a member of the American Academy of Actuaries and meets the Qualification Standards of the Academy to render the opinions expressed in this presentation regarding actuarial assumptions.*

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## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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**COMMONWEALTH OF MASSACHUSETTS**

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