OHIO PUBLIC EMPLOYEES RETIREMENT SYSTEM
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MEMORANDUM

DATE: February 4, 2005

TO: OPERS Retirement Board Members

FROM: Karen Carraher, Director – Finance
Mark Snodgrass, Assistant Director – Accounting & Budgeting

RE: **V. Discussion Items:**
B. Actuarial Fundamentals

Purpose: To provide the OPERS Retirement Board with educational material regarding the actuarial aspect of the System.

Background: Each year OPERS' retained actuary performs an actuarial valuation of the retirement system's financial condition. The information provided from these annual valuations is an indispensable tool in properly overseeing OPERS operations and establishing system-wide policy. The concepts gained in this month's training (see attached slides) will aid Board members in both obtaining and maintaining a working knowledge of actuarial concepts. This month's educational presentation will be followed by a summary of the results of the 50-Year Population and Cash Flow Projection Report issued November 16, 2004.

Next Steps: Within the next few months the board will receive additional educational presentations on related topics, including DROP plans and potential plan design changes.

Actuarial Fundamentals

February 16, 2005

GRS
Gabriel Roeder Smith & Company

Table of Contents

- Retirement Plans
- Actuarial Mathematics
- Actuarial Assumptions
- Actuarial Cost Methods
- Conclusions

Retirement Plans

Types of Retirement Plans

- Defined Benefit Plans
- Defined Contribution Plans
- Hybrid Plans

Pure Defined Benefit Plans

- Benefit determined by a formula
- Usually involves Years of Credited Service
- Final Average Salary (FAS)
- A multiplier such as 2.2%
- 2.2% x 30 years x $50,000 = $33,000 per year

Pure Defined Contribution Plans

- A stated percent of earnings is put into an account each year
- Employee can usually direct the investment of that account
- Balance in the account is available for distribution at retirement (or earlier)

Hybrid Plans

Combines features of both DB and DC Plans

Examples:

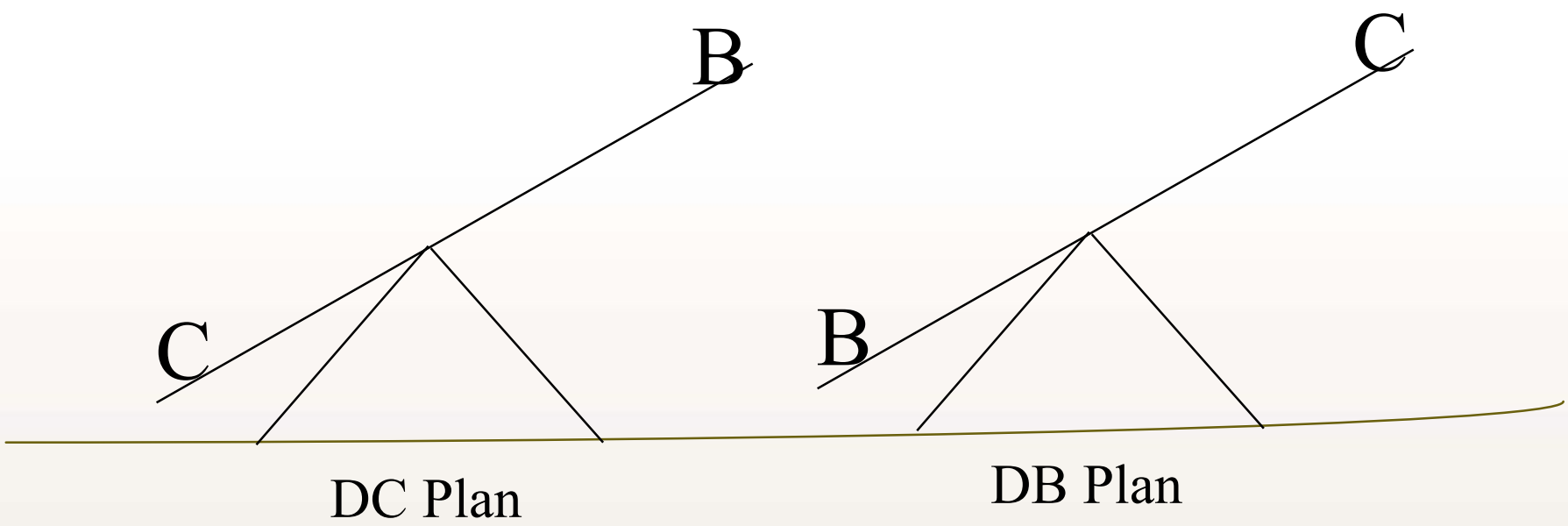
- **Target Benefit Plan**: A DC plan where the contribution rate is designed to target a specific benefit.
- **Cash Balance Plan**: A DB plan that looks like a DC plan with some type of interest rate guarantee.
- **"Floor Plan":** A defined benefit plan with a DC Floor.
- Many other types of hybrid plans exist.

Ohio PERS

- **Traditional Plan** is a defined benefit that has a guarantee that an individual will always receive at least twice the value of his or her own contributions.
- **Member Directed**: A pure DC plan with annuity options.
- **Combined Plan** is a hybrid plan that joins a pure defined benefit with a pure DC Plan.

DB Plans vs. DC Plans

What is known at the outset vs. what is to be determined (possibly at a date far in the future).



C = Contributions B = Benefits

Defined Benefit Plan

Risk Characteristics

- Investment Risk
- Mortality Risk
- Inflation Risk

- Employer bears the risks
- Benefits are predictable (defined)

Defined Contribution Plan

Risk Characteristics

- Investment Risk
- Mortality Risk
- Inflation Risk

- Employee bears the risks
- Benefits are not predictable

Actuarial Mathematics

Basic Retirement Funding Equation

$$\mathbf{C + I = B + E}$$

Where

- C is Contribution Income
- I is Investment Return
- B is Benefits Paid
- E is Expenses

"Money In = Money Out"

Basic Retirement Funding Equation

$$\mathbf{C + I = B + E}$$

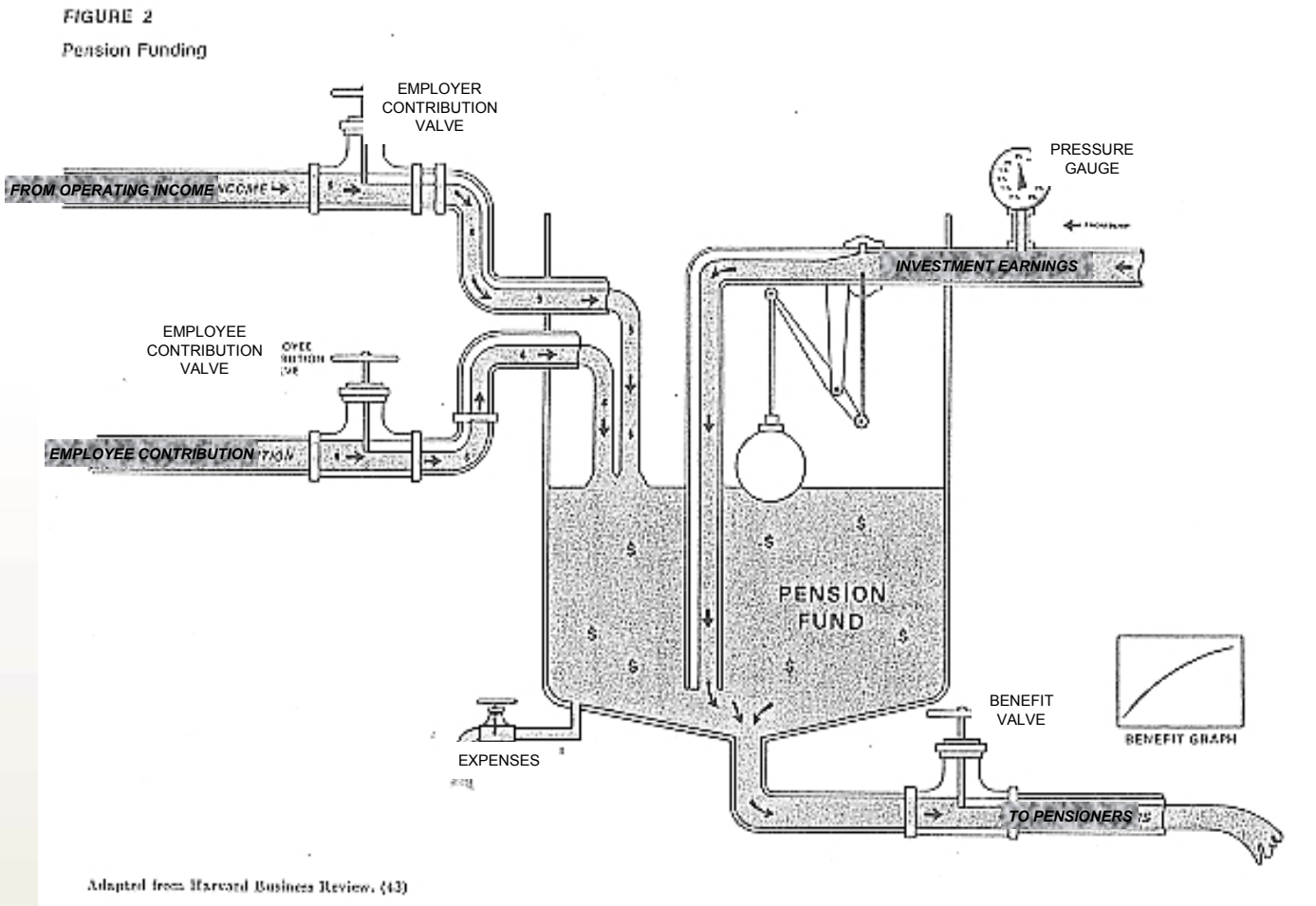
B depends on

- Plan Provisions
- Experience

C depends on

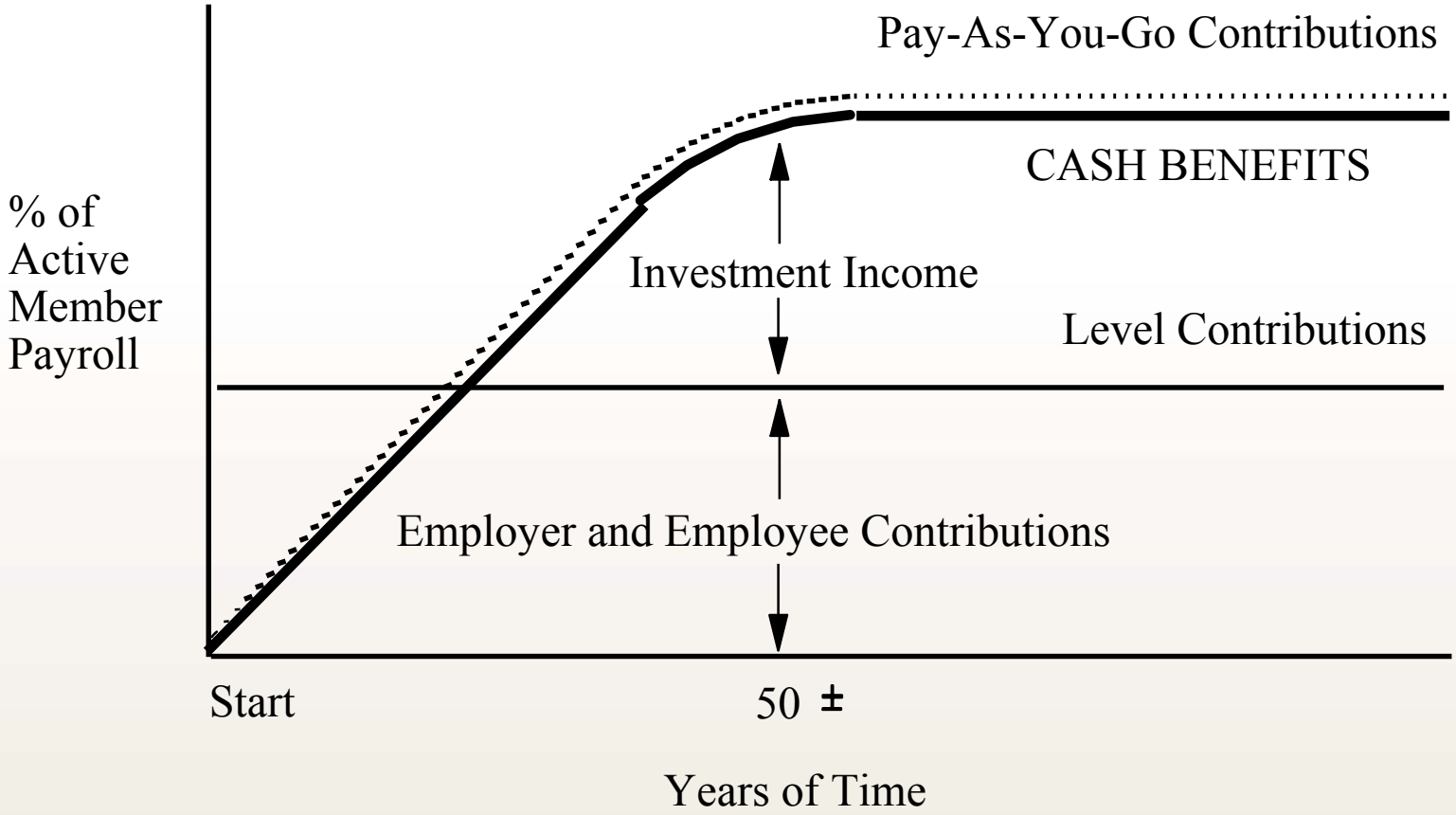
- Short Term: Actuarial Assumptions
  Actuarial Cost Method
- Long Term: I, B, E

A Picture of the Equation

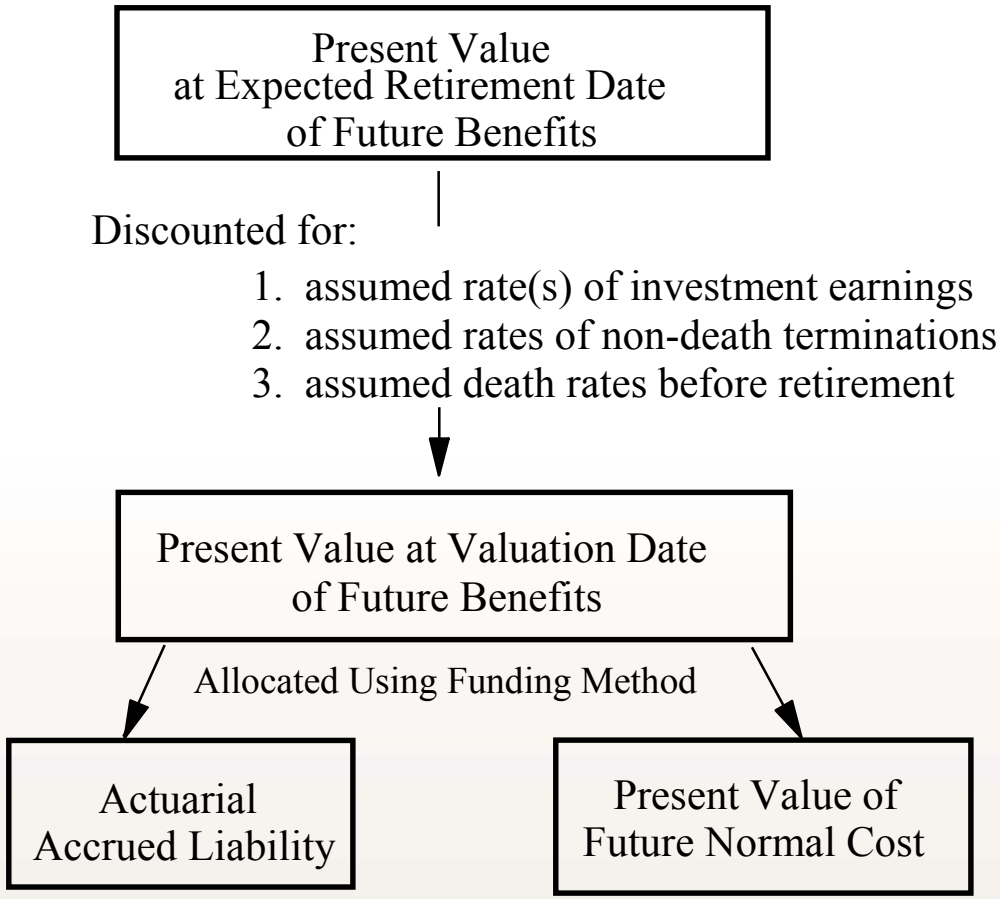


Source: Trowbridge and Farr: Theory and Practice of Pension Funding 1976

The Long Term Solution to the Equation



Actuarial Valuation Process



Actuarial Accrued Liability
- Valuation Assets
= Unfunded Actuarial Accrued Liability

OPERS 2003 Pension Results

All Plans All Divisions		
(1) Actuarial Accrued Liability	$54,814	Million
(2) Valuation Assets	46,786	
(3) Unfunded Liability (1)-(2)	$ 8,028	
(4) Funded Ratio (2)/(1)	85%	

Unfunded liabilities are not bad; like a home mortgage, it is important to have a realistic plan for paying them off over a reasonable period of time. OPERS is paying off unfunded liabilities as a level % of payroll over 29 years, in compliance with Ohio Statutes and GASB accounting guidelines.

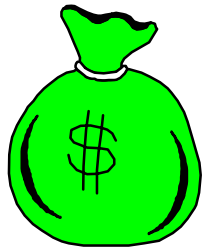
Discussion of Funded Ratios

- It is difficult to compare funded ratios among different systems in a meaningful manner.
- Actuarial assumptions are not uniform among systems.
- Valuation dates and reporting schedules are different.
- Each system has a different past history.
- That having been said, however, a 2004 report of funding ratios of State Retirement Systems indicates that at the time the report was assembled, OPERS' funding ratio was higher than 80% of the 123 systems surveyed.

Funding a $10,000 Annual Pension for a Person

Present Value of Benefits

At Retirement Date $90,000



At Valuation Date $25,000

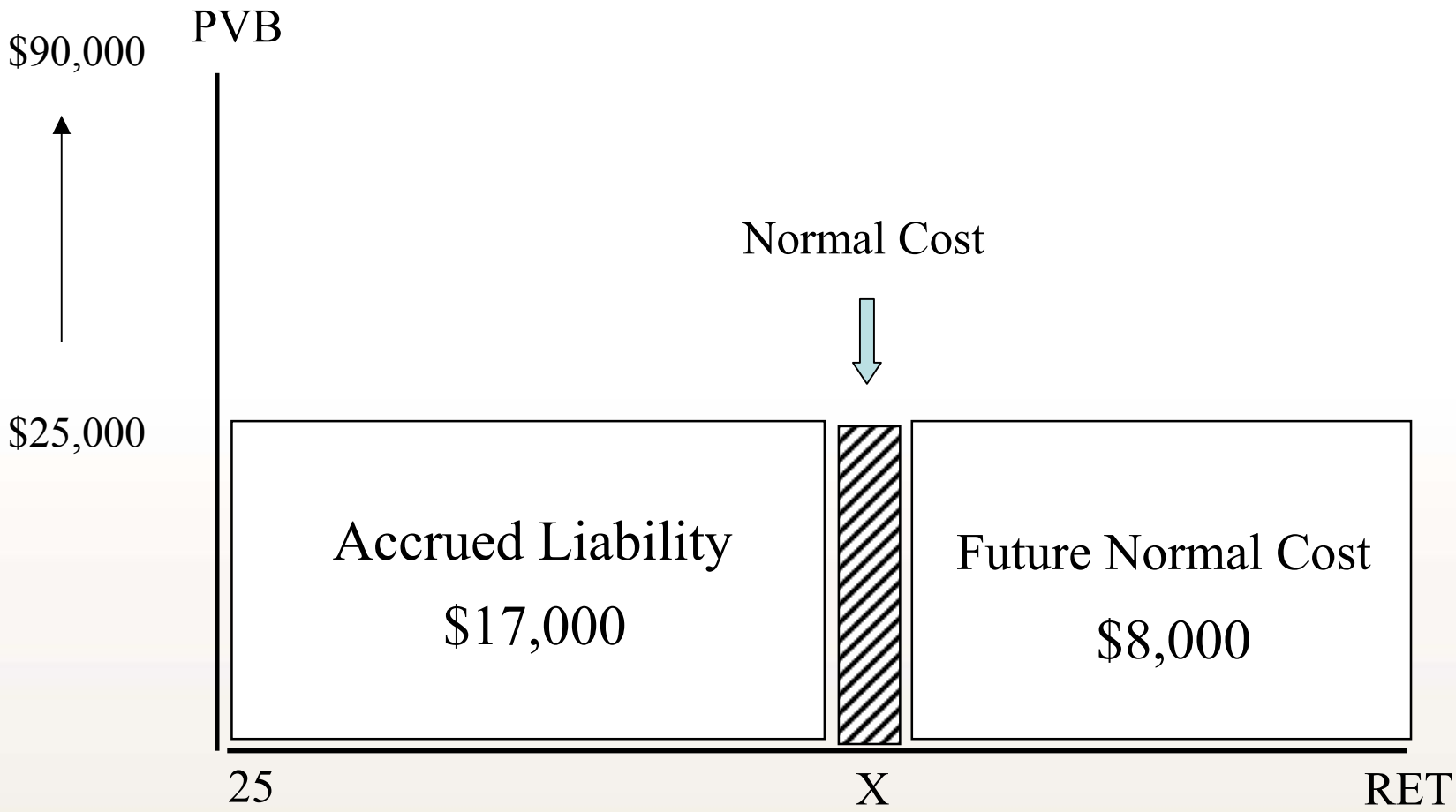
Allocated to Past and Future Service

$17,000
Actuarial Accrued Liability

$8,000
Present Value of
Future Normal Costs

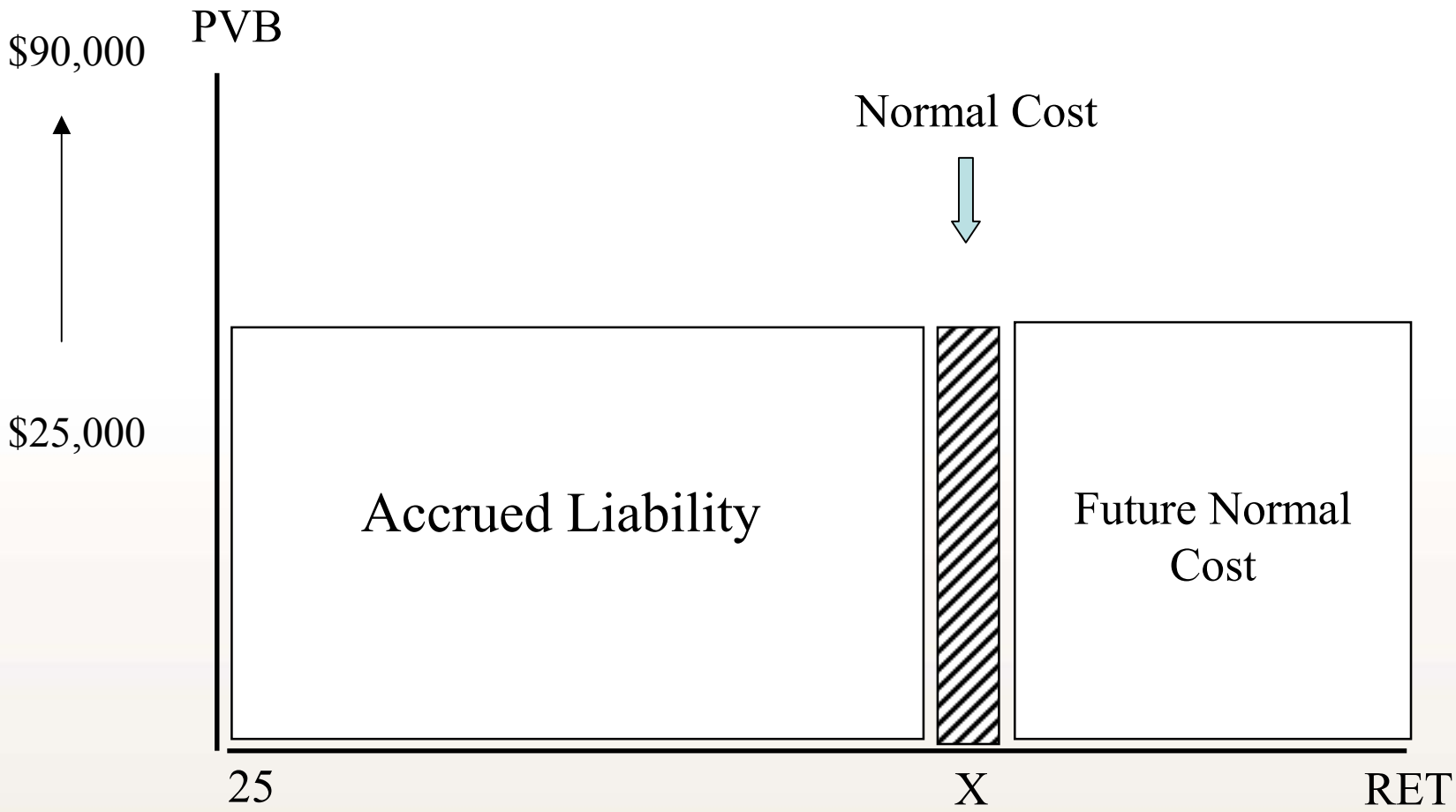
Actuarial Accrued Liabilities
\- Accrued Assets
Unfunded Actuarial Accrued Liabilities

Completing the Pension Funding



As the person ages, the boxes grow Northward until the PVB becomes $90,000. At the same Time, the normal cost layer moves to the right. At retirement, there is one big square box; the accrued liability and the PVB are both $90,000, and the Future Normal Cost is $0.

Completing the Pension Funding



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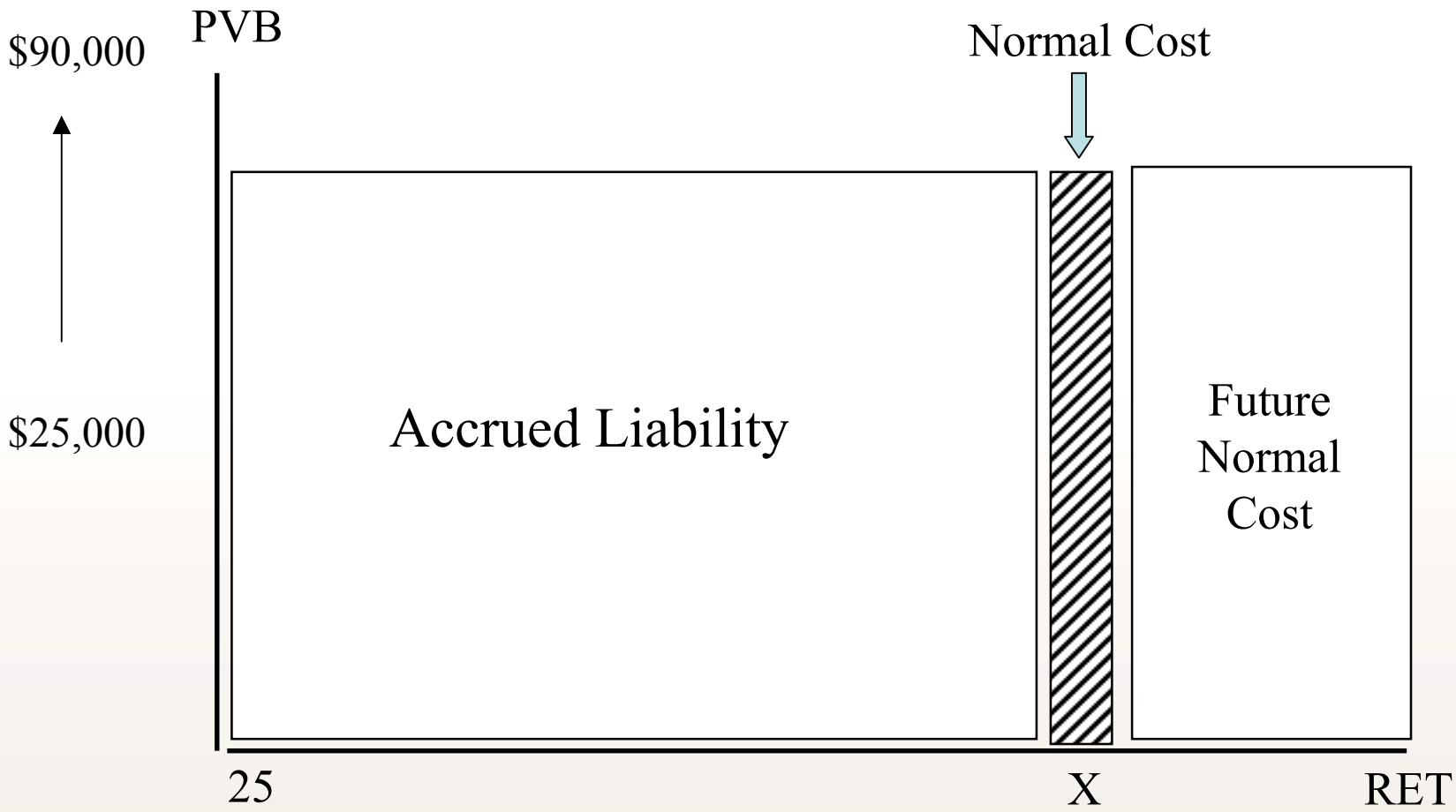

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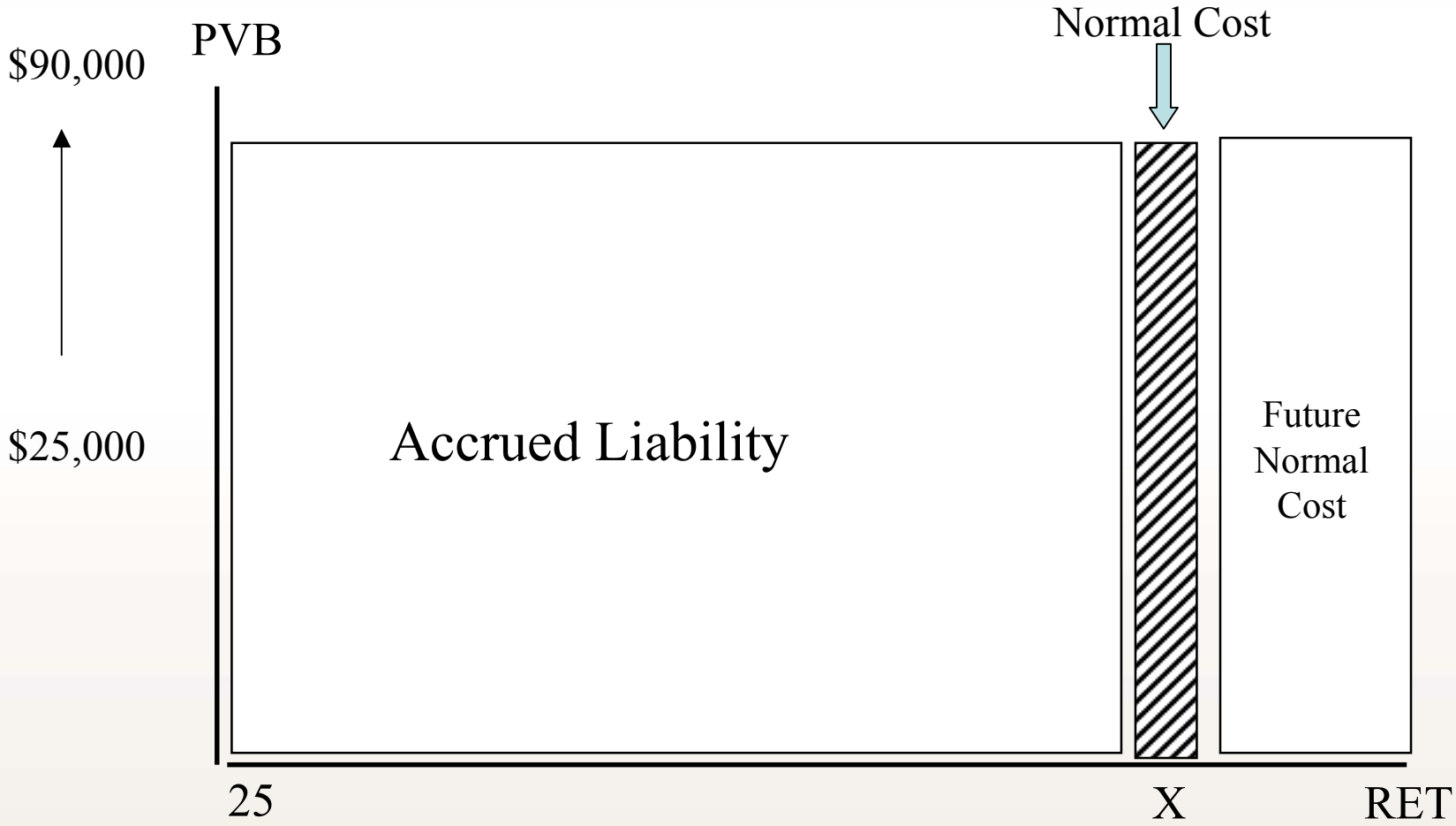

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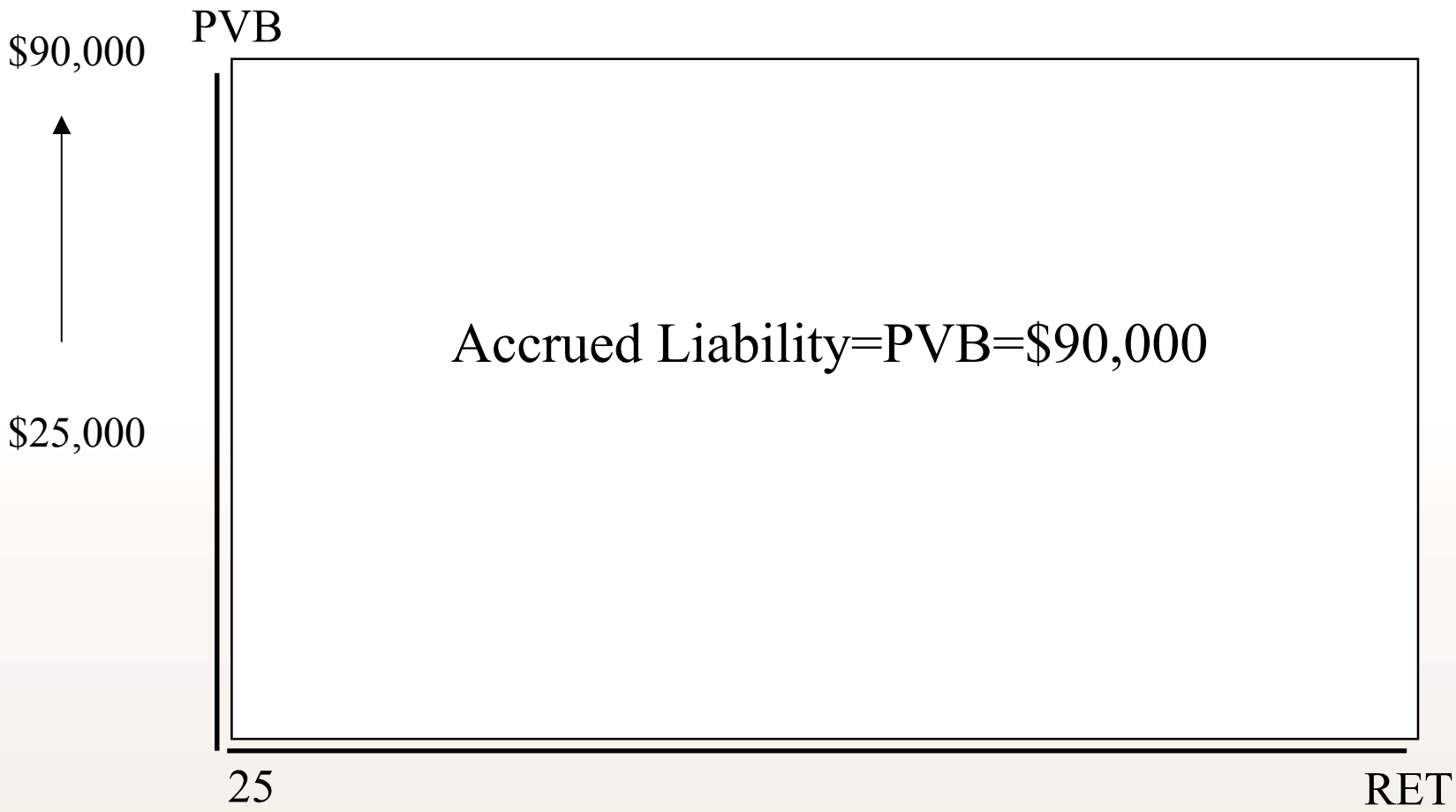

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Measurement of Assets

- For assets that have to be used today, Market Value is the most sensible measure.
- In the long term, the Market is always right.
- In the short term the Market is often volatile and subject to temporary conditions and mood swings that distort the value.
- In pension funding, a volatile measurement of assets would tend to produce volatile contribution rates and funding progress measurements, both of which are undesirable.
- Commonly in pension funding, some type of smoothed market measurement is applied to the assets, and the result is called the “Actuarial Value of Assets” or the “Funding Value of Assets”.

Measurement of Assets at OPERS

- In the OPERS actuarial work, asset gains and losses above or below the assumed rate of return are smoothed in over the current year, and three future years.
- Three years after a valuation date, all asset gains or losses known at that time are fully recognized.
- The OPERS method contains an additional provision that, regardless of the results of the calculation, actuarial value cannot differ from market value by more than 12%. This is referred to as a "Market Value Corridor".
- The OPERS Board installed the 12% Market Value Corridor in response to the 2000-2002 market downturn. The corridor ensures that the relationship between the asset value used by the actuary and the market value is reasonable and that, therefore, OPERS' financial position is not unrealistically overstated or understated.

OPERS 12/31/2003 Calculation

Total DB Pension and Health Assets in $ Millions

Beginning Funding Value	$	53,744.7
Plus Net Cash Flow		(735.4)
+ Assumed Return		4,270.1
+Phased in Return		(36.0)
=Ending Funding Value	**$**	**57,243.4**
Market Value		59,054.8
Ratio		97%

Page 8 of the 12/31/2003 OPERS actuarial report gives the full calculation

What is Net Cash Flow?

- Net Cash flow is the difference between Contribution Income and Benefit Outgo.
- At OPERS, benefit outgo exceeds contribution income, and the net cash flow is negative.
- This is a natural and expected result in a well funded, maturing pension plan.
- The difference is made up by investment return.

Example Contribution Rate Results

Amount	Contribution For	Description
19%	Normal Cost	Value of this year's expected benefit accruals; some portion often paid by members
5%	UAL	Unfunded Liability
24%	Contributions are usually expressed as a % of Payroll	

Funding Unfunded Liabilities

- Usually as a level % of payroll.
- Often funded over a closed period with a specific target funding date.
- Sometimes funded over a variable period designed to stabilize contribution rates.
- Narrow range of practice. Well defined map.

Funding Unfunded Liabilities at OPERS

- OPERS uses the "Funding over a Variable Period" concept.
- A contribution rate is set, and the actuary solves for the period over which that contribution rate will fund the unfunded liabilities.
- Section 145.221 of Ohio Statutes provides that if the amortization period exceeds 30 years, the Board must submit a plan to the ORSC for reducing the amortization period to 30 years. The plan must be submitted within 90 days of the actuarial report.
- Accounting standards promulgated by the Governmental Accounting Standards Board (GASB) require that the plans financial statements be prepared on the basis of a contribution rate that is based upon a 30 year or smaller period.
- Based upon contribution rates enacted in connection with the Health Care Preservation Plan, OPERS funding period is currently 29 years.

Actuarial Assumptions

The Concept of Present Value

Actuarial calculations almost always begin with the calculation of a present value.

The present value of an amount of money payable in the future is the amount of money that, if we had it today, would accumulate to the amount that will be payable considering

- Investment return.
- Probability that money will be paid.

The calculation of the present value depends upon assumptions.

Investment Return

- Relates to Economic Assumptions

Probability that Money will be Paid

- Relates to Demographic Assumptions

Selection of Assumptions

What

Economic	Demographic
• Investment Return • Payroll Growth Rate • Population Growth Rate (Usually, a constant population size is assumed)	• Retirement Rates • Promotional/Step Pay Increases • Disability • Turnover • Mortality

Who

• Board, Actuary, Other Advisors	• Mostly Actuary

Understanding Economic Assumptions

OPERS	
8%	Interest Rate
-4%	Minus Constant Population Payroll Growth rate
4%	Equals Assumed Real Rate of return over wages or "Spread"

Since payroll growth normally exceeds inflation, a 4% real rate of return or “spread” over wages might correspond to a 5% real rate of return over price inflation.

Basically, the interest rate tells us how much money we think we will have. The inflation rate tells us what we think we can buy with it.

How do OPERS Assumptions Compare?

Based upon information known on 2/3/2005, the NASRA/NCTR Public Fund Survey indicates the following about assumptions for 53 Retirement systems with assets of $10 billion or greater.

Assumption	High	Low	Average	Most Common	OPERS
Interest	8.75%	7.25%	8.02%	8.00%	8%
Wage Inflation	5.00%	2.50%	3.72%	3.50%	4%
Spread	5.50%	2.75%	4.30%	5% & 3.5%	4%

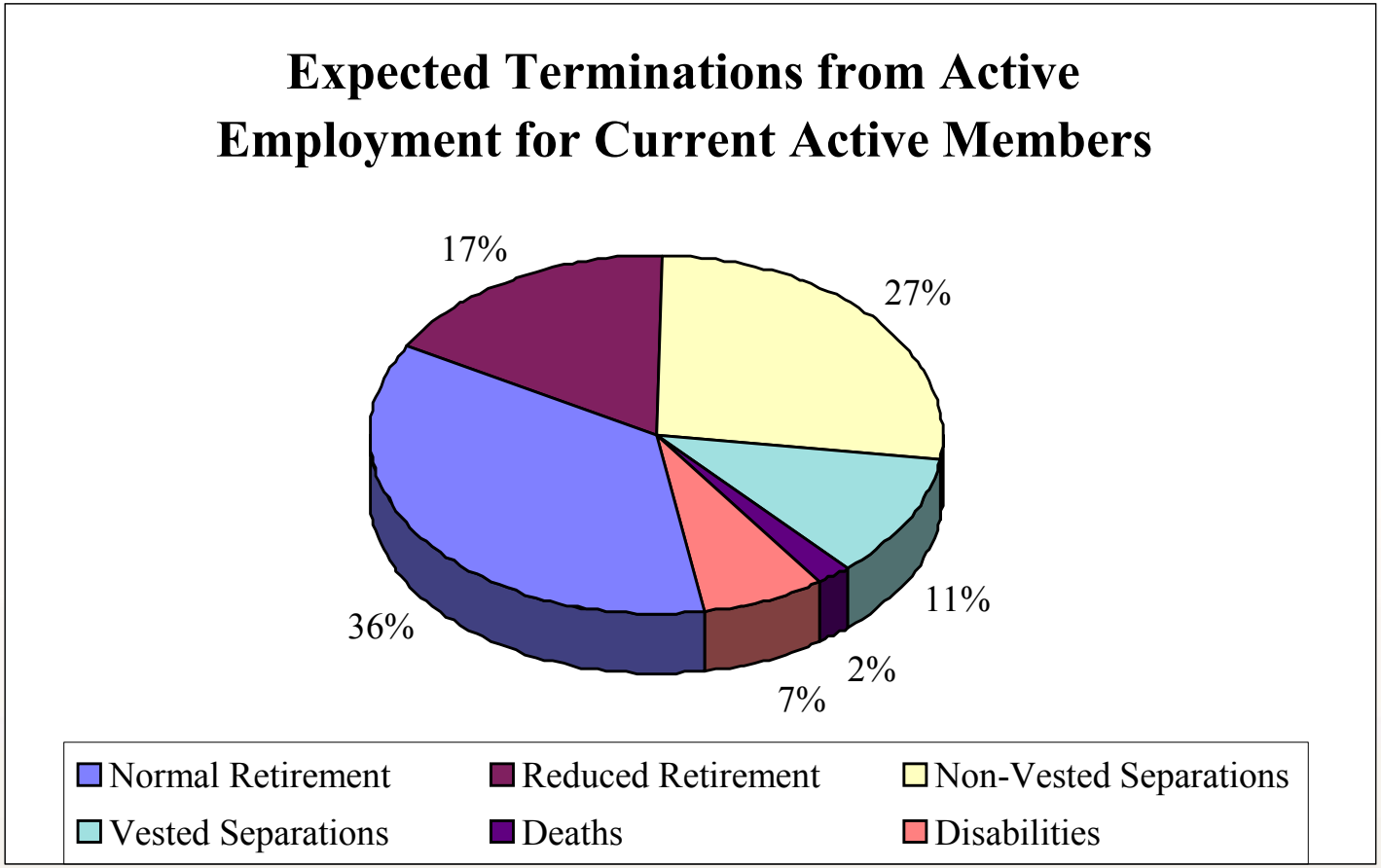
As a general rule, the most important assumption is the spread. A high spread indicates a higher level of risk than a lower spread. The information above indicates that OPERS assumptions are mainstream and very close to the middle of the pack.

Changes in Major Assumptions

Effect on Liabilities and Contributions

Assumption	Action	Usual Effect
Interest Rate	Increase	Decrease
Wage Inflation	Increase	Increase
Spread	Increase	Decrease
Population Growth	Increase	Decrease
Retirement	Retire Younger	Increase
Turnover	More Quits	Decrease
Mortality	Live Longer	Increase

Understanding Demographic Assumptions



In Ohio PERS, as in most plans, the vast majority of participants are expected to draw retirement benefits.

Actuarial Cost Methods

The Actuarial Cost Method determines the allocation of cost between past and future.

Two common methods are:

- Entry Age Normal Cost
- (Projected) Unit Credit Normal Cost

The next page illustrate the two methods in a simple case.

Funding for a $30,000 Present Value at 30 Years of Service

(End of Year Deposits - 7% Interest)

No Inflation !!!

	Entry Age		Unit Credit	
Year	**Normal Cost**	**Accrued Liability**	**Normal Cost**	**Accrued Liability**
1	$317.59	$ 317.59	$ 140.56	$ 140.56
5	317.59	1,826.38	184.25	921.26
10	317.59	4,387.98	258.42	2,584.21
15	317.59	7,980.74	362.45	5,436.70
20	317.59	13,019.77	508.35	10,167.00
25	317.59	20,087.27	712.99	17,824.67
30	317.59	30,000.00	1,000.00	30,000.00

How Were the Numbers Calculated?

Entry Age: What is the level amount to be contributed each year so that at the end of the funding period, exactly the right amount of money is available?

Unit Credit: What amount should be contributed each year, so that that amount plus interest equals that year's share of the total present value? (In the example, each year's contribution must grow to $1,000 at the end of the period.)

Case Study of a Benefit Change

A plan is amended to provide a 10% benefit increase, so the contribution rate has to go up 10% right?

Wrong!!

	Contributions Expressed as %'s of Active Payroll		
	Before Change	Effect of Change	After Change
Total Normal Cost	20%	times 1.10	22%
Accrued Liabilities	$100 Million	times 1.10	$110 Million
Assets	90 Million		90 Million
Unfunded Liability	$10 Million		$20 Million
% to Amortize	4%		8%
Total Contribution	**24%**		**30%**
% Increase			**25.0%**

In this example, a 10% increase in benefits led to a 25% increase in contributions.

Conclusions

Concluding Remarks

- There are many forces trying to get retirement boards to make decisions based upon:
  - Short term considerations.
  - A partial view of reality.
  - An incorrect view of reality.
- Left unchecked, these forces can do great harm to a Retirement System and to the people who depend on it.

Conclusion

Understanding actuarial concepts is a fundamental element of pension plan fiduciary responsibility.