

BENEFIT STREAM DRIVEN ACTUARIAL VALUATIONS FOR 'DEFINED BENEFIT' PENSION PLANS

Daniel F. McGinn, United States of America

Executive Summary

Although the ideas expressed in this article are explained in terms of defined benefit pension plan issues, the author's primary purpose is to urge pension actuaries to re-focus their actuarial expertise. Instead of thinking in terms of present values of benefit, actuarial assumptions and cost methods, actuaries should think much more about the future year-by-year benefits that an employer commits to pay under an employee benefit plan. This series of projected benefit payments can be viewed as a "benefit stream." The corporate commitment is to pay a stream of benefits, not merely to pay annual contributions fixed by a selected actuarial cost method, subject to ERISA's Full Funding Limitations and influenced by potential PBGC plan termination concerns.

Using benefit streams in combination with alternative actuarial cost methods, different employer contributions are generated, together with rates of asset growth and levels of benefit security. Linkage of a unique asset allocation strategy, a specific actuarial cost method and a set of actuarial assumptions produces a particular confidence level in measuring the probability that assets will be sufficient to pay the promised benefits and to fully fund vested benefit liabilities.

This article examines the effect of expanding and contracting covered populations and their impact on employer contributions, rate of asset growth and benefit payments. The author points out that many of the concepts outlined in this paper really are just different ways of viewing pension funding and the techniques available to help the pension actuary in a rapidly changing economic environment. With the continuing movement from defined benefit to defined contribution plans, pension actuaries should re-focus their expertise. The probable range of yearly benefits payable under health care plans can be measured; trust fund investment strategies can be evaluated in light of the timing and amount of benefit payments the funds must support; and other identifiable probable future events whose costs are measurable, within specified confidence levels, can be priced.

The author concludes that pension actuaries should be able to expand their expertise to solve complicated business planning problems and move along quickly with the swift tide of changing economic events.

Introduction

When an employer establishes an IRS-qualified defined benefit pension plan, he commits the corporation to the payment of benefits each year into the future for the covered employees who become eligible for benefits. This series of benefits can be viewed as a "benefit stream."

The projection of benefit streams for a continuing "defined benefit" pension plan appears to this author to be critical for an actuary to give professional and appropriate funding, plan design and investment strategy advice to a plan sponsor. The projections do not have to be linked to any cost method but merely need to represent the expected payments under the plan. Projections of benefit streams can also be useful in evaluating a series of "what if" questions. For instance, what if

- ▶ the corporation grows more rapidly than expected and pension liabilities correspondingly expand; or
- ▶ the corporation experiences a sudden, sharp decline in business activity; or
- ▶ the asset allocation strategy does not validate the actuary's assumptions within a reasonable confidence level. (In other words, there is little likelihood of meeting the actuary's assumed investment results under the existing investment policy); or
- ▶ inflationary salary trends occur and cause benefit costs to explode; or
- ▶ a sharp increase in the number of early retirement results from subsidized benefits, and so forth?

In the current environment of computer applications, the actuary has the ability to model virtually any number of potential events. He/She also can apply statistical analyses to measure confidence levels of a plan sponsor's asset allocation policy and/or selection of funding methods.

In preparing this brief paper, it has become quite apparent that modelling a few alternative population and experience scenarios for defined benefit pension plans requires extensive time and effort, but the results can be enlightening and very useful to a plan sponsor. Due to time constraints, only a few sets of alternative benefit streams have been developed to reflect alternative population change/investment result scenarios. The purpose of these projections is primarily to evaluate their effects on a plan's potential asset growth and the funding of vested benefit liabilities. With more time, the impact of alternative experiences on

potential PBGC plan termination liability calculations, the limitations on the tax-deductibility of employer contributions, and other issues could be explored.

In general, the concept of benefit streams, defined by either a defined benefit pension plan formula, as presented in this paper, or, in fact, benefit streams generated by any type of employee retirement or health care plan, should, in this author's opinion, become a more important focus of future actuarial work. Actuaries should acknowledge that cost methods are neither intrinsically liberal nor conservative: their selection generally will be influenced by numerous economic factors. However, the so-called "conservative" cost methods do lead to higher confidence levels relative to a plan sponsor's ability to deliver the benefits promised. Every benefits program requires contributions, investment returns and asset growth, and the actuary is the plan advisor in the best position to model the financial effects of any benefits program on the sponsor's operation.

The following presentation addresses only a few issues of defined benefit pension plans and the use of benefit streams in an actuary's practice. Hopefully, these expressed thoughts, supported by illustrative examples, will prompt actuaries to re-evaluate their future role as professional advisors to corporate plan sponsors.

Defined Benefit Plan Benefit Streams

Traditionally, pension actuaries have made their calculations for defined benefit pension plans, using one of the following actuarial cost methods:

- ▶ Unit Credit
- Entry Age
- ▶ Aggregate
- ▶ Frozen Initial Liability (where the initial liability is calculated alternatively under the Unit Credit or Entry Age Actuarial Cost Methods).

In the mid '70s, a paper was presented by Donald R. Fleisher to the Society of Actuaries on the "Forecast Valuation Method for Pension Plans." Robert J. Schnitzer followed-up on this paper with his own "Characteristics and Operations of Projection Valuation Methods for Pension Plan Funding," published in the Society's Transactions. Both papers viewed actuarial projection methodology differently, but the focus of each paper was on technology. For instance, Mr. Schnitzer promoted the concept of projecting benefits into the future and "layering-in" new entrant benefits to reflect dynamic actuarial assumptions that, presumably, would allow actuaries to provide plan sponsors with more realistic cost estimates.

This article incorporates the principal concepts of those papers since there is no intention to introduce any new actuarial cost methods: the goal of this discussion is to propose that actuaries change their focus in performing valuations. For many years, actuaries have concerned themselves primarily with present value calculations and the selection of economic assumptions and cost methods. These factors are obviously important to actuaries, but they do not clearly communicate to the plan sponsor the nature of the commitment made when a plan is established or amended. Continuing emphasis on these factors has contributed to a perception that the role an actuary can play in advising a plan sponsor is limited to matters often unintelligible to a lay person.

It is the opinion of this author that the actuary should utilize the value of projected benefit streams to provide plan sponsors a better insight into the implications of actuarial assumptions. By analyzing the rate of growth of assets and liabilities linked with benefit streams, the actuary can be positioned to evaluate the appropriateness of alternative cost methods to reflect their clients' economic circumstances, funding policy and investment allocation strategy.

Development of Benefit Streams

For most plans, the actuarial present value of contributions for future generations of new entrants will equal the actuarial present value of their benefits. Consequently, their present values are not directly reflected in a traditional actuarial valuation. However, if a plan's benefit structure is recognized as implying yearly benefit streams and changes in yearly contributions and asset values, the actuary can generate those benefit streams for current plan participants and for future new entrants to assist him/her in selecting an appropriate cost method, in working with investment managers for asset allocation purposes and in advising a corporation's management in evaluating alternative plan design changes.

In the opinion of this author, all of the actuary's knowledge of the company's operations, including planned expansion or contraction of the employee group, probable deviations of investment experience from expected results, the sensitivity of a plan's contributions to compensation changes that differ from the expected, etc. should be evaluated. Additionally, the potential influence of the Full Funding Limitation (linked in part to the calculation of a "current liability"), the probable growth, decline or elimination of unfunded vested benefit liabilities and the company's asset allocation policy are factors that should be taken into account.

An efficient method of accounting for these factors is to project future benefit streams that can reflect one or more of these factors and, if necessary, a combination of all factors. Obviously, the projected benefit streams are totally

independent of the actuarial cost method the actuary may adopt. However, the present value of future benefit streams at any reference point of a projection period might indicate that it is imprudent to adopt a certain cost method due to

- the increased probability of employer contributions being constrained or eliminated for several years by the Full Funding Limitation. This constraint alone would limit employer flexibility in making contributions if there were a too-rapid build-up of plan assets.
- ▶ the rate of growth of Vested Benefit Liabilities (VBL's). The employer may wish to maintain a very well-funded plan by establishing, as a goal, a specified ratio of asset value to VBL's --- a ratio that always exceeds 100% after a specified number of years.
- the rate of growth in annual benefit payments due to either anticipated increases in the covered employee compensation base and/or an increased utilization of liberal early retirement rights.

Example

The significant value of projected benefit streams to management is best demonstrated by an example using a typical corporate pension plan. For this purpose, the author has used the data base and benefit structure of an actual plan with benefits based on "career average" compensation. Through an analysis of projected results under a series of scenarios, management can establish a feel for the sensitivity of plan costs to alternative conditions. The effects of a decline in the workforce can readily be evaluated. The potential growth in PBGC-related employer liabilities can be analyzed. Additionally, such projections can provide an insight into the potential funding progress of the plan, the volatility of asset values when fair market values are used and the latter's effect on Full Funding Limitation and Unfunded Vested Benefit Liability (UVBL) calculations. This paper addresses some, not all, of these issues.

For an actual client plan, actuarial projections in this paper develop the following:

- Plan contribution and fund growth characteristics during a ten year period, developed from use of the plan's actuarial assumptions.
- Effects of both a decline and/or growth in the workforce.
- The manner in which investment results different from the actuarial assumptions affect projected asset values when alternative cost methods and

actuarial asset valuation methods are used.

In this paper, the effects of several alternative scenarios are examined briefly. The actuarial values presented are based on the actual client plan outlined in Appendix A, using the plan's current actuarial assumptions, as described in Appendix B. All calculations are based on an existing client's census data, covered compensation and liabilities, but actuarial values have been pro-rated to reflect an active initial population of 1,000 employees with an average annual salary of \$25,000.

For simplicity purposes, asset projections are linked to annual employer contributions, assumed to be paid at mid-year, equal to the plan's normal cost plus the Unfunded Actuarial Liability (UAL) divided by 10. Only the Entry Age Actuarial and Unit Credit Actuarial Cost Methods have been used to calculate alternative levels of employer contributions.

Initial Analyses

The first step is to project the financial characteristics during a ten year study period, assuming that the actuarial assumptions used in the plan's regular actuarial valuation are exactly fulfilled. This projection shows explicitly the entry of new participants into the plan during the projection period. A regular actuarial valuation implicitly assumes that new entrants replace participants who leave the plan (due to termination, disability, retirement or death) in such a way as to maintain a stable contribution base; i.e., to keep the number of active plan participants level from year to year, but traditional valuation methods do not disclose the population changes caused by these many factors. Therefore, in our projection technique, we have introduced a sufficient number of new entrants each year to maintain the active population at 1,000 participants.

Table 1 on the following page illustrates the year-by-year changes in the number of active lives under the stated actuarial assumptions, and also presents the contributions to be made to the plan under the Entry Age Actuarial Cost Method. (A change in the cost method would affect only the level of annual contributions to the plan and the rate of asset growth: benefit streams are not affected.) Investment results are assumed to grade from 9.0% initially to 7.29% in the tenth year of the projection. These assumptions are the actual assumptions used for a client based on its existing investment policy and asset allocation practice.

The reader should note that nearly 60% of the initial population is replaced by new hires to compensate for the participants who retire, withdraw, become disabled or die during the 10 year projection period. Meanwhile, annual salaries grow by more than 36.3%, based on the stated inflation assumption of 3.5% per year, while the

TABLE 1
10-YEAR PROJECTION OF POPULATION AND CONTRIBUTIONS
Entry Age Actuarial Cost Method
Level Active Plan Population
(All Dollar Amounts in Thousands)

YEAR	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENT	1996 NEW ENT	1997 NEW ENT	1998 NEW ENT	1999 NEW ENT	2000 NEW ENT	2001 NEW ENT	2002 NEW ENT	TOTAL ACTIVE LIVES	TOTAL PROJ. PAY	TOTAL N. COST 5.3% PAY	TOTAL PROJ. BR. CONT.	TOT. ER. CONT. AS % OF PAY
1993	1,000										1,000	\$25,000	\$1,325	\$2,009	8.04%
1994	895	105									1,000	\$25,875	\$1,371	\$2,045	7.90%
1995	808	82	110								1,000	\$26,781	\$1,419	\$2,082	7.77%
1996	732	70	86	112							1,000	\$27,718	\$1,469	\$2,121	7.65%
1997	664	62	74	87	113						1,000	\$28,688	\$1,520	\$2,161	7.53%
1998	603	58	65	75	88	111					1,000	\$29,692	\$1,574	\$2,203	7.42%
1999	548	53	61	66	76	87	109				1,000	\$30,731	\$1,629	\$2,245	7.31%
2000	498	48	55	62	67	74	85	111			1,000	\$31,807	\$1,686	\$2,288	7.19%
2001	453	44	51	56	62	65	73	87	109		1,000	\$32,920	\$1,745	\$2,331	7.08%
2002	412	40	46	52	57	61	64	74	85	109	1,000	\$34,072	\$1,806	\$2,376	6.97%

total population remains stable at 1,000 active members. Although the normal cost rises in direct proportion to the salaries, total contributions as a percent of salaries declines from just over 8% to just under 7% since the UAL remaining each year is declining. Using this data, the benefit streams are developed and shown in **Table 2** that follows.

Table 2 shows that the plan's annual benefit payout should nearly double over the ten year study period if the total number of actives participants remains stable and actual experience is consistent with the actuarial assumptions. Also, by the tenth year, roughly 50% of the benefit payments are made to participants who were active on the initial valuation date (1993).

Beginning with assets of \$37.0 million, **Table 3** shows the cash flow implied by these benefit streams and contributions based on the stated actuarial investment earnings rates, ranging from 9.0% in 1993 to 7.29% in 2002. Using these actuarial assumptions and methods, assets grow continuously even though benefit payments in the tenth year are almost 60% greater than annual contributions and, ultimately, will exceed contributions by 150% or more.

Comments

The IRS requires an actuary to use a "closed group" approach to making the funding calculations for a tax-qualified defined benefit pension plan. However, when the actuary uses a standard actuarial cost method acceptable to the IRS, it only **appears** that the actuary is making a "closed group" valuation. **Table 1** demonstrates that use of the Entry Age Actuarial Cost Method implies the "layering-in" of new entrants. If new entrants were not implicitly "layered-in," the actuarial computations anticipate that the plan is gradually terminating. In other words, the covered population and compensation would shrink sharply over the projection period, while benefit streams would decline only slightly. Contributions in the tenth year would be about 35% (\$1.3 million) of benefits projected under a continuing plan assumption.

Alternative Population Scenarios

One of the greatest advantages of performing a valuation through the use of benefits streams is that the plan's future population can be modeled in accordance with the expected rate of growth or decline in the particular industry. Without changing the assumed rates of decrement, the future population and salary levels can be modified by simply reducing or increasing the number of new entrants that are expected to enter plan coverage.

TABLE 2
10-YEAR PROJECTION OF BENEFIT PAYOUT
Level Active Plan Population

YEAR	PROJ. BEN. PAYMENT	PROJ. BEN	CURR. & FUT. ACT.	VT&RET	TOTAL				
	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENTRANTS	1996 NEW ENTRANTS	1997 NEW ENTRANTS	1998 NEW ENTRANTS	PROJECTED BEN. PAYMENT	PROJECTED BEN. PAYMENT	PROJECTED BEN. PAYMENT
1993	\$127,734	\$0	\$0	\$0	\$0	\$0	\$128,000	\$1,863,000	\$1,991,000
1994	\$356,389	\$0	\$0	\$0	\$0	\$0	\$356,000	\$1,916,000	\$2,272,000
1995	\$564,879	\$0	\$0	\$0	\$0	\$0	\$565,000	\$1,934,000	\$2,499,000
1996	\$763,926	\$0	\$0	\$0	\$0	\$0	\$764,000	\$1,943,000	\$2,707,000
1997	\$955,404	\$0	\$0	\$0	\$0	\$0	\$955,000	\$1,943,000	\$2,898,000
1998	\$1,141,699	\$523	\$0	\$0	\$0	\$0	\$1,142,000	\$1,938,000	\$3,080,000
1999	\$1,324,031	\$1,566	\$567	\$0	\$0	\$0	\$1,326,000	\$1,931,000	\$3,257,000
2000	\$1,502,749	\$2,942	\$1,698	\$598	\$0	\$0	\$1,508,000	\$1,921,000	\$3,429,000
2001	\$1,677,835	\$4,669	\$3,190	\$1,790	\$624	\$0	\$1,688,000	\$1,908,000	\$3,596,000
2002	\$1,851,668	\$6,650	\$5,062	\$3,362	\$1,869	\$634	\$1,869,000	\$1,891,000	\$3,760,000

TABLE 3
10-YEAR CASH FLOW PROJECTION
Entry Age Actuarial Cost Method
Level Active Plan Population
Investment Rates of Return Equal Actuarial Assumption
(All Dollar Amounts in Thousands)

YEAR	BOY ASSETS	ER CONTR.	BEN. PAYOUT	ACTUAL ROR	INVEST. INCOME	EOY ASSETS
1993	\$37,000	\$2,009	\$1,991	9.00%	\$3,331	\$40,349
1994	\$40,349	\$2,045	\$2,272	8.90%	\$3,581	\$43,703
1995	\$43,703	\$2,082	\$2,499	8.80%	\$3,828	\$47,114
1996	\$47,114	\$2,121	\$2,707	8.70%	\$4,073	\$50,601
1997	\$50,601	\$2,161	\$2,898	8.60%	\$4,320	\$54,184
1998	\$54,184	\$2,203	\$3,080	8.34%	\$4,482	\$57,789
1999	\$57,789	\$2,245	\$3,257	8.08%	\$4,628	\$61,405
2000	\$61,405	\$2,288	\$3,429	7.81%	\$4,751	\$65,015
2001	\$65,015	\$2,331	\$3,596	7.55%	\$4,861	\$68,611
2002	\$68,611	\$2,376	\$3,760	7.29%	\$4,951	\$72,178

Using the same model plan, results can be developed quite easily to demonstrate the effects of the total active population growing at by an average rate of 3% per year or, alternatively, declining by 3% per year. (Other rates of growth and/or decline that vary by year could also be readily accommodated.) **Tables 4 and 5** that follow contrast the projections of populations and contributions during a ten year projection period under these two scenarios.

While **Tables 4 and 5** show, as expected, substantial differences in projected population and contribution levels relative to such values for a stable population, the immediately following **Tables 6 and 7** demonstrate that a rising or falling covered population has very little impact on a plan's anticipated benefit payout over the ten year projection period.

Because of the significant differences in expected contributions under expanding plan population vs. contracting plan population scenarios, and their minor difference in benefit payments, the expanding population scenario presented in **Table 8** would result in the accumulation of roughly \$5.7 million more in assets during the ten year study period than the declining plan population illustrated in **Table 9** if the plan's actuarially assumed rates of return were realized. The cash flow projections that support that statement follow.

Projecting Earned and Vested Benefit Liabilities

In addition to projecting annual contributions, benefit payouts and accumulated assets, it is also useful to project the earned and vested benefit liabilities of a plan implied by the current set of actuarial assumptions. Projections can be made on the basis of a stable, increasing or declining plan population. As before, consideration must be made for participants who will enter plan coverage subsequent to the valuation date but before the end of the projection period.

The following **Table 10** demonstrates the development of VBL's for the model plan under the assumption that the plan population will remain stable. For simplicity purposes, new entrants are assumed to enter plan coverage as of January 1 of each year, beginning in 1994. Therefore, since the plan's vesting schedule is 100% after 5 years, the first year that new entrants can generate any VBL is 1999 (1994 + 5). The table also shows that, in this case, there is no UVBL after the first year of the projection.

Projecting Investment Results that Differ from the Valuation Assumption

Using a valuation approach that incorporates benefit streams allows the actuary to test the sensitivity of the plan's funding to investment results that vary year by year,

TABLE 4
10-YEAR PROJECTION OF POPULATION AND CONTRIBUTIONS
Entry Age Actuarial Cost Method
Active Plan Population Increasing 3% Annually
(All Dollar Amounts in Thousands)

YEAR	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENT	1996 NEW ENT	1997 NEW ENT	1998 NEW ENT	1999 NEW ENT	2000 NEW ENT	2001 NEW ENT	2002 NEW ENT	TOTAL ACTIVE LIVES	TOTAL PROJ. PAY	TOTAL N.COST 5.3% PAY	TOTAL PROJ. BR. CONT.	TOT. BR. CONT. AS % OF PAY
1993	1,000										1,000	\$25,000	\$1,325	\$2,009	8.04%
1994	895	135									1,030	\$26,651	\$1,413	\$2,087	7.83%
1995	808	105	148								1,061	\$28,414	\$1,506	\$2,169	7.63%
1996	732	90	115	156							1,093	\$30,295	\$1,606	\$2,258	7.45%
1997	664	80	99	122	161						1,126	\$32,302	\$1,712	\$2,353	7.28%
1998	603	74	87	105	126	165					1,160	\$34,442	\$1,825	\$2,454	7.13%
1999	548	68	81	92	108	129	169				1,195	\$36,723	\$1,946	\$2,562	6.98%
2000	498	62	74	86	95	111	132	173			1,231	\$39,153	\$2,075	\$2,677	6.84%
2001	453	57	68	78	89	97	113	135	178		1,268	\$41,741	\$2,212	\$2,799	6.71%
2002	412	51	62	72	81	91	100	116	139	182	1,306	\$44,497	\$2,358	\$2,928	6.58%

TABLE 5
10-YEAR PROJECTION OF POPULATION AND CONTRIBUTIONS
Entry Age Actuarial Cost Method
Active Plan Population Decreasing 3% Annually
(All Dollar Amounts in Thousands)

YEAR	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENT	1996 NEW ENT	1997 NEW ENT	1998 NEW ENT	1999 NEW ENT	2000 NEW ENT	2001 NEW ENT	2002 NEW ENT	TOTAL ACTIVE LIVES	TOTAL PROJ. PAY	TOTAL N. COST 5.3% PAY	TOTAL PROJ. ER. CONT.	TOT. ER. CONT. AS % OF PAY
1993	1,000										1,000	\$25,000	\$1,325	\$2,009	8.04%
1994	895	75									970	\$25,099	\$1,330	\$2,004	7.98%
1995	808	59	74								941	\$25,201	\$1,336	\$1,999	7.93%
1996	732	50	58	73							913	\$25,307	\$1,341	\$1,993	7.88%
1997	664	44	50	57	71						886	\$25,418	\$1,347	\$1,988	7.82%
1998	603	41	44	49	55	67					859	\$25,506	\$1,352	\$1,981	7.77%
1999	548	38	41	43	48	52	63				833	\$25,600	\$1,357	\$1,973	7.71%
2000	498	35	37	40	42	45	49	62			808	\$25,701	\$1,362	\$1,964	7.64%
2001	453	32	34	37	39	40	42	48	59		784	\$25,810	\$1,368	\$1,954	7.57%
2002	412	29	31	34	36	37	37	42	46	56	760	\$25,896	\$1,372	\$1,942	7.50%

TABLE 6
10-YEAR PROJECTION OF BENEFIT PAYOUT
Active Plan Population Increasing 3% Annually

YEAR	PROJ. BEN. PAYMENT	BEN.	BEN.	BEN.	BEN.	BEN.	CURR. & FUT. ACT.	VT&RET	TOTAL
	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENTRANTS	1996 NEW ENTRANTS	1997 NEW ENTRANTS	1998 NEW ENTRANTS	PROJECTED BEN. PAYMENT	PROJECTED BEN. PAYMENT	PROJECTED BEN. PAYMENT
1993	\$127,734	\$0	\$0	\$0	\$0	\$0	\$128,000	\$1,863,000	\$1,991,000
1994	\$356,389	\$0	\$0	\$0	\$0	\$0	\$356,000	\$1,916,000	\$2,272,000
1995	\$564,879	\$0	\$0	\$0	\$0	\$0	\$565,000	\$1,934,000	\$2,499,000
1996	\$763,926	\$0	\$0	\$0	\$0	\$0	\$764,000	\$1,943,000	\$2,707,000
1997	\$955,404	\$0	\$0	\$0	\$0	\$0	\$955,000	\$1,943,000	\$2,898,000
1998	\$1,141,699	\$672	\$0	\$0	\$0	\$0	\$1,142,000	\$1,938,000	\$3,080,000
1999	\$1,324,031	\$2,014	\$763	\$0	\$0	\$0	\$1,327,000	\$1,931,000	\$3,258,000
2000	\$1,502,749	\$3,783	\$2,285	\$832	\$0	\$0	\$1,510,000	\$1,921,000	\$3,431,000
2001	\$1,677,835	\$6,003	\$4,293	\$2,493	\$889	\$0	\$1,692,000	\$1,908,000	\$3,600,000
2002	\$1,851,668	\$8,549	\$6,811	\$4,683	\$2,663	\$943	\$1,875,000	\$1,891,000	\$3,766,000

TABLE 7
10-YEAR PROJECTION OF BENEFIT PAYOUT
Active Plan Population Decreasing 3% Annually

YEAR	PROJ. BEN. PAYMENT	BEN.	BEN.	BEN.	BEN.	BEN.	CURR. & FUT. ACT.	VTARET	TOTAL
	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENTRANTS	1996 NEW ENTRANTS	1997 NEW ENTRANTS	1998 NEW ENTRANTS	PROJECTED BEN. PAYMENT	PROJECTED BEN. PAYMENT	PROJECTED BEN. PAYMENT
1993	\$127,734	\$0	\$0	\$0	\$0	\$0	\$128,000	\$1,863,000	\$1,991,000
1994	\$356,389	\$0	\$0	\$0	\$0	\$0	\$356,000	\$1,916,000	\$2,272,000
1995	\$564,879	\$0	\$0	\$0	\$0	\$0	\$565,000	\$1,934,000	\$2,499,000
1996	\$763,926	\$0	\$0	\$0	\$0	\$0	\$764,000	\$1,943,000	\$2,707,000
1997	\$955,404	\$0	\$0	\$0	\$0	\$0	\$955,000	\$1,943,000	\$2,898,000
1998	\$1,141,699	\$374	\$0	\$0	\$0	\$0	\$1,142,000	\$1,938,000	\$3,080,000
1999	\$1,324,031	\$1,119	\$381	\$0	\$0	\$0	\$1,326,000	\$1,931,000	\$3,257,000
2000	\$1,502,749	\$2,102	\$1,142	\$390	\$0	\$0	\$1,506,000	\$1,921,000	\$3,427,000
2001	\$1,677,835	\$3,335	\$2,146	\$1,166	\$392	\$0	\$1,685,000	\$1,908,000	\$3,593,000
2002	\$1,851,668	\$4,750	\$3,406	\$2,191	\$1,174	\$383	\$1,864,000	\$1,891,000	\$3,755,000

<p style="text-align: center;">TABLE 8 10-YEAR CASH FLOW PROJECTION Entry Age Actuarial Cost Method Active Plan Population Increasing 3% Annually Investment Rates of Return Equal Actuarial Assumption (All Dollar Amounts in Thousands)</p>								
YEAR	BOY ASSETS	ER CONTR.	BEN. PAYOUT	ACTUAL ROR	INVEST. INCOME	EOY ASSETS		
1993	\$37,000	\$2,009	\$1,991	9.00%	\$3,331	\$40,349		
1994	\$40,349	\$2,087	\$2,272	8.90%	\$3,583	\$43,747		
1995	\$43,747	\$2,169	\$2,499	8.80%	\$3,835	\$47,252		
1996	\$47,252	\$2,258	\$2,707	8.70%	\$4,091	\$50,894		
1997	\$50,894	\$2,353	\$2,898	8.60%	\$4,353	\$54,702		
1998	\$54,702	\$2,454	\$3,080	8.34%	\$4,536	\$58,612		
1999	\$58,612	\$2,562	\$3,258	8.08%	\$4,708	\$62,624		
2000	\$62,624	\$2,677	\$3,431	7.81%	\$4,861	\$66,731		
2001	\$66,731	\$2,799	\$3,600	7.55%	\$5,008	\$70,938		
2002	\$70,938	\$2,928	\$3,766	7.29%	\$5,141	\$75,241		

TABLE 9
10-YEAR CASH FLOW PROJECTION
Entry Age Actuarial Cost Method
Active Plan Population Decreasing 3% Annually
Investment Rates of Return Equal Actuarial Assumption
(All Dollar Amounts in Thousands)

YEAR	BOY ASSETS	ER CONTR.	BEN. PAYOUT	ACTUAL ROR	INVEST. INCOME	EOY ASSETS
1993	\$37,000	\$2,009	\$1,991	9.00%	\$3,331	\$40,349
1994	\$40,349	\$2,004	\$2,272	8.90%	\$3,579	\$43,660
1995	\$43,660	\$1,999	\$2,499	8.80%	\$3,820	\$46,980
1996	\$46,980	\$1,993	\$2,707	8.70%	\$4,056	\$50,322
1997	\$50,322	\$1,988	\$2,898	8.60%	\$4,289	\$53,701
1998	\$53,701	\$1,981	\$3,080	8.34%	\$4,433	\$57,035
1999	\$57,035	\$1,973	\$3,257	8.08%	\$4,557	\$60,308
2000	\$60,308	\$1,964	\$3,427	7.81%	\$4,653	\$63,498
2001	\$63,498	\$1,954	\$3,593	7.55%	\$4,732	\$66,591
2002	\$66,591	\$1,942	\$3,755	7.29%	\$4,788	\$69,566

TABLE 10
10-YEAR PROJECTION OF VESTED BENEFIT LIABILITIES
Level Active Plan Population
Assets Projected on the Basis of the Entry Age Cost Method
and Assumed Investment Rates of Return
(All Dollar Amounts in Thousands)

YEAR	VBL ACTIVES AS OF 1/1/93	VBL 1994 NEW ENTRANTS	VBL 1995 NEW ENTR.	VBL 1996 NEW ENTR.	VBL 1997 NEW ENTR.	VBL CUR. & FUT. ACTIVES	VBL CURRENT RET & VT	TOTAL VBL	ASSETS	UVBL
1993	\$15,091	\$0	\$0	\$0	\$0	\$15,091	\$22,241	\$37,332	\$37,000	\$332
1994	\$18,034	\$0	\$0	\$0	\$0	\$18,034	\$22,298	\$40,332	\$40,349	(\$17)
1995	\$21,020	\$0	\$0	\$0	\$0	\$21,020	\$22,282	\$43,302	\$43,703	(\$401)
1996	\$24,043	\$0	\$0	\$0	\$0	\$24,043	\$22,225	\$46,268	\$47,114	(\$846)
1997	\$27,100	\$0	\$0	\$0	\$0	\$27,100	\$22,133	\$49,233	\$50,601	(\$1,368)
1998	\$29,962	\$0	\$0	\$0	\$0	\$29,962	\$22,012	\$51,974	\$54,184	(\$2,210)
1999	\$32,825	\$262	\$0	\$0	\$0	\$33,087	\$21,830	\$54,917	\$57,789	(\$2,872)
2000	\$35,687	\$346	\$290	\$0	\$0	\$36,323	\$21,586	\$57,909	\$61,405	(\$3,496)
2001	\$38,550	\$429	\$382	\$312	\$0	\$39,674	\$21,277	\$60,951	\$65,015	(\$4,064)
2002	\$41,413	\$513	\$475	\$411	\$332	\$43,144	\$20,904	\$64,048	\$68,611	(\$4,563)

in a relatively random manner, rather than under standard, pre-determined, assumed rates of investment results. The testing can be accomplished through stochastic modelling, taking into account both the plan's asset allocation policy and desired risk tolerance vis a vis avoidance of UVBL's, or it can be tested by examining the effects of using alternative published indices, especially where the initial rates of return of each asset category's index is close to expectations on the valuation date.

It is an interesting exercise to see how contributions and asset growth would be affected by investment results significantly different from the actuarially assumed rates. In particular, if a plan is concerned with either "over-funding" or "under-funding," the actuary can project asset values using random rates that represent reasonable expectations, probably sharply different from the actuarial valuation assumption, in order to determine the potential for future funding problems. Such studies can be very helpful in evaluating the practicability of alternative investment policies and asset allocation techniques.

For purposes of the following example, a schedule of hypothetical investment earnings rates for the next ten years has been based on the actual fluctuations in the bond and stock markets over a recent ten year period. It has been assumed that plan assets are managed and continually rebalanced so that they comprise 50% diversified common stocks and 50% diversified high grade corporate bonds. On the recommendation of an investment advisor, the assumed average yield on bonds over the projection period has been set at 7%, and the average yield on stocks has been fixed at 10%, and historical results have been prorated down accordingly.

Table 11 that follows presents the 10-year cash flow based on the previously described set of "experience" rates of return. These financial results can be compared readily with the corresponding information from **Table 3**. In **Table 11**, investment income fluctuates considerably from year to year, and while the normal cost each year does not differ from that reported in **Table 3**, the total amount of employer contributions does change because the UAL is affected by the changes in assets. (As the reader will recall, the method of determining employer contributions is to set the amount equal to the normal cost plus one-tenth of the UAL.)

Table 12 develops UAL's and UVBL's assuming investment earnings mirror the actuarial assumptions. The impact of the "experience" rates of return on the annual growth or reduction in the plan's UAL's and UVBL's are shown in **Table 13**. The projected Actuarial Liabilities (AL's) and VBL's are the same in each projection since the actuarial assumptions used to project those liabilities are identical. However, since the pattern of asset growth is considerably different, the UAL and UVBL decline smoothly when the actuarially assumed rates are used, but swing up

TABLE 11
10-YEAR CASH FLOW PROJECTION
Entry Age Actuarial Cost Method
Level Active Plan Population
Investment Rates of Return Different from Actuarial Assumption
(All Dollar Amounts in Thousands)

YEAR	BOY ASSETS	ER CONTR.	BEN. PAYOUT	ACTUAL ROR	INVEST. INCOME	EOY ASSETS
1993	\$37,000	\$2,009	\$1,991	6.41%	\$2,372	\$39,390
1994	\$39,390	\$2,141	\$2,272	16.26%	\$6,394	\$45,653
1995	\$45,653	\$1,887	\$2,499	9.96%	\$4,517	\$49,558
1996	\$49,558	\$1,877	\$2,707	1.94%	\$953	\$49,681
1997	\$49,681	\$2,253	\$2,898	7.20%	\$3,554	\$52,590
1998	\$52,590	\$2,363	\$3,080	13.89%	\$7,255	\$59,128
1999	\$59,128	\$2,111	\$3,257	1.14%	\$668	\$58,650
2000	\$58,650	\$2,563	\$3,429	14.00%	\$8,150	\$65,934
2001	\$65,934	\$2,240	\$3,596	4.18%	\$2,728	\$67,306
2002	\$67,306	\$2,506	\$3,760	5.63%	\$3,754	\$69,806

TABLE 12
10-YEAR PROJECTION OF ACTUARIAL VALUES
Entry Age Actuarial Cost Method
Level Active Plan Population
Investment Rates of Return Equal Actuarial Assumption
(All Dollar Amounts in Thousands)

YEAR	ASSUMED ROR	BOY ASSETS	NC	AL	UAL	AVB	UAVB	VBL	UVBL
1993	9.00%	\$37,000	\$1,325	\$43,836	\$6,836	\$37,925	\$925	\$37,332	\$332
1994	8.90%	\$40,349	\$1,371	\$47,085	\$6,736	\$40,838	\$489	\$40,332	(\$17)
1995	8.80%	\$43,703	\$1,419	\$50,334	\$6,631	\$43,713	\$10	\$43,302	(\$401)
1996	8.70%	\$47,114	\$1,469	\$53,636	\$6,522	\$46,604	(\$510)	\$46,268	(\$846)
1997	8.60%	\$50,601	\$1,520	\$57,010	\$6,409	\$49,521	(\$1,080)	\$49,233	(\$1,368)
1998	8.34%	\$54,184	\$1,574	\$60,476	\$6,292	\$52,462	(\$1,722)	\$51,974	(\$2,210)
1999	8.08%	\$57,789	\$1,629	\$63,951	\$6,162	\$55,445	(\$2,344)	\$54,917	(\$2,872)
2000	7.81%	\$61,405	\$1,686	\$67,424	\$6,019	\$58,469	(\$2,936)	\$57,909	(\$3,496)
2001	7.55%	\$65,015	\$1,745	\$70,879	\$5,864	\$61,539	(\$3,476)	\$60,951	(\$4,064)
2002	7.29%	\$68,611	\$1,806	\$74,309	\$5,698	\$64,663	(\$3,948)	\$64,048	(\$4,563)

TABLE 13
10 – YEAR PROJECTION OF ACTUARIAL VALUES
Entry Age Actuarial Cost Method
Level Active Plan Population
Investment Rates of Return Different from Actuarial Assumption
(All Dollar Amounts in Thousands)

YEAR	ACTUAL ROR	BOY ASSETS	NC	AL	UAL	A/VB	UAVB	VBL	UVBL
1993	6.41%	\$7,000	\$1,325	\$43,836	\$6,836	\$37,925	\$925	\$37,332	\$332
1994	16.26%	\$39,390	\$1,371	\$47,085	\$7,695	\$40,838	\$1,448	\$40,332	\$942
1995	9.96%	\$45,653	\$1,419	\$50,334	\$4,681	\$43,713	(\$1,940)	\$43,302	(\$2,351)
1996	1.94%	\$49,558	\$1,469	\$53,636	\$4,078	\$46,604	(\$2,954)	\$46,268	(\$3,290)
1997	7.20%	\$49,681	\$1,520	\$57,010	\$7,329	\$49,521	(\$160)	\$49,233	(\$448)
1998	13.89%	\$52,590	\$1,574	\$60,476	\$7,886	\$52,462	(\$128)	\$51,974	(\$616)
1999	1.14%	\$59,128	\$1,629	\$63,951	\$4,823	\$55,445	(\$3,683)	\$54,917	(\$4,211)
2000	14.00%	\$58,650	\$1,686	\$67,424	\$8,774	\$58,469	(\$181)	\$57,909	(\$741)
2001	4.18%	\$65,934	\$1,745	\$70,879	\$4,945	\$61,539	(\$4,395)	\$60,951	(\$4,983)
2002	5.63%	\$67,306	\$1,806	\$74,309	\$7,003	\$64,663	(\$2,643)	\$64,048	(\$3,258)

and down when experience rates are used. In practice, an actuarial "smoothing" technique is usually applied to the market value of assets to avoid such fluctuations.

Projections under the Unit Credit Cost Method

As stated previously, the choice of funding method has no impact whatsoever on the liabilities incurred by the plan, and the benefit streams are not linked to the actuarial cost method. The funding method merely defines the rate at which funds are going to be accumulated to pay for the benefits promised to plan participants.

This paper has explored asset growth and unfunded liabilities when the Entry Age Cost Method is used to calculate the annual amount of contributions to be made to the plan. The normal cost under this approach is a level 5.3% of salaries, based on the benefit structure outlined in Appendix A.

The cash flow and UVBL projections using the Unit Credit Actuarial Cost Method are sharply different since the normal cost for any given year simply equals the present value of benefits earned that year, and the AL equals the total present value of earned benefits. As before, the corporation's total required contribution to the plan would equal the normal cost, plus an amount to fund the outstanding UAL. For purposes of this example, one-tenth of any outstanding UAL is assumed to be paid annually.

Table 14 below shows the development of the annual normal cost and total contribution for the sample plan, using the Unit Credit Actuarial Cost Method and assuming that the population remains stable. Some interesting observations can be made when the contribution data from this table are compared with the corresponding information shown in **Table 1** for which annual employer contributions were developed under the Entry Age Actuarial Cost Method.

The most significant finding is that the annual normal cost under the Unit Credit Actuarial Cost Method is greater than the normal cost computed under the Entry Age Actuarial Cost Method for each year of the projection period. This finding is an indication of a mature plan population and, in fact, the actual plan on which this study analysis is based has been in existence for over 35 years.

On the other hand, the total amount of employer contributions each year is less under the Unit Credit Actuarial Cost Method, although by the end of the projection period, total employer contributions under both methods are nearly equivalent.

Although the AL under the Unit Credit Actuarial Cost Method is 13% to 14% lower than the AL computed under the Entry Age Actuarial Cost Method during

TABLE 14
10-YEAR PROJECTION OF POPULATION AND CONTRIBUTIONS
Unit Credit Cost Method
Level Active Plan Population
(All Dollar Amounts in Thousands)

YEAR	ACTIVES AS OF 1/1/93	1994 NEW ENTRANTS	1995 NEW ENT	1996 NEW ENT	1997 NEW ENT	1998 NEW ENT	1999 NEW ENT	2000 NEW ENT	2001 NEW ENT	2002 NEW ENT	TOTAL ACTIVE LIVES	TOTAL PROJ. PAY	TOTAL NORMAL COST	TOTAL PROJ. ER. CONT.	TOT. ER. CONT. AS % OF PAY
1993	1000										1000	\$25,000	\$1,511	\$1,604	6.42%
1994	895	105									1000	\$25,875	\$1,543	\$1,634	6.31%
1995	808	82	110								1000	\$26,781	\$1,582	\$1,672	6.24%
1996	732	70	86	112							1000	\$27,718	\$1,615	\$1,704	6.15%
1997	664	62	74	87	113						1000	\$28,688	\$1,632	\$1,719	5.99%
1998	603	58	65	75	88	111					1000	\$29,692	\$1,741	\$1,827	6.15%
1999	548	53	61	66	76	87	109				1000	\$30,731	\$1,855	\$1,940	6.31%
2000	498	48	55	62	67	74	85	111			1000	\$31,807	\$1,987	\$2,070	6.51%
2001	453	44	51	56	62	65	73	87	109		1000	\$32,920	\$2,127	\$2,208	6.71%
2002	412	40	46	52	57	61	64	74	85	109	1000	\$34,072	\$2,224	\$2,303	6.76%

the projection period, there is always an UVBL because of the much slower rate of growth of assets. The UAL is artificially lower than it otherwise should be because the assets of the model plan under study were actually accumulated based on employer contributions calculated under the Entry Age Actuarial Cost Method. If the Unit Credit Actuarial Cost Method had been in effect from the inception of the plan, the level of accumulated assets at the beginning of this ten year projection period would be well below \$37 million and the resulting UAL's and plan contributions would be substantially higher.

The following **Table 15** presents the cash flow and UVBL projections assuming that investment yields will be at the actuarially assumed rates. Since contributions are lower than under the entry age method, assets take longer to accumulate. Total assets after ten years are \$67.0 million, or \$5.2 million less than total assets projected under the Entry Age method (**Table 3**).

Concluding Remarks

The role of the pension actuary is changing significantly as employers terminate *defined benefit pension plans* and establish *defined contribution retirement plans* and/or *non-qualified deferred compensation programs*. Many of the concepts of pension funding and the techniques of the pension actuary can be adopted to help these employers. If actuaries think of employer benefit plans as involving benefit streams, their actuarial expertise can become a powerful means of

- ▶ measuring the future growth of health care annual costs and post-retirement liabilities that reflect the secular trends of medical, surgical, hospital and other costs;
- ▶ assisting in corporate and/or trust fund investment strategies to provide the funds for deferred benefits; and
- ▶ identifying the probable future yearly costs of essentially any benefit, payable upon any future event to assist corporations in their business plans.

Re-focusing actuarial expertise will be a continuing trend as each future year's events unfold. Actuaries, and especially pension actuaries, should be able to move quickly with the swift tide of changing economic events.

TABLE 15
10-YEAR PROJECTION OF VBL, UVBL AND CASH FLOW
Unit Credit Cost Method
Level Active Plan Population
(All Dollar Amounts in Thousands)

YEAR	BOY ASSETS	VBL	UVBL	ER CONTR.	BEN. PAYOUT	ACTUAL ROR	INVEST. INCOME	EOY ASSETS
1993	\$37,000	\$37,332	\$332	\$1,604	\$1,991	9.00%	\$3,313	\$39,926
1994	\$39,926	\$40,332	\$406	\$1,634	\$2,272	8.90%	\$3,525	\$42,813
1995	\$42,813	\$43,302	\$489	\$1,672	\$2,499	8.80%	\$3,731	\$45,717
1996	\$45,717	\$46,268	\$551	\$1,704	\$2,707	8.70%	\$3,934	\$48,648
1997	\$48,648	\$49,233	\$585	\$1,719	\$2,898	8.60%	\$4,133	\$51,602
1998	\$51,602	\$51,974	\$372	\$1,827	\$3,080	8.34%	\$4,251	\$54,600
1999	\$54,600	\$54,917	\$317	\$1,940	\$3,257	8.08%	\$4,338	\$57,641
2000	\$57,641	\$57,909	\$268	\$2,070	\$3,429	7.81%	\$4,449	\$60,731
2001	\$60,731	\$60,951	\$220	\$2,208	\$3,596	7.55%	\$4,533	\$63,876
2002	\$63,876	\$64,048	\$172	\$2,303	\$3,760	7.29%	\$4,603	\$67,022

APPENDIX A

Summary of Plan Provisions

The Provisions of the Plan in effect on January 1, 1993 are summarized below.

1. Normal Retirement Benefit

The normal retirement benefit is an annual pension (payable monthly) equal to 1.9% of a participants' career average salary times total years of service.

The pension benefits are payable monthly in installments of 1/12 of the annual amount.

The normal retirement benefit is payable at age 65.

2. Early Retirement

In general, a Plan participant may elect to retire upon reaching age 55 and completing 5 years of service. However, a participant may retire at any age if he/she meets the Rule of 85; that is, if the sum of his/her attained age plus total years of service is equal to or greater than 85.

If a participant does not meet the Rule of 85, the early retirement benefit is the earned monthly pension benefit, reduced by 0.25% for each month by which the retirement age precedes age 65. If a participant meets the Rule of 85, the early retirement benefit equals 100% of the earned pension benefit.

3. Disability Benefit

An active participant who has at least 5 years of service and who is totally and permanently disabled is eligible to receive a pension equal to his or her accrued normal retirement benefit. The disability payment is considered an age retirement benefit when the disabled pensioner reaches age 65. A disabled pensioner is provided surviving spouse pension protection without a reduction in the disability pension while the disability pensioner is under age 65.

4. Pre-Retirement Death Benefit

Pre-retirement surviving spouse pension protection is provided to vested active and inactive participants. A lump sum death benefit equal to the total employer contributions paid on a participant's behalf is payable upon the pre-retirement death of a vested active participant, and a surviving spouse entitled to the lump sum benefit must elect between this benefit and the monthly spouse pension.

The spouse of a vested terminated participant is eligible for a pre-retirement spouse benefit. The spouse will receive a lifetime pension equal to 50% of the pension the employee would have received had he survived to age 55, retired early and elected a reduced joint and 50% survivor pension benefit.

5. Survivor Option Death Benefit

A married participant who retires and does not elect otherwise will receive a reduced joint and 75% survivor pension commencing at retirement.

6. Joint and Survivor "Pop-Up"

If an age/disabled pensioner is receiving a reduced Joint and 75% Survivor form of pension benefit and his/her spouse predeceases the pensioner, then the monthly pension benefit increases to the amount the pensioner would have received under the normal "life only" pension form.

7. Vested Benefits

Earned pension benefits are 100% vested after accumulation of 5 years of service.

APPENDIX B

Actuarial Assumptions (Basis and Methodology)

1. Actuarial Basis

a. Investment Earnings Rate

The following schedule of assumed rates of investment return was used to value all benefits:

Calendar Year	Rate
1993	9.00%
1994	8.90%
1995	8.80%
1996	8.70%
1997	8.60%
1998	8.34%
1999	8.08%
2000	7.81%
2001	7.55%
2002	7.29%
2003	7.03%
2004	6.76%
2005 and thereafter	6.50%

b. Assumption for Projecting Future Benefits based on Compensation

For projecting benefits to be earned after the valuation date by participants with salary based benefit, the salary earned by an active participant is assumed to increase according to a salary scale dependent on the Participant's attained age. Examples of the assumed rates of salary increase are as follows:

Age Last Birthday	% Increase at Indicated Age
25	5.6
30	5.0
35	4.7
40	4.2
45	3.7
50	3.5
55	3.5
60	3.5
65	3.5

c. Mortality

The 1971 Group Annuity Mortality Table was used for all plan participants. Examples of the mortality rates used are:

Age Last Birthday	Male	Female
25	.06%	.04%
30	.08%	.05%
35	.12%	.07%
40	.17%	.10%
45	.31%	.15%
50	.56%	.22%
55	.89%	.34%
60	1.38%	.58%
65	2.25%	1.01%
70	3.81%	1.77%
75	5.77%	3.44%
80	9.14%	5.90%

The mortality table used for disabled retirees was based on 1977-1980 Social Security experience for disabled lives. This is a 5 year select and ultimate table.

d. Employee Termination and Disability Rates

Examples of the annual probabilities used are:

Age Last Birthday	Annual Probability of Employee Termination*		Annual Probability of Disability
	Select (Less than 1 Year)	Ultimate (Over 3 Years)	
25	23.00%	9.13%	0.17%
30	21.14%	8.24%	0.22%
35	19.28%	7.34%	0.31%
40	17.43%	6.44%	0.46%
45	15.57%	5.55%	0.71%
50	13.71%	4.65%	1.18%
55	11.85%	3.75%	2.08%
60	9.99%	2.86%	3.19%
64	8.50%	2.14%	0.00%

* Excluding death and retirement rates. Also, withdrawal rates are not applied when an individual is eligible for age retirement benefits.

e. Age Retirement Rates

Examples of the age retirement rates used are:

Annual Probability of Retirement	
Age Last Birthday	Rate
49 - 53	4%
54	8%
55 - 58	7%
59	10%
60	25%
61	38%
62	25%
63	44%
64	54%
65 - 68	35%
69	100%

Note: For vested terminated participants, the above rates are used from age 54 through age 63, but the annual probability of retirement is assumed to be 100% at age 64.

f. Provision for Expenses

It is assumed that future operating expenses will be covered by investment earnings in excess of the valuation assumption

g. Incomplete Data

Participants whose records were missing dates of birth were assumed to be the same average age as participants whose records had valid birthdates. Records with missing sex codes were assumed to be male participants.

h. Family Composition

80% of the non-retired participants were assumed to be married, and female spouses were assumed to be 4 years younger than male spouses.

2. Actuarial Cost Method

- ▶ Entry Age Actuarial Cost Method. Under this method, the annual contribution consists of two parts: the Normal Cost and an additional payment to amortize the Unfunded Actuarial Liability.

The Normal Cost, is determined as a level percentage of pay, which, if paid from Entry Age until retirement or termination, would accumulate with interest at the rate(s) assumed in the actuarial valuation to fund projected benefits. Entry age is determined as the age at which an employee actually becomes a Plan participant or would have become a Plan participant had the Plan always been in effect.

Since there are Plan participants who have entry dates before the inception of the Plan and participants with benefit credits granted for service with an employer before the employer's participation in the Plan, there is an Unfunded Actuarial Liability (UAL). A UAL also results from benefit increases when they are granted from time to time for prior contributory service.

- ▶ Unit Credit Actuarial Cost Method. Under this method, the annual contribution includes both a Normal Cost and an additional payment to amortize the UAL; however, these latter two amounts are determined as follows:
 - the Normal Cost for a single year is the sum of the current service cost of one unit of pension benefit for all active participants covered by the Plan.
 - the UAL is the excess of the actuarial liabilities for retired, active and inactive participants over the actuarial value of Plan assets.