IV

The Cash Balance Funding Method

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1. Introduction

Cash balance plans are defined benefit (DB) plans and are required to comply with minimum funding standards. Actuarial cost methods such as *entry age normal* or *projected unit credit* (PUC) have been used to calculate the plan's *normal cost* and *accrued liability*.

Cash balance plan designs typically include an annual pay-related credit and interest credit. These features define the rate of growth of the cash balance account and the accrual pattern can be very different from a traditional DB plan.

This paper will examine how these design concepts are related to the normal cost and accrued liability in the various actuarial cost methods, as well as the interaction of the economic assumptions in the valuation: salary increase, interest credit, and investment return. The analysis will show that the traditional cost methods may understate the actual liability, especially on a termination basis.

Finally, the paper presents an alternative cost method that would define the accrued liability as equal to the cash balance. This method would be controversial since it would not require an actuary. The paper examines the advantages and disadvantages of this approach.

2. Cash Balance Plan Design

Cash balance plans are unique in that the benefit accrues like a defined contribution plan account balance. Typically a "contribution" or pay-based credit is added to the account and it is credited with interest at a rate defined in the plan. Employees think of these accounts as savings accounts like 401(k) plans. However, these plans are DB plans and are subject to all DB regulations, including minimum funding.

The plan's interest credit rate is commonly set to an index, such as the yield on one or 30-year Treasury securities. Plan sponsors usually choose an index that will have a lesser return that the assumed investment return on the underlying pension fund. To the extent that the fund's return exceeds the plan's interest rate, this creates leverage that lowers the cost and liability.

Cash balance plan accruals are very different from traditional DB plans. In Figure 1, the lump-sum value of all three designs meet at $460,000 at age 65. However, the cash balance plan is more frontloaded, and this is its appeal to the younger, more mobile work force. The traditional plans have faster accruals at the later ages. Note that the cash balance plan in the following example will cost more than the traditional designs because employees terminating prior to age 65 will have greater benefits.

Many companies have converted their traditional final average plans to cash balance plans, and the present value of the accrued benefit at the transition date is often used as the starting balance. This approach may adversely affect mid- and late-career employees who will miss out on the rapid accruals of the final pay plan during the last years of service.

Figure 2 shows the effect of a cash balance conversion for a mid-career employee age 50. As you can see, the cash balance plan does not deliver the same value at the older ages because the initial account balance accumulates at the plan's interest credit rate while a final pay plan value grows with both interest and annual pay increases. In other words, these employees would miss the rapid accruals in a final pay plan that occur during the final five or ten years before retirement.

Most companies choose to grandfather these employees under the prior plan's formula or grant supplemental interest credits on the initial account balance. Other companies have decided not to provide protect mid-career employees from this loss in

future pension accrual. Pension formulas can be very complicated to average employees and, in some of these cases, the loss in pension has not been adequately disclosed.

Since the cash balance designs are often frontloaded, this shifts the emphasis on cost from normal retirement to earlier termination of employment. Employers are choosing to spend their benefit costs on younger employees instead of rich pensions for full career employees.

The cash balance pay credit and account balance are not unlike the normal cost and accrued liability. The pay credit represents the current year's cost, and the account balance is the accumulated value of the pay credits with interest. Both liabilities accrue to the final cash balance lump-sum payment. The following analysis discusses how the normal cost and accrued liability relate to the cash balance pay credit and account balance under the different cost methods.

3. Cash Balance Using Traditional Cost Methods

To illustrate these concepts, I'll use a hypothetical cash balance plan with basic design and simplified actuarial assumptions. For my formulas, I will use the following abbreviations:

- NC = normal cost
- AL = accrued liability
- CB = cash balance
- PC = pay credit
- S = salary
- BP = benefit payments
- NVT = accounts for nonvested terminations
- PA = plan amendment liability (prior service cost)
- r = investment return (valuation interest rate)
- i = cash balance interest credit
- s = salary increase rate
- e = entry age
- w = assumed termination/retirement age
- x = current age

For simplicity, these examples assume termination of employment only at one age (w). The examples also assume that the cash balance is paid out in a lump sum.

3.1 Entry Age Normal Method

Under entry age normal, the normal cost is a level percentage of salary. If we assume no terminations from entry age (e) until retirement age (w), then the accrued liability at age w equals the accumulated value of the normal costs:

$$AL_w = NC_e \times \sum_{t=0}^{w-e-1} (1+s)^t (1+r)^{w-e-t}$$

$$= NC_e \times \frac{\dot{s}}{w-e|(1+r)/(1+s)-1} (1+s)^{w-e}$$

The assumed investment return (i.e. discount rate) is r and the salary increase rate is s. The cash balance account at age w equals the accumulated value of the pay credits, but the account grows with interest at an annual rate of i, which is defined by the plan.

$$CB_w = PC_e \times \sum_{t=0}^{w-e-1} (1+s)^t (1+i)^{w-e-t}$$

$$= PC_e \times \frac{\ddot{s}}{w-e|(1+i)/(1+s)-1} (1+s)^{w-e}$$

At retirement, the final lump-sum cash balance payment must be fully accrued. Therefore, the cash balance account must equal the accrued liability at age w, and

$$NC_e = PC_e \frac{\dfrac{\ddot{s}}{w-e|(1+i)/(1+s)-1}}{\dfrac{\ddot{s}}{w-e|(1+r)/(1+s)-1}}.$$

Note that if the interest credit (*i*) equals the investment return (*r*), then the normal cost equals the pay credit rate, and the accrued liability will equal the cash balance at all ages.

As mentioned previously, it is common to credit cash balance interest at a rate less than the investment return, so that the normal cost is less than the pay credit. Likewise, the accrued liability will be less than the cash balance at all ages until retirement. This is one of the advantages of a cash balance plan: You can provide a benefit of *X*% of pay at a cost of less than *X*%.

3.2 Traditional Unit Credit Method

Under the traditional unit credit (TUC) method, the accrued liability equals the present value of accrued benefits, and the normal cost equals the present value of benefits accruing during the year. If we define the benefit accrued during the year as the pay credit accumulated with interest to retirement age, then the normal cost equals the present value of the pay credit and the accrued liability equals the present value of the current balance projected to retirement age:

$$NC_x = PC_x(1+i)^{w-x}(1+r)^{x-w}$$

$$\text{and } AL_x = CB_x(1+i)^{w-x}(1+r)^{x-w}.$$

Similar to entry age, the normal cost and accrued liability equal the pay credit and cash balance respectively if the interest credit rate equals the investment return rate. The cost and liability are lower than the pay credit and cash balance if interest is less than the return.

However, the unit credit method typically starts with a lower normal cost and accrued liability than entry age, and increases more rapidly. By definition, the entry age normal cost increases as salaries increase, while the unit credit normal cost increases by a factor of

$$NC_{x+1} \Big/ NC_x = PC_{x+1}(1+i)^{w-x-1}(1+r)^{x+1-w} \Big/ PC_x(1+i)^{w-x}(1+r)^{x-w} = (1+s)(1+r)/(1+i).$$

The unit credit normal cost increases faster than entry age normal cost if the assumed return exceeds the cash balance interest credit.

3.3 Projected Unit Credit

The PUC method does not simplify to an easy formula related to the pay credit. The normal cost equals the present value of the projected benefit divided by the years of service at retirement age. PUC costs often have the lowest initial cost and increase at a faster rate. Therefore,

$$NC_x = (1+r)^{x-w}\, CB_w / (w-e)$$

$$NC_{x+1} / NC_x = (1+r).$$

The PUC method normal cost increases at the investment return rate or discount rate.

Figure 3 shows the growth in the accrued liability under these three methods, compared with the cash balance. This example assumes 8% investment return, 4% salary increases, retirement only at 65, 7% pay credit, and 6% cash balance interest.

All methods trail the cash balance account until age 65. Note that if this hypothetical employee terminated after 10 years of service at age 45, the lump-sum cash balance would be $57,617. However, the liability under the different methods would be:

- Entry age normal: $46,156.
- Unit credit: $39,645.
- PUC: $33,167.

Upon payment of the lump sum, the plan would have an actuarial loss using the traditional methods. This would not be a major problem if there were a large number of employees in the plan, or if ongoing turnover experience was expected to be close to the actuarial termination assumption. However, this could be a problem if the plan were very small or if the entire plan was being terminated.

Under traditional DB plans, early termination normally results in an actuarial gain. For example, the entry age normal accrued liability would be reduced to a deferred annuity payable at age 65. As shown in Figure 3, cash balance plans have the opposite effect because the benefit is so valuable at early ages.

4. The Effect of Earlier Termination

Let's expand our model to examine decrement at various ages. Using the unit credit method, the present value of the current balance at age x equals

$$PVAB_x = CB_x \sum_{t=0}^{w-x-1} {}_tp_x q_{x+t} \, 1+r^{-t} \, 1+i^{t}.$$

This assumes that the accumulated balance will be paid out at termination at all ages. Written in this manner, the present value can be understood as a weighted average of the termination ages, where the weights are defined as

$$W_t = {}_tp_x q_{x+t},$$

and the sum of the weights equals 1. Again, if the investment return and plan interest rate are equal, the present value of accrued benefits equals the account balance. If the interest rate is less than the discount rate, then the present value will be less than the cash balance. If a plan has high expected turnover at the earlier ages, then the present value will be higher than a plan with low turnover. This is because the leverage effect will be less pronounced since there will be fewer years of compounding.

Consider a simple example with four assumed ages of termination (see Table 1). Plan A has 5% turnover and plan B has 20% turnover. Both plans have the final decrement at the end of year 3. If the discount rate is greater than 6%, the hypothetical plan's interest credit rate, then the present value of plan A will be less than plan B because the payments under plan B are frontloaded. For example, using 8%, the present value of plan A is $9,507, compared to $9,644 for plan B.

As the duration of the expected payments gets shorter, the present value approaches the cash balance. In the case of an immediate payment, the liability is obviously equal to the cash balance. Under the entry age normal and PUC method, the accrued liability also generally increases because we reflect earlier assumed dates of payment. If a plan has a vesting provision, some benefits will be forfeited upon termination prior to reaching the full vesting age. Expected forfeitures will be reflected in a lower present value.

5. Cash Balance Method

The previous analysis shows that, as the cash balance interest rate approaches the investment return or discount rate, the accrued liability approaches the cash balance. Likewise, plans with high turnover will have accrued liabilities that approximate the cash balance.

What if the liability were defined simply as the cash balance account? What would be the advantages or disadvantages? Those against would argue that this method would overstate the liability because it would not anticipate any future gains due the interest spread or forfeitures from nonvested terminations. Also, if the cash balance was greater than the liability under the other methods, this might overstate the cost, which would not be attractive to employers who want to minimize contributions. The IRS may not approve it since it could increase the maximum deductible contribution.

But there are also many positives. Since the cash balance and pay credit have to be calculated anyway, there would be no actuarial valuation required, thus saving the company on consulting fees. If the plan had assets equal to the cash balances, the plan would be funded on a termination basis no matter what unexpected event might occur. I expect that the PBGC would be in favor of this increased level of benefit security. The actuarial loss upon early termination would not occur. In fact, there could never be any actuarial losses.

It would also be much easier for plan sponsors to understand. Laypeople think the cash balance represents the pension liability, and at the time of payment they are correct. Companies that offer unfunded deferred compensation or nonqualified defined contribution plans also typically hold reserves equal to the employee's balance. In many ways these accounts are simply unfunded cash balance plans with an assumed interest credit.

There are two ways to fund plans using this methodology. In the first case, you could have employers make contributions equal to the excess of the accumulated cash balances over plan assets. This would ensure that the plan would always be funded on a termination basis. However, this method would

have very volatile costs because you would always "true up" the plan assets to the liability, effectively requiring immediate recognition of all net investment gains or losses.

A more reasonable approach would be to follow traditional ERISA, PBGC, and IRS regulations, but define the accrued liability, current liability, and PBGC variable premium liability as the cash balance. The valuation process would only require adding up the cash balances. There would be no need to project future benefits and make assumptions on future salary increases, termination, death, and retirement rates.

The contribution would consist of a normal cost plus an amortization of the unfunded liabilities. As with traditional plans, the unfunded liability could come from plan amendments, investment gains or losses, and liability gains. However, liability gains would only be attributable to nonvested terminations, and there would never be any actuarial losses. This is because there would be no need to project and discount future benefit payments.

Using traditional actuarial methodology,

$$AL_{t+1} = (AL_t + NC)_t(1+r) - B_tP - NV_tT + PA_t$$

where *BP*, *NVT*, and *PA* represent benefit payments, nonvested terminations, and the liability increase due to a plan amendment, respectively.

The normal cost at the end of the year equals

$$NC_t(1+r) = AL_{t+1} - AL_t(1+r) + BP_t + NVT_t - PA_t$$

Replacing the accrued liability with the cash balance, we get

$$= \left[(CB_t + PC_t)(1+i) - B_tP - NV_tT + P_tA - CB_t(1+r)\right] + BP_t + NV_tT - P_tA$$

$$I) = PC_t(1+i) - CB_t(r-i)$$

This formula includes a provision related to the pay credits with interest, but also reflects the interest spread on the cash balance. Nonvested forfeitures would be considered liability gains and would be subject to an amortization credit. Plan amendment liability would be amortized as well. We can also write the formula above as

$$NC_t(1+r) = PC_t(1+i) + CB_t i - CB_t r .$$

Those familiar with FAS 87 accounting will note that this looks similar to the definition of service cost, interest cost, and expected return on assets.

Figure 4 shows the normal costs that are consistent with the earlier accrued liability chart. Note that the cash balance method starts higher than the other methods and eventually declines. This is because the "interest spread," which in this example assumes a 6% interest credit and 8% investment return, is greater as the cash balance grows.

Under this method, older workers cost less than younger ones do. I would argue that this more accurately reflects the accrual pattern of the cash balance plan. This illustrates the gradual decline in value for older workers that is at the heart of the current cash balance controversy.

5.1 Example

Consider a plan with five employees, each with a balance of $10,000 at the beginning of the year and a beginning-of-year pay credit of $3,000 (see Table 2). The plan's interest credit is 6% and the assumed investment return is 8%. The accounts for each employee would have grown to $13,780 at the end of the year, except that one employee quit at the beginning of the year before being vested. At the end of the year, the plan is amended to increase the accounts by $500 each for the remaining four employees. Assume that the plan has assets of $45,000 at the beginning of the year, but the fund earns only 4% during the year.

The required contribution will be made up of two components: the normal cost plus an amortization of the unfunded liability. However, the contribution would be limited to the excess of the year-end liability over the plan assets. The normal cost at the end of the year (see Formula 1 above) is made up of:

$12,720	Pay Credits with interest to the end of the year
-1,000	2% interest spread on beginning of year balance
$11,720	Normal Cost

The unfunded accrued liability, after reflecting the normal cost, is: $10,320 - $11,720 = -$1,400. Note that this is the same $5,000 unfunded at the beginning of the year, plus interest at 8%, plus the investment loss of $1,800 and $2,000 plan amendment, less the $10,000 gain for forfeiture with interest to year's end: $5,000 x 1.08 + $1,800 + $2,000 - $10,000 x 1.06 = - $1,400.

If this amount is amortized over 5 years, the contribution would equal the normal cost of $11,720 less an amortization credit of $325, or $11,395. However, the plan is fully funded at this point, so the contribution is limited to $10,320, the full-funding limit (see Table 3).

5.2 Traditional Benefits in Cash Balance Plans

Most mature plans have participants who retired under a former version of the plan and are currently receiving annuity payments. Likewise, a plan may have terminated vested participants who may have a deferred annuity instead of a cash balance account. Also, many plans have grandfathered benefits, making a closed group of employees eligible to receive the greater of the cash balance plan or some other traditional DB formula, possibly the plan design in effect prior to the cash balance design.

Obviously, these benefits cannot be valued using this proposed method. You might consider participants with these benefits as belonging to a separate plan. In this case, you could calculate a normal cost and accrued liability using traditional methods for these participants and then add it to the costs and liabilities under the cash balance method for those who only have the pure cash balance benefit.

Alternatively, you could assign a hypothetical "cash balance" to inactive employees equal to the present value of benefits discounted at the cash balance interest rate. This liability would be credited with the plan's interest rate, and benefits paid each year would be deducted. Active grandfathered benefits could be valued by multiplying the regular plan cash balance times a loading factor to recognize the additional grandfather value.

Summary

I'd be surprised if the IRS or DOL approved of this proposed method, but I thought it would be a worthwhile exercise to illustrate the problems that the current cost methods have with typical cash balance designs.

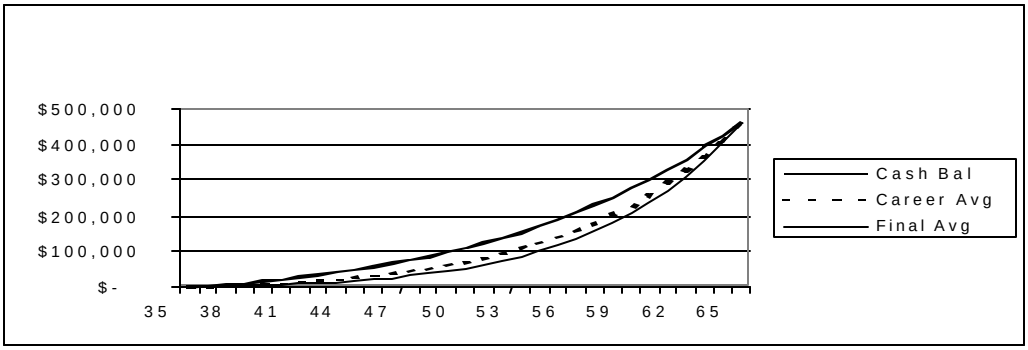
The purpose of a cost method is to allocate the appropriate cost, so that the buildup in asset values approximates the growth in the benefit liability. Cash balance plans are unique in that the benefit liability is clearly defined by the plan provisions. The traditional cost methods result in a liability that is less than the cash balance account, so that there is an actuarial loss when the balance is paid at termination.

Plans with high turnover or with interest credits equal or close to the assumed investment return must hold greater reserves. Under the traditional methods, the plan liabilities will converge to the account balance as the duration of payments gets shorter or as the interest credit approaches the discount rate.

As shown here, you can design a method with the accrued liability equal to the account balance, which would still recognize forfeitures of nonvested accounts and interest credits less than the assumed investment return. This method would be very easy to communicate to plan sponsors, and the method does not require the "project and discount" routines of traditional actuarial methods. In fact, there would be no need for any actuarial assumptions beyond the assumed investment return. The cash balance could also be used as the liability for current liability, PBGC variable premium, and FAS 87 purposes.

The popularity of cash balance plans is attributable, in part, to the simplicity of the benefit accrual. It is very easy for employees to understand the annual growth in their account balance. The cash balance funding method would apply the same commonsense approach to the funding and expensing of the pension plan.

Figure 1
Cash Balance Accrual Compared with Traditional DB Plans



Notes: $50,000 initial salary; 4% pay increases.
Cash balance: 7% pay credit, 6% interest.
Career average: 1.55% annual rate, 6% interest, 1983 GAM Unisex at age 65 only.
Final average: five-year average, 1% rate, 6% interest, 1983 GAM Unisex at age 65 only.

Figure 2
Convert Final Average to Cash Balance at Age 50

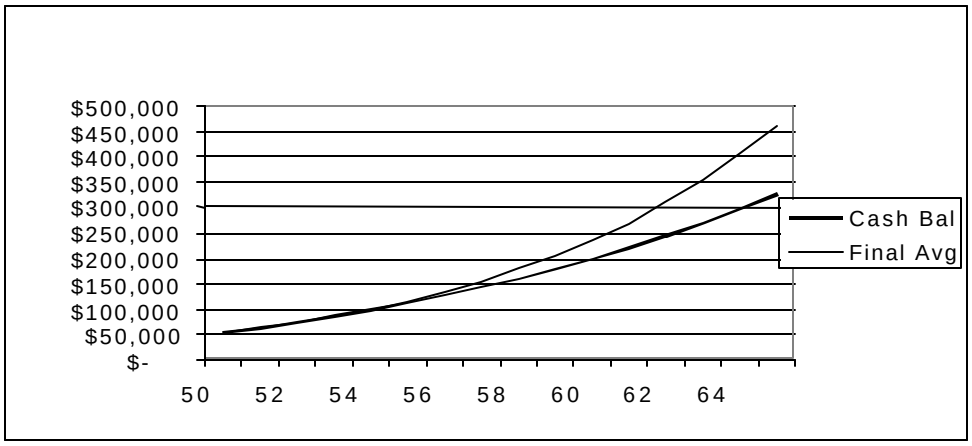


Figure 3
Accrued Liability under Different Cost Methods

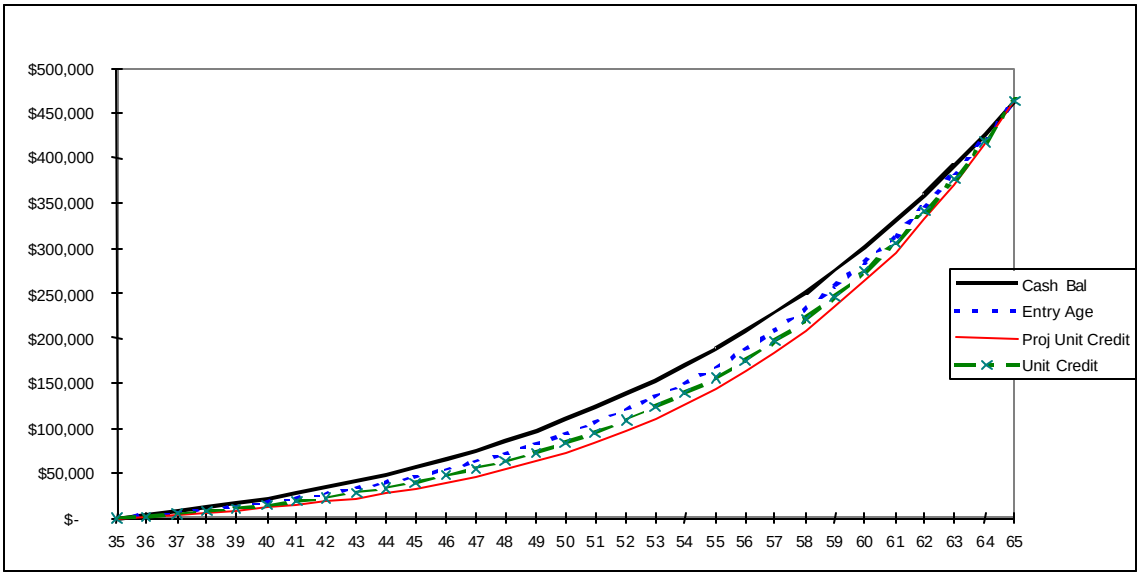


Figure 4
Normal Cost under Different Cost Methods

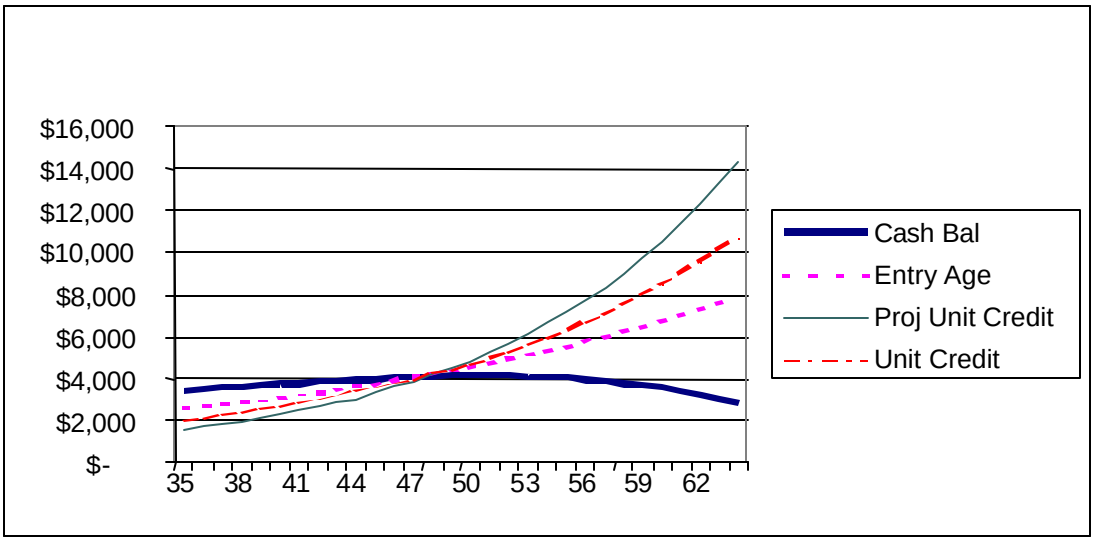


Table 1
Cash Flow Examples with Decrements

Year	Accumulated cash balance 6% Interest	Plan A Decrement Weight	Plan B Decrement Weight	Plan A Cash Flow	Plan B Cash Flow
0	$10,000	5.00%	20.00%	$500.00	$2,000.00
1	$10,600	4.75%	16.00%	$503.50	$1,696.00
2	$11,236	4.51%	12.80%	$507.02	$1,438.21
3	$11,910	85.74%	51.20%	$10,211.47	$6,098.00

Table 2
Reconciliation of Unfunded Accrued Liability

	Account balance = accrued liability	Asset value	Unfunded accrued liability
Beginning of year	$50,000	$45,000	$5,000
Nonvested forfeiture	-10,000	0	-10,000
Pay credit	$12,000	0	$12,000
Interest credit	$3,120	0	$3,120
Investment return	$0	$1,800	-1,800
Plan amendment	$2,000	$0	$2,000
End of year	$57,120	$46,800	$10,320

Table 3
Unfunded Accrued Liability after Contribution

	Account balance = accrued liability	Asset value	Unfunded accrued liability
End of year before contribution	$57,120	$46,800	$10,320
Contribution	0	$10,320	-10,320
End of year after contribution	$57,120	$57,120	$0