

EDUCATION COMMITTEE
OF THE
SOCIETY OF ACTUARIES

GROUP AND HEALTH VALUATION AND REGULATION STUDY NOTE

SUPPLEMENTAL CALCULATION NOTE FOR IAS 19

by

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IAS 19: Supplementary Study Note for Canadian Health Actuaries

1. Introduction

Canada's accounting standards board (ASB) defines accounting standards as the authoritative standards for financial reporting. Canadian valuation actuaries can encounter several accounting standards, including Canadian GAAP, US GAAP, and International Financial Reporting Standards (IFRS).

Many large entities in Canada report under IFRS – this includes those with debt or equity this is publicly traded, certain self-supporting government crown corporations, or those with a multinational presence. The specific standard applicable to the actuarial valuation of the non-pension benefits that Canadian health actuaries encounter is International Accounting Standard 19 (IAS 19).

As many Canadian valuation practitioners represent such entities, the purpose of this study note is to provide the information and considerations necessary to conduct actuarial valuations and prepare financial statements under the requirements of IAS 19.

2. Definitions

- **Types of benefits:**

Paragraph 5 defines the types of benefits that fall under the scope of IAS 19. This paper will limit discussion to the following:

- *Post-employment benefits*, as defined under paragraph 5(b) of IAS 19. As the name implies, these are benefits that are payable to individuals (and eligible dependants) who were once employed, but are no longer. The most common such benefits are those provided to retirees, often referred to as “post-retirement benefits” or “PRBs”. From a non-pension perspective, these benefits may include medical/dental coverage, life insurance, lump sum payments at retirement, etc.
- *Other long-term employee benefits*, as defined under paragraph 5(c) of IAS 19. These benefits, unlike post-employment benefits, are payable to employees during their employment and are long-term in nature. The most common such benefits are those provided to employees who are on long-term disability (LTD), but could also include long-term paid absences, service awards, etc. This study note is limited to the benefits provided during LTD.

- **Attribution Period:**

Discussed in paragraphs 70-74, the attribution period is the period over which the actuarial present value of all expected future benefit payments is recognized. Its start date is equal to the date when

service first leads to benefits under the plan. Its end date is equal to the date when additional service will not lead to a material amount of additional benefits (other than future salary increases).

For example, the actuarial present value of PRBs are commonly attributed from an employee's date of hire to the date of attaining their eligibility to retire. But there are other possibilities, discussed in the *Actuarial Methods* section of this study note.

As it relates to LTD benefits, paragraph 157 states, *"If the level of benefit is the same for any disabled employee regardless of years of service, the expected cost of those benefits is recognised when an event occurs that causes a long-term disability."* In other words, the full actuarial present value of future benefits is reflected when the event causing the long-term disability occurs. As the majority of group LTD plans in Canada are the same for all eligible employees regardless of service, the scope of this study note will be limited to such plans.

- **Valuation date:**
The date at which is actuarial present value of all expected future benefit payments is determined.
- **Defined benefit obligation (DBO):**
The actuarial present value of all expected future benefit payments, prorated on past service attributed to the benefit.
- **Current service cost (CSC):**
The actuarial present value of all expected future benefit payments, attributed to the current year.

3. Actuarial Methods

Paragraphs 67 and 155 of IAS 19 specify that the projected unit credit method is used to determine the DBO. This method recognizes the full actuarial present value of future benefit payments over the benefit's attribution period.

The selection of the appropriate attribution period is critical, as it can have a significant impact on the DBO – especially with respect to the appropriate start date of the attribution period.

Consider an example where a PRB plan has eligibility criteria of age 55 with a minimum of 20 years of service. In this case, the date at which "service first leads to benefits under the plan" is age 35 – representing the start of the attribution period. This would mean that all employees age 35 and under have a DBO of \$0.

But what if the eligibility criteria was age 55 with a minimum of *two* years of service? In this case, all employees age 53 and under would have a DBO of \$0. An auditor may take the opinion that attributing a PRB benefit over such a short period produces a misleading DBO.

As such, the selection of the appropriate start date of the attribution period can be subjective – and input from the entity sponsoring the plan and/or the entity's auditors should be obtained in such cases.

For the purposes of this study note, however, the following general guidelines will apply:

If service requirement ¹ is:	Then the start of attribution period is:
Up to 5 years	Date of hire
At least 15 years	Full eligibility date less the service requirement
Between 5 and 15 years	Either may be appropriate depending on the facts and circumstances of the case

As it relates to the, “facts are circumstances of the case” for service requirements between 5 and 15 years, consider the following example:

1. A PRB plan with eligibility criteria age 55 with a minimum of 10 years of service.
2. An employee who:

	Cumulative service (years)
Was hired at age 43	0
Goes on a leave of absence at age 51	8
Returns to the employer at age 53	8
Retires at age 55	10

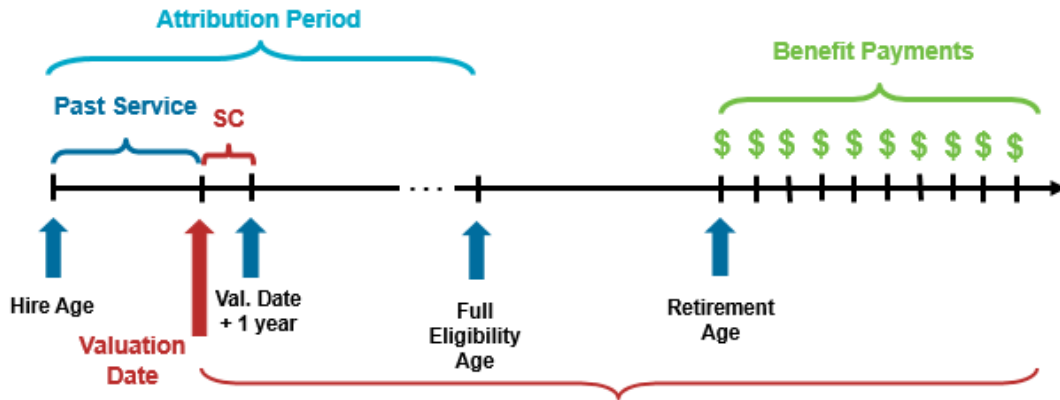
If this employee meets the eligibility requirements, it is because all service measured from the date of hire was considered. In turn, this implies that the appropriate attribution period’s start date is the date of hire.

So if the entity wishes to accrue the PRBs starting at age 45 (in order to keep the DBO at \$0 for all employees age 45 and under), the plan text will often describe the eligibility as, “Age 55 with 10 years of continuous service immediately prior to retirement.” Under this criteria, the employee in the above example would not be eligible for PRBs.

The end date of the attribution period is generally much clearer. It is the date when additional service will not lead to a material amount of additional benefits (other than future salary increases). For most PRBs, this is the date full eligibility is first attained. But for some other types of benefits, such as a lump sum payment dependent on the years of service at retirement, the benefit may be required to be attributed to the employee’s date of retirement. From a computational perspective, such attribution periods can be time-consuming. For example, if the employee becomes eligible to retire at age 55, and will retire no later than age 65, then there are 11 possible retirement ages – implying 11 attribution periods.

¹ Some eligibility requirements utilize an age + service “points” system, as opposed to specific age and/or service requirements. For example, if the eligibility criteria is 85 points, then an employee becomes eligible when the sum of their age and service equals 85. If there is no specific minimum age requirement, then the attribution period would commence at the employee’s date of hire. If there is a specific minimum age requirement (e.g. age 55 with a minimum of 85 points), then the attribution period commences X years prior to the minimum age, where X = Points – Minimum Age. In this example, that would imply age 25.

Visually, the attribution period (assuming it starts on the hire date and ends at the full eligibility date), valuation date, DBO and CSC for an active employee who may become eligible for a PRB plan is as follows:

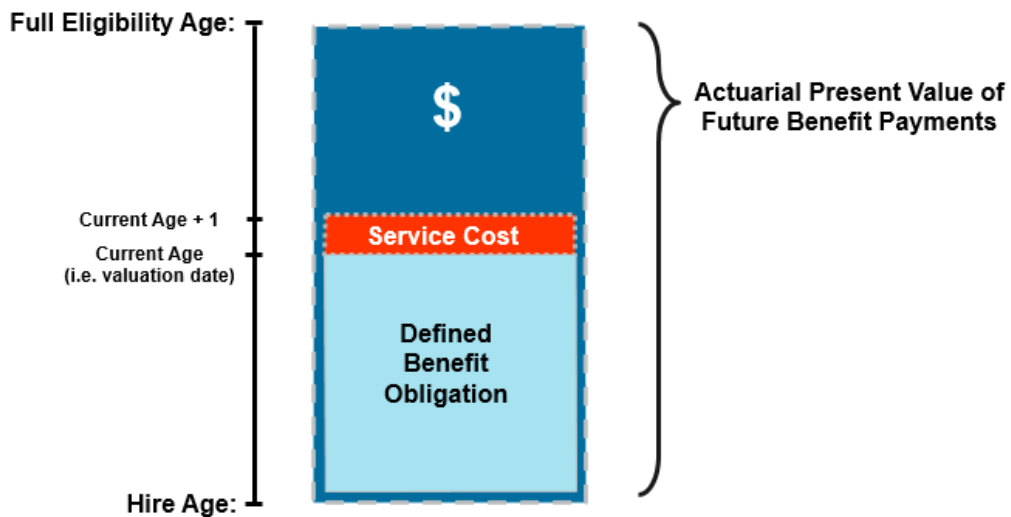


Actuarial Present Value (APV) = Discount Benefit Payments to Valuation Date

$$\text{DBO} = \text{APV} * \text{Past Service} / \text{Attribution Period}$$

$$\text{SC} = \text{APV} / \text{Attribution Period}$$

Or to illustrate another way:



In steps, the calculation of the DBO and CSC is as follows:

1. Project a benefit payment stream starting at the employee's date of retirement. This projection is based on best-estimate actuarial assumptions for the per capita claims cost, health care inflation,

aging, integration with public plans, dependant coverage assumptions, etc. These assumptions are discussed in further detail in the next section.

Note: While benefits are paid throughout the year, they are generally assumed to be paid at mid-year for valuation purposes.

2. Determine the actuarial present value (APV) by applying best-estimate assumptions for applicable decrements to the benefit stream in Step 1, and then discounting the stream to the valuation date.
3. Determine the defined benefit obligation (DBO) by prorating the APV on the proportion of the attribution period that has been satisfied. If the entire attribution period has been satisfied, then the APV = DBO.
4. Determine the current service cost by dividing the APV by the attribution period. If the entire attribution period has been satisfied, then the CSC = \$0.

4. Actuarial Assumptions

Paragraphs 75-98 provide information on the actuarial assumptions used to determine the DBO. It is important to note that under IAS 19, assumptions should reflect the entity's best-estimate assumptions. In other words, there are no provisions for adverse deviation (i.e. PfAD's) applied.

There are many factors that can influence the choice of the best-estimate assumptions, for example:

- Provisions governing the plan
- Characteristics of the current and past employees and the entity itself
- Terms of collective bargaining agreements between the entity and the workforce
- Past experience in the plan
- Expectations on how the benefits change over time
- Expectations about future experience in the plan
- Expectations about the financial market
- Expectations about changes in government legislation that directly or indirectly affect the plan
- Assumptions used to determine the DBO for other plans sponsored by the entity (for example, a pension plan)

As it relates to PRB plans, there are also additional considerations such as:

- Expectations for withdrawal (i.e. leaving the entity prior to attaining eligibility for coverage)
- Expectations for retirement
- Expectations for mortality
- Expectations for integration with public plan coverage
- Expectations for dependant coverage

As it relates to LTD plans, a further assumption for the expectations of termination from LTD are considered.

Under IAS 19, actuarial assumptions are split into **financial assumptions** and **demographic assumptions**. The most common such assumptions are as follows.

Financial assumptions

Discount rate

As stated in paragraph 83 of IAS 19, the discount rate on which the DBO is based should reference market yields at the valuation date on high quality corporate bonds. When a deep market for corporate bonds does not exist, government bonds can be referenced. The discount rate reflects the estimated timing of the benefit payments. Usually this is done by calculating a single weighted average discount rate based on the spot rates that reflect the expected timing and amount of the future benefit payments. The single weighted average discount rate is determined as the rate that results in the same present value of the projected benefits using the spot rates. An example is shown below:

Year	Time (t)	Projected benefit payment stream (B_t)	Spot rates (R_t)	PV based on spot rate [$B_t / (1 + R_t)^t$]	Equivalent single rate (i)	PV based on equivalent single rate [$B_t / (1 + i)^t$]
0	0.5	\$500	4.50%	\$489	5.31%	\$487
1	1.5	\$600	4.80%	\$559	5.31%	\$555
2	2.5	\$700	5.00%	\$620	5.31%	\$615
3	3.5	\$800	5.20%	\$670	5.31%	\$667
4	4.5	\$700	5.50%	\$550	5.31%	\$555
5	5.5	\$600	5.70%	\$442	5.31%	\$451
				\$3,330		\$3,330

The entity has little control over the value of the discount rate, as it is governed by market conditions on the valuation date. Actuaries generally have internal methods of referencing the bond yields and setting the discount rates, which is outside the scope of this study note.

To establish consistency in the determination of the discount rate, the Canadian Institute of Actuaries (the "CIA") produces the CIA Method Accounting Discount Rate Curve on a monthly basis. This curve is commonly used to select the appropriate discount rate to determine the DBO, and is described in the CIA educational note, "Accounting Discount Rate Assumptions for Pension and Post-Employment Benefit Plans", dated September 2011.

Discount Rates: Modified Duration

As a significant actuarial assumption, paragraph 145 requires sensitivity reporting on the DBO for changes to the discount rates. Typically, discount rate sensitivity is determined by measuring the DBO at 1.00% above and below the valuation date's discount rate.

The actuary can assess the reasonableness of discount rate sensitivity results by referencing the plan's duration. The duration provides the approximate percentage change in the DBO for a 1% change in the discount rate.

Discount Rates: Modified Duration (continued from prior page)

There are several acceptable methods for calculating duration, but for the purposes of this study note, Modified Duration will be reviewed.

Modified duration is defined as:

$$\text{Modified duration} = \frac{1}{(1+i)} \times \sum_{t=0}^n \frac{t \times B_t \times v^t}{B_t \times v^t}$$

As it relates to the above example, the Modified Duration is:

Year	Time (t)	Projected benefit payment stream (B _t)	Equivalent single rate (i)	Numerator of summation [t * B _t * (1+i) ^{-t}]	Denominator of summation [B _t * (1+i) ^{-t}]
0	0.5	\$500	5.31%	\$244	\$487
1	1.5	\$600	5.31%	\$833	\$555
2	2.5	\$700	5.31%	\$1,538	\$615
3	3.5	\$800	5.31%	\$2,336	\$667
4	4.5	\$700	5.31%	\$2,496	\$555
5	5.5	\$600	5.31%	\$2,483	\$451
				\$9,930	\$3,330

So:

$$\text{Modified duration} = \frac{1}{(1 + 5.31\%)} \times \frac{\$9,930}{\$3,330} = 2.8$$

Therefore, a 1% change to the discount rate should result in an approximate 3% change to the DBO, which is verified below:

Year	Time (t)	Projected benefit stream	PV at 5.31%	PV at 4.31%	PV at 6.31%
0	0.5	\$500	\$487	\$490	\$485
1	1.5	\$600	\$555	\$563	\$547
2	2.5	\$700	\$615	\$630	\$601
3	3.5	\$800	\$667	\$690	\$646
4	4.5	\$700	\$555	\$579	\$532

Year	Time (t)	Projected benefit stream	PV at 5.31%	PV at 4.31%	PV at 6.31%
5	5.5	\$600	\$451	\$476	\$429
			\$3,330	\$3,428	\$3,240
% change:				+2.9%	-2.7%

Salary escalations

Some PRBs, such as life insurance, may be based on an employee's salary at retirement. Therefore, an appropriate assumption to project the employee's salary to their expected salary at retirement is typically made. An entity would usually base this assumption on their expected annual adjustments to employees' salaries for inflation and merit over the long-term. In cases where there is a collective bargaining agreement between the employees and the entity, any negotiated salary increases may also influence the assumption over a specific horizon, as dictated by the agreement. This assumption would be consistent with the assumption used for the entity's pension plan valuation, if the definition of earnings for determining both types of benefits is the same.

Medical inflation / trend rates

Trend rates can be defined as the rate of change in annual medical costs and are difficult to predict. But as the cost of providing post-retirement medical benefits is generally expected to increase annually, assumptions for future increases in healthcare benefits are critical. In fact, similar to the discount rate, trend rates are considered to be a "significant actuarial assumption" and require additional sensitivity testing under IAS 19.

Actuaries will generally:

1. Determine appropriate short-term, or "select", trend rates based on a combination of recent experience, short-term expectations and accepted actuarial practice. Short-term expectations can be influenced by items such as:
 - a. New health products and services
 - b. Behavioral patterns of the general population
 - c. The type of benefit (e.g. prescription drug costs and hospital drug costs grow differently)
 - d. Geographical location of health care services
 - e. Significant external events, such as the COVID-19 pandemic (e.g. dental associations increased their fee guides to cover new costs associated with enhanced personal protective equipment)
 - f. Integration with government programs
 - g. Plan provisions
2. Determine appropriate long-term, or "ultimate", trend by referring to accepted actuarial practice and macroeconomic studies providing guidance with respect to what the economy can sustain.
 - a. In March 2018, the CIA and SOA released a jointly-sponsored study titled, "*Model of Long-Term Health Cost Trend Rates in Canada*", which is generally cited in the development of best-estimate assumptions for long-term trend rates. This model provided ranges for the "building blocks" of health care trend. Namely:

- i. Real GDP per capita growth: -0.60% to 3.10%
 - ii. Inflation (as measured by the GDP deflator): 1.30% to 6.40%
 - iii. **Total: 0.70% to 9.50%**
 - b. From a generally accepted actuarial standpoint, this range is narrowed. As of 2022, most valuations in Canada employ ultimate health care trend rates in the range of 3.00% to 5.00% per annum, with 4.00% commonly selected.
3. Bridge the select trend to the ultimate trend, often in a linear / straight-line fashion, over a period of time.

Guidance for when the ultimate trend is reached is also discussed in the “*Model of Long-Term Health Cost Trend Rates in Canada*” study. While the study suggests that Quebec may have a longer horizon compared with other jurisdictions, many valuations employ the year 2040 as the year when ultimate trend rates are reached.

Medical inflation: Effects of plan provisions

Valuation actuaries need to consider whether adjustments to the trend assumptions are necessary due to the plan’s provisions. In particular, provisions such as maximums, deductibles and copayments should be assessed for their potential impacts.

For example, consider a dental benefit plan with an employer coinsurance level of 80% and annual maximum of \$1,000. If the average dental cost was \$1,200 last year, and increases 5.0% for the current year, the impact on the paid claims will only be 4.2%. See the table below:

		Prior year	Current year	
A	Dental claim	\$1,200	\$1,260	→ 5.0% increase
B	Coinsurance %	80%	80%	
C	Eligible claim (A x B)	\$960	\$1,008	
D	Annual maximum	\$1,000	\$1,000	
E	Paid claim (minimum of C and D)	\$960	\$1,000	→ 4.2% increase

Provincial sales taxes, premium taxes and administration expenses

Depending on the province, benefit, and funding arrangement, sales and/or premium taxes may be charged on the claims or premium paid. In addition, insurance companies will charge fees to administer the benefit program for entities. Therefore, the expected future benefit payment stream should be loaded appropriately to reflect the impact of applicable taxes and expenses.

Demographic assumptions

Mortality

Mortality rates are usually based on age and gender. In almost all instances, standard population tables are used as the basis for the mortality rate assumptions, as most plans are not large enough for credible rates to be determined. However, in some cases, it may be appropriate to adjust the standard mortality tables based on actual plan experience. Most standard tables make allowance for future improvements in mortality by combining base mortality rates with improvement tables (i.e. adjustment to future rates to account for increased life expectancy).

In February 2014, the CIA released the results of their study on the mortality of pensioners across the private and public sector industry in Canada. The results showed a marked improvement in longevity when compared to the standard tables used in the past. Improved longevity results in higher obligations for health and dental benefits and lower obligations for life insurance benefits. The mortality table is called the 2014 Canadian Pensioners Mortality table (CPM2014). In addition to the overall table, separate CPM2014 mortality tables were developed for private and public sector entities.

Adjustment factors to the tables may be appropriate depending on the entity's experience, its industry, geographical location, retirement income and/or other economic and demographic factors.

Improvement scales are then applied to the mortality table to reflect that mortality rates will improve in the future. Most valuations today employ the CPM Scale B or the Mortality Improvement Scale 2017 (MI-2017).

Other decrement assumptions

In addition to mortality, assumptions are also made as to when an active employee is expected to retire and receive benefits, withdraw from the plan, and/or becoming long-term disabled.

Retirement rates

Retirement rates are usually based on age but could also be service-based depending on the design of the plan, hiring practices of the entity, or other reasons. Depending on the size of the employee group, actual plan experience can be used to develop the retirement rates. In cases where plan experience is not credible, experience from similar groups or industry studies can be used.

Many PRB plans in Canada provide coverage until age 65 only. These plans are common due to the various benefits residents become eligible for at 65, such as provincial drug programs (e.g. the Ontario Drug Benefit), old age security, etc. In these cases, the retirement rates are a critical assumption. For example, if an update to the retirement rates raised the expected retirement age from 61 to 63, then for anyone not yet retired, the DBO for a PRB ending at age 65 would be effectively halved.

Withdrawal rates

Withdrawal rates represent the probability of an employee ending their relationship with the entity, either voluntarily or involuntarily, before attaining eligibility for PRBs. Depending on the size of the employee group, these rates can be based on actual plan experience, experience of other similar groups, published industry tables, or industry tables adjusted for actual plan experience.

The retirement, termination and disability incidence assumptions are usually consistent with the assumptions used for the company's pension plan valuations.

Termination rates (LTD)

For benefits paid to individuals on long-term disability, assumptions need to be made as to when the individuals will terminate from disability status prior to the maximum benefit period (often age 65) being reached.

A termination results from the disabled employee's recovery (full or partial), death, a legal decision in favour of the entity or insurer, or no longer meeting the eligibility requirements for LTD benefits (for example, many LTD plans employ an "own occupation" definition of disability for the first two years, followed by a stricter "any occupation" definition thereafter).

Standard termination tables in Canada, taken from the CIA's "*Group Long-Term Disability Termination Study (2009-2015)*" published in January 2019, are two-dimensional – varying by age-at-disability and duration-of-disability. Furthermore, the tables are split between mortality (necessary to value life insurance liabilities) and all other reasons, and are provided for male (in Quebec), male (outside Quebec), female (in Quebec), female (outside Quebec).

For large Canadian employers with mature LTD plans, actual-to-expected studies can be conducted with the goal of applying entity-specific adjustment factors to the termination tables.

In addition to province and gender, other underwriting factors can influence LTD termination rates such as diagnosis, industry, and level of income replacement. In May 2019, the CIA released a study titled, "*Predictive Analytic Models for Canadian Group Disability Termination Experience*" which provides adjustment factors to the termination rates for these underwriting considerations.

Provincial prescription drug offsets

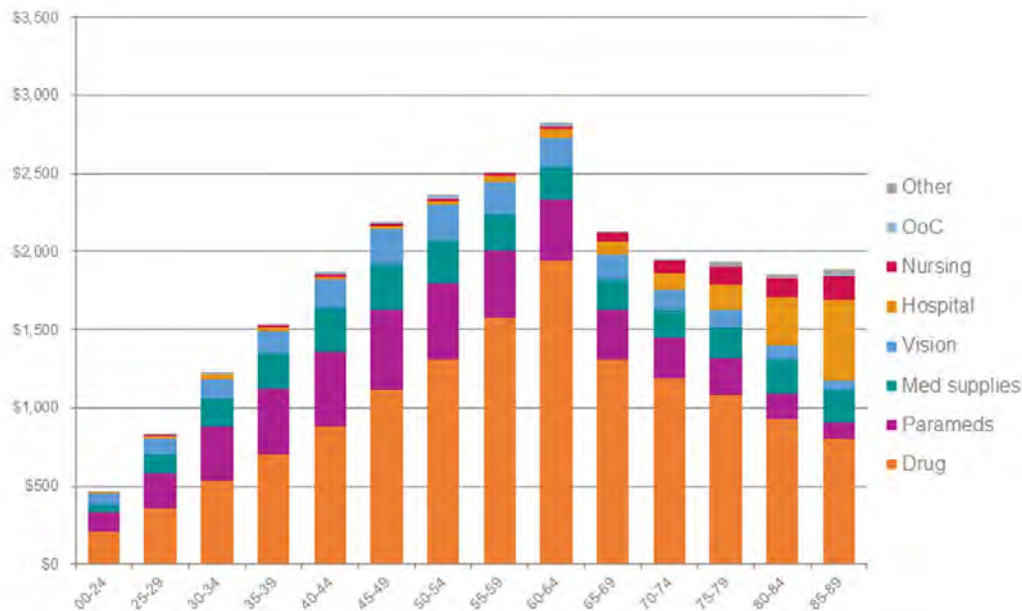
Group benefit plans in Canada, active and retiree, are designed to "wrap around" the provincial government benefit programs – providing coverage only in areas not already covered by the province.

For example, in Ontario, all residents age 65 and over are eligible for the Ontario Drug Benefit (ODB). This program provides full drug coverage to a comprehensive formulary of approximately 5,000 drugs – subject only to a small annual deductible (\$100 per year as of 2022) and, once the deductible is paid, a per-prescription copayment towards the prescription's dispensing fee (\$6.11 per prescription as of 2022). Furthermore, the Ontario Drug Benefit is the first-payer of eligible prescription drug costs, regardless of whether the individual has access to private coverage. Therefore, private plans covering Ontario employees and/or retirees will generally see a significant decrease in drug costs once the individual reaches age 65. Remaining drug costs charged to the private plan would be associated with plans covering the ODB deductible and copayments and/or drugs that are on the entity's formulary but not the ODB formulary. As such, an assumption would be required to reflect the assumed reduction in drug costs at age 65. This assumption is referred to as an offset.

Aging assumptions

As an individual's health deteriorates as they age, the use of certain benefits can change as well. For example, the use of hospital care and private duty nursing care benefits increases significantly with age.

For example, the following chart represents the distribution of medical claims by age band²:



Some observations:

- The decrease in the 65-69 age band is caused almost exclusively due to decreased drug claims. This is due to the integration with public plans like the ODB.
- Total medical costs generally increase as an individual ages. But benefit-to-benefit, the observations can be different. For example:
 - Hospital costs appear to increase dramatically in advanced ages.
 - Vision and paramedical benefits increase, but reach a maximum before decreasing.
 - Even prescription drug costs appear to decrease in the retirement ages.

As a result of these observations, aging assumptions are typically employed in PRB valuations. Similar to mortality assumptions, aging assumptions are often based on industry studies, e.g. “*Extended Healthcare and Dental Experience: A Report on a Post-employment Benefits Experience Study*” published by the CIA in March 2016. However, entity-specific data can be used as well if credible.

It should be noted that for LTD valuations which provide medical and dental benefits to disabled employees while on LTD, aging assumptions are typically not employed in valuations. This is due to the wide variation in the need for benefits for a disabled individual, and also due to the role that disability duration plays on claims experience (often, claims experience is at its highest at the onset of the disability, before settling into a steadier state over time).

Per capita claims cost

² Source: 2015 Great-West Life Health & Dental Trend Study

The per capita claims cost for a benefit can be defined as the average amount an individual is expected to claim in a particular year. It takes into account trend rates (both realized and assumed), integration with public programs (e.g. the drug offsets at age 65), the age of the individual, and insurer expenses and taxes – all discussed previously.

To develop the per capita claims cost assumptions, recent plan experience – often three years – is usually obtained. With this data, the following procedure can be generally applied for PRB plans:

1. Summarize paid claims experience by year and by grouping (e.g. hospital, drugs, vision, dental, etc.). Paid claims should be adjusted for any plan changes that have occurred or are expected to occur in the future.
2. Divide the paid claims by the number of eligible members (i.e. retirees + dependants) for each year. For retiree plans, dependants are generally limited to spouses as most children will have aged out of the plan.
3. Trend the average costs for each period forward to a common date (i.e. 6 months after the valuation date) using a combination of historical trend and short-term trend assumptions.
4. Determine a weighted-average cost at the common date. Equal weighting for all three years of experience is regularly applied, but higher weighting on the most recent period may be appropriate if the claims data is credible.
5. Distribute the resulting average costs over the ages of the members eligible for the benefit. This would take into account both aging assumptions and provincial drug offsets.
6. Add in applicable taxes and administrative expenses.

In cases where there is insufficient credible data and/or the retiree population is not mature, reference can be made to similar plans offered in the industry, and/or to insurance premium rates.

For per capita claims cost analysis associated with LTD individuals, it should be noted that insurers may not be able to provide experience associated with the disabled members exclusively, and/or the experience data may not be credible. In these cases, per capita claims costs are usually developed for the active plan in its entirety, and increased to account for the assumed additional usage for a disabled employee. For example, it might be assumed that a disabled employee carries three times the average medical costs of an active employee, but the same dental costs.

Participation

As it relates to PRB benefits, retirees may wish to opt-out of coverage upon retirement or even into their retirement. For example, the plan may require retirees to pay a portion of premium costs, which may not be worthwhile for some retirees (for example, low users of benefits, retirees with access to another plan, etc.).

Actual plan experience would usually be used to set participation assumptions.

Dependant assumptions

Many PRB plans, similar to the group benefits provided to active employees, extend coverage to eligible dependants of retirees. Dependants may be eligible for their lifetime, during the lifetime of the retiree, or some other specified period (e.g. for 2 years following the death of the retiree).

Generally, actual dependant information would be taken into account for current retirees. However, for potential future retirees, assumptions are generally employed. These assumptions include the proportion of the future retiree that will cover a spouse, and the age of that spouse. For example, a common assumption is 80% of future retirees covering a spouse, with a 3-year age difference.

5. Net Defined Benefit Liability and Defined Benefit Cost

The net defined benefit liability (DBL) represents the liability reported on the entity's balance sheet. It is defined in paragraph 8 as the DBO less the fair value of plan assets adjusted for any asset ceiling limits. For most non-pension plans, there are no dedicated assets (i.e. benefit payments are paid from general company cash), so the defined benefit liability is simply equal to the DBO.

From one year to the next, the DBO (equal to DBL if no assets) will change as follows:

DBO at Beginning of Year
+ Current service cost
+ Interest expense
+/- Past service costs / (negative PSCs)
+/- Settlement losses / (gains)
+/- Actuarial losses / (gains)
- Benefit payments
= DBO at End of Year

Definitions for each of the components are as follows:

Defined benefit obligation (DBO)

The actuarial present value of all expected future benefit payments, prorated on past service attributed to the benefit. It is equal to the APV for retired employees and active employees who have completed their attribution period.

Current service cost (CSC)

This is the increase in the DBO due to service in the current year. It is equal to zero for retired employees and active employees who have completed their attribution period.

It should be noted that for LTD plans that fall under paragraph 157 (i.e. LTD plans which provide the same benefits regardless of years of service), the full actuarial present value of future benefits is reflected once the disability occurs. Therefore, there is no "service cost" for such benefits, as the APV is

precisely equal to the DBO. Instead, some plans project an assumed liability for new claimants who incur a disability in the year following the valuation date.

Interest expense

This is the increase in the DBO due to the effect of interest in the passage of time. It is equal to the interest rate at the beginning of the year, multiplied by the expected average benefit obligation over the course of the year, i.e.

$$\text{Interest expense} = i * [\text{DBO} + \text{CSC} - 0.5 \times \text{Expected Benefit Payments}]$$

Where i is the discount rate used to determine the DBO at the start of the year.

Note that the formula above assumes that service cost is measured at the start of the year and therefore a full year's interest is earned on it. If service cost is expressed as an end-of-year value instead, then the interest earned on the current service cost is included as part of the service cost and not the interest expense. i.e.

$$\text{Current service cost EOY} = \text{Current service cost BOY} \times (1 + i)$$

$$\text{Interest expense} = i * [\text{DBO} - 0.5 \times \text{Expected Benefit Payments}]$$

As the sum of the service cost and interest expense are equivalent, both approaches are acceptable.

Past service costs (PSC)

Under paragraphs 102-108, these are changes in the DBO due to either:

- Plan amendments, which – for example – would include the introduction of new benefits, the removal and/or modification of existing benefits, changing benefit eligibility, etc.
- Curtailments, which are significant reductions in the number of employees covered by the plan. Such curtailments usually decrease the DBO, but depending on the nature of the reduction, the DBO may *increase*. For example, if a plant closure results in employees retiring earlier than anticipated, the DBO for a PRB plan may increase.

Increases in the DBO are referred to as “past service costs” and decreases in the DBO are referred to as “negative past service costs”. Either are measured at the earlier of the date the event occurs and the date the company recognizes related restructuring costs. Therefore, depending on when measured, (negative) past service costs can affect the calculation of the current service cost, interest expense and also the amount of expected benefit payments in the portion of the year following the event.

Settlement losses/(gains)

Under paragraphs 109-112, these are transactions that eliminate all future obligations with respect to the benefit plan, other than through the normal terms of the plan. For example, an entity may decide to pay a lump sum payment to retirees in exchange for their rights to the PRB plan in the future.

To the extent that the settled DBO was more than the payment required to settle it, a gain is created. For example, if an entity settles a DBO of \$10,000 for a price of \$7,000, a settlement gain of \$3,000 is created. Otherwise, it is a loss.

The settlement loss/(gain) is measured at the date the event occurs. Therefore, similar to past service costs, settlements can affect the calculation of the current service cost, interest expense and also the amount of expected benefit payments in the portion of the year following the event.

Actuarial losses/(gains)

These are changes in the DBO due to:

- Changes to the actuarial assumptions used in the determination of the DBO. For example, the impact of a discount rate change, or a change in mortality table, or a change in the per capita claims cost assumptions, etc.
- Actual experience differing from expected. This generally includes actual benefit payments in a particular year being higher or lower than expected, as well as the impact of refreshing census data sets.

Actuarial gains reduce the DBO and actuarial losses increase the DBO. Changes in actuarial assumptions are typically reflected at the end of the fiscal year, but are also reflected when a special event occurs (e.g. plan amendment, curtailment, settlement).

Under IAS 19, actuarial gains and losses are reported in three categories:

- (Gains)/Losses due to demographic assumption changes
- (Gains)/Losses due to financial assumption changes
- (Gains)/Losses due to experience

Benefit payments

This is the annual cash flow paid in the year – which releases the DBO.

Collectively, the items discussed above – aside from the benefit payments and DBO – are referred to as the defined benefit cost (DBC). Therefore:

$$\begin{aligned} \text{DBL}_{\text{end of period}} &= \text{DBL}_{\text{start of period}} + \text{DBC}_{\text{current period}} \\ &\quad - \text{Benefit payments}_{\text{current period}} \end{aligned}$$

Under IAS 19, the DBC is further broken down into components that appear in an entity's Profit & Loss (P&L) statement and its Other Comprehensive Income (OCI) statement. The distinction is meaningful to finance departments, as the P&L statement is used to determine common financial metrics such as earnings-per-share.

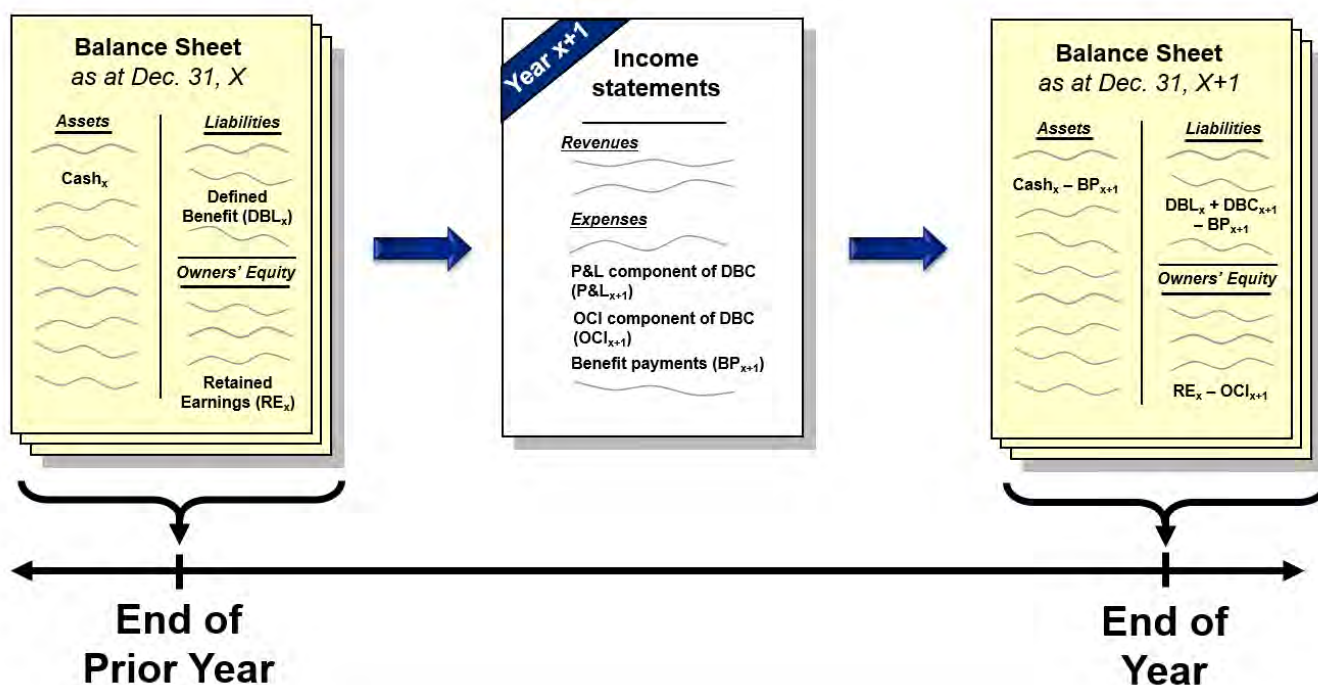
The following table indicates which components of the DBC are considered P&L components versus OCI components:

Component of DBC	For post-employment plans (e.g. PRB plan)	For other long-term benefit plans (e.g. LTD plan)
Current service cost	P&L	P&L

Component of DBC	For post-employment plans (e.g. PRB plan)	For other long-term benefit plans (e.g. LTD plan)
Past service costs	P&L	P&L
Interest expense	P&L	P&L
Settlement losses/(gains)	P&L	P&L
Actuarial losses/(gains) due to demographic assumption changes	OCI	P&L
Actuarial losses/(gains) due to financial assumption changes	OCI	P&L
Actuarial losses/(gains) due to experience differences	OCI	P&L

For this reason, although other long-term benefit plans (e.g. LTD plans) tend to carry significantly lower DBO's than their post-employment plan counterparts (e.g. a pension or PRB plan), they also tend to be reviewed by finance departments closely, as actuarial losses will reduce the entity's P&L earnings for the year – along with its associated financial metrics such as earnings-per-share.

An entity's financial statements as it relates to a plan reporting under IAS 19 (with benefit payments made from the entity's general cash reserves) would look like this:



$$\text{Where: } DBC_{x+1} = P\&L_{x+1} + OCI_{x+1}$$

Appendix: Examples

Example 1: DBO and current service cost for an active employee

Entity ABC sponsors a post-retirement dental plan for their employees. The plan provides full dental coverage until the attainment of age 65.

In order to be eligible for the benefit, employees must be age 55 with 10 years of service at the time of retirement.

The actuarial assumptions are as follows:

Discount rate	5.00% per annum
Trend rate	4.00% per annum
Aging	-0.50% at each age (e.g. age x+1 claims 0.50% <i>less</i> than age x)
Annual claims cost per capita	\$850 at mid-year, relative to age 65 (includes taxes & expenses)
Withdrawal rates	1.00% at each age until full eligibility is attained
Mortality rates	0.50% at each age
Retirement rates	100% at age 62
Dependant coverage	None

Task:

Assuming that benefits are paid mid-year, determine the DBO and current service cost for an active employee who is currently 45 years old with 5 years of service.

Answer:

Follow the steps per Section 3 of this study note:

Step 1: Determine the benefit stream

Per the assumptions and eligibility requirements, this employee will retire at age 62 – which is in 17 years.

The dental benefits will continue for a period of 3 years and then cease at age 65. The following table provides the projected benefit stream (prior to decrements being applied):

Age	Per capita claims cost at age 65 (A)	Trend (B)	Aging factor (C)	Projected benefit payment stream prior to decrements (A x B x C)
62	\$850	1.9479 [= 1.04^(62 - 45)]	1.0152 [= 1 / (1 - 0.5%)^3]	\$1,681
63	\$850	2.0258	1.0100	\$1,739

Age	Per capita claims cost at age 65 (A)	Trend (B)	Aging factor (C)	Projected benefit payment stream prior to decrements (A x B x C)
64	\$850	2.1068	1.0050	\$1,800

At age 65 and beyond, there is no further coverage. Note that the aging factors are > 1 due to the negative aging factor. Negative aging implies that younger individuals claim *more* than older individuals.

Step 2: Determine the actuarial present value of the benefit stream

Apply decrements to the projected benefit payment stream and discount to the valuation date.

Age	Projected benefit payment stream (from Step 1) (D)	${}_t p_x$ (mortality) (E)	${}_t p_x$ (withdrawal) (F)	Discount rate factor (G)	APV (D x E x F x G)
62	\$1,681	0.9160 [= (1 - 0.5%) ^{17.5}]*	0.9044 [= (1 - 1.0%) ¹⁰ **]	0.4258 [= 1 / (1.05 ^{17.5})]	\$593
63	\$1,739	0.9144	0.9044	0.4055	\$581
64	\$1,800	0.9069	0.9044	0.3862	\$570
Total:					\$1,744

* The additional half-year of mortality (i.e. age 45 to age 62.5 = 17.5 years) is to account for the fact that the payment is not made until mid-year.

** No withdrawal is assumed once age 55 (i.e. full eligibility age) is attained.

Step 3: Determine the DBO

The DBO is determined by prorating the APV on the proportion of the attribution period that has been completed. In this case:

- The attribution period's end date is the date at which full eligibility is attained, since no service beyond that point will lead to additional benefits.
- As the service requirement is between 5 and 15 years, the attribution period's start date could be the date of hire, or could be 10 years prior to eligibility being attained depending on the "facts and circumstances of the case". In this case, because the eligibility criteria does not specify that the 10 years of service must be *continuous* years of service prior to retirement, assume that the date of hire was approved by the auditors to be the appropriate start date of the attribution period.
- Therefore:
 - The attribution period extends from age 40 (the employee's hire age) to age 55 (when the employee becomes eligible to retire) – a period of 15 years.

- The employee has completed 5 years of service, resulting in a DBO factor of 0.3333.
- **DBO = APV x [5 / 15] = \$1,744 x 0.3333 = \$581**

This example highlights the importance of the attribution period. If the attribution period were instead determined to be the 10-year period leading up to age 55, then the DBO would be \$0 as the employee would not have completed any portion of the attribution period at the valuation date.

Step 4: Determine the current service cost

The current service cost is proportion of the APV that will be recognized in the current year. In this case:

- **Current service cost (beginning of year basis) = \$1,744 / 15 years = \$116**

If current service cost were reported on an end-of-year basis, interest would need to be loaded on, resulting in \$122. This additional \$6 in the service cost would lower the interest expense by the same amount.

The current service cost becomes \$0 when the employee attains full eligibility, since the APV will be equal to the DBO.

Note that if the attribution period were instead determined to be the 10-year period leading up to age 55, the DBO is \$0 as previously discussed, but the current service cost would be \$174 (i.e. \$1,744 / 10 years), since this employee will have completed 1 year of the attribution period next year.

Example 2: DBO for a retiree

Task:

Assuming that benefits are paid mid-year, determine the DBO for a newly retired individual who is currently 60 years old.

Answer:

Being a retiree, the DBO is equal to the APV – so steps 3 and 4 are not necessary.

Step 1: Determine the benefit stream

The following table provides the projected benefit stream (prior to decrements being applied):

Age	Per capita claims cost at age 65 (A)	Trend (B)	Aging factor (C)	Projected benefit payment stream prior to decrements (A x B x C)
60	\$850	1.0000	1.0254	\$872
61	\$850	1.0400	1.0203	\$902
62	\$850	1.0816	1.0152	\$933
63	\$850	1.1249	1.0100	\$966

Age	Per capita claims cost at age 65 (A)	Trend (B)	Aging factor (C)	Projected benefit payment stream prior to decrements (A x B x C)
64	\$850	1.1699	1.0050	\$999

At age 65 and beyond, there is no further coverage.

Step 2: Determine the actuarial present value of the benefit stream

Apply decrements to the projected benefit payment stream and discount to the valuation date.

Age	Projected benefit payment stream (from Step 1) (D)	${}_t p_x$ (mortality) (E)	${}_t p_x$ (withdrawal) (F)	Discount rate factor (G)	APV (D x E x F x G)
60	\$872	0.9975	n/a	0.9759	\$849
61	\$902	0.9925	n/a	0.9294	\$832
62	\$933	0.9875	n/a	0.8852	\$816
63	\$966	0.9826	n/a	0.8430	\$800
64	\$999	0.9777	n/a	0.8029	\$784
Total:					\$4,081

Therefore, the DBO is \$4,081. This example highlights the significance of the retirement assumptions on plans such as this that end at age 65. If this retiree retired at the assumed age of 62, their DBO would have been only \$2,400.

Example 3: Actuarial loss/(gain) determination

One year later:

1. The active employee is still working and the retired employee is still alive.
2. Actual benefit payments made to the retiree were \$750. Following an analysis of experience from similar plans, per capita claims cost assumptions relative at age 65 for the following year were updated from an assumed \$884 (i.e. \$850 + 4.00% assumed trend) to \$800. All other demographic assumptions remain the same as they were.
3. The discount rate has fallen from 5.00% to 4.25% per annum.

Task:

Determine the benefit cost – both P&L and OCI components for the current year, and the balance sheet position at the end of the year.

Answer:

As there are no plan assets, the balance sheet liability (i.e. DBL) is equal to the DBO.

From the prior example, the DBO at the start of the year was \$4,662 (i.e. \$581 for the active employee, plus \$4,081 for the retiree). One year later, the expected DBO is \$4,125, reconciled as follows:

DBO at Beginning of Year	\$4,662
+ Current service cost	\$116
+ Interest expense	\$217 [= 5.00% * (\$4,661 + \$116 – 0.5 * \$872)]
- Benefit payments (expected)	\$870 [= \$872 * t_{px} factor of 0.9975]
Expected DBO at End of Year	\$4,125

This means that if all assumptions and experience were realized, the DBO at the end of the year would be \$4,125. But we know this cannot be the case because:

1. Both the active and the retiree survived the year, which creates an experience loss (i.e. increases the DBO).
2. The per capita claims cost assumption relative to age 65 was lowered from \$884 to \$800, which creates a demographic assumption gain (i.e. decreases the DBO).
3. The discount rate changed from 5.00% to 4.25%, which creates a financial assumption loss (i.e. increases the DBO).

Following the same procedures, the DBO is updated as follows:

	DBO at end of year	(Gain) / Loss
Expected DBO	\$4,125 (from above)	
Reflecting survival of members	\$4,155 (\$744 active + \$3,411 retiree)	→ experience loss of \$30
Reflecting survival of members <u>and</u> change in claims costs	\$3,759 (\$673 active + \$3,086 retiree)	→ demographic gain of \$396

	DBO at end of year	(Gain) / Loss
Reflecting survival of members <u>and</u> change to per capita claims cost <u>and</u> change to discount rate	\$3,894 (\$763 active + \$3,131 retiree)	→ financial loss of \$135
Final DBO at End of Year	\$3,894	→ net actuarial gain of \$231

It is important to note that these results build upon one another in order to isolate the impact of each individual change. The gain/loss due to discount rate is often the final run completed since the discount rate – as discussed earlier in this study note – is determined by matching a cashflow stream to a yield curve. Therefore, any and all changes impacting the cashflow stream should be reflected prior to the determination of the discount rate.

Now the DBO can be reconciled:

DBO at Beginning of Year	\$4,662	
+ Current service cost	\$116	→ P&L component of DBC
+ Interest expense	\$217	→ P&L component of DBC
+/- Past service costs / (negative PSCs)	\$0	→ P&L component of DBC
+/- Settlement losses / (gains)	\$0	→ P&L component of DBC
+/- Actuarial losses / (gains) as determined above	(\$231)	→ OCI component of DBC
+/- Actuarial losses / (gains) for actual benefit payments being higher / (lower) than expected	(\$120) (Exp: \$870, Actual \$750)	→ OCI component of DBC
- Actual benefit payments	\$750	
= DBO at End of Year	\$3,894	

Therefore:

- The balance sheet position at the end of the year is a liability of \$3,894
- The defined benefit cost for the year is an income item of \$18, comprised of:
 - P&L charge of \$333
 - OCI credit of \$351

A typical accounting schedule under IAS 19, excluding the required sensitivity results, may look as follows:

Plan name	PRB Dental Plan
Country	Canada
A. Change in defined benefit obligation	
1. Defined benefit obligation at end of prior year	4,662
2. Service cost	
a. Current service cost	116
b. Past service cost	-
c. (Gain) / loss on settlements	-
3. Interest expense	217
4. Cash flows	
a. Benefit payments from plan assets	-
b. Benefit payments from employer	(750)
c. Settlement payments from plan assets	-
d. Settlement payments from employer	-
e. Participant contributions	-
f. Administrative expenses included in the DBO	-
g. Taxes included in the DBO	-
h. Insurance premiums for risk benefits	-
5. Other significant events	-
a. Increase (decrease) due to effect of any business combinations / divestitures / transfers	-
b. Increase (decrease) due to plan combinations	-
6. Remeasurements	
a. Effect of changes in demographic assumptions	(396) --> impact of per capita claims cost assumption change
b. Effect of changes in financial assumptions	135 --> impact of discount rate assumption change
c. Effect of experience adjustments	(90) --> loss of \$30 on census data offset by gain of \$120 for benefit payments lower than expected
7. Effect of changes in foreign exchange rates	-
8. Defined benefit obligation at end of year	3,894
B. Change in fair value of plan assets	
1. Fair value of plan assets at end of prior year	-
2. Interest income	-
3. Cash flows	
a. Total employer contributions	
(i) Employer contributions	-
(ii) Employer direct benefit payments	750
(iii) Employer direct settlement payments	-
b. Participant contributions	-
c. Benefit payments from plan assets	-
d. Benefit payments from employer	(750)
e. Settlement payments from plan assets	-
f. Settlement payments from employer	-
g. Administrative expenses paid from plan assets	-
h. Taxes paid from plan assets	-
i. Insurance premiums for risk benefits	-
4. Other significant events	
a. Increase (decrease) due to effect of any business combinations / divestitures / transfers	-
b. Increase (decrease) due to plan combinations	-
5. Remeasurements	
a. Return on plan assets (excluding interest income)	-
6. Effect of changes in foreign exchange rates	-
7. Fair value of plan assets at end of year	-
C. Amounts recognized in the statement of financial position	
1. Defined benefit obligation	3,894
2. Fair value of plan assets	-
3. Funded status	3,894
4. Effect of asset ceiling/onerous liability	-
5. Net defined benefit liability (asset)	3,894

Plan name	PRB Dental Plan
Country	Canada

D. Components of defined benefit cost

1. Service cost		
a. Current service cost		116
b. Past service cost		-
c. (Gain) / loss on settlements		-
d. Total service cost		116
2. Net interest cost		
a. Interest expense on DBO		217
b. Interest (income) on plan assets		-
c. Interest expense on effect of (asset ceiling)/onerous liability		-
d. Total net interest cost		217
3. Remeasurements of Other Long Term Benefits	Not applicable	--> since this is a post-employment benefit under IAS 19
4. Administrative expenses and/or taxes (not reserved within DBO)		-
5. Defined benefit cost included in P&L		333
6. Remeasurements (recognized in other comprehensive income)		
a. Effect of changes in demographic assumptions		(396)
b. Effect of changes in financial assumptions		135
c. Effect of experience adjustments		(90)
d. (Return) on plan assets (excluding interest income)		-
e. Changes in asset ceiling/onerous liability (excluding interest income)		-
f. Total remeasurements included in OCI		(351)
7. Total defined benefit cost recognized in P&L and OCI		(18)

E. Net defined benefit liability (asset) reconciliation

1. Net defined benefit liability (asset)	4,662
2. Defined benefit cost included in P&L	333
3. Total remeasurements included in OCI	(351)
4. Other significant events	
a. Net transfer in/(out) (including the effect of any business combinations/divestitures)	-
b. Amounts recognized due to plan combinations	-
5. Cash flows	
a. Employer contributions	-
b. Employer direct benefit payments	(750)
c. Employer direct settlement payments	-
6. Effect of changes in foreign exchange rates	-
7. Net defined benefit liability (asset) as of end of year	3,894

F. Significant actuarial assumptions

<i>Weighted-average assumptions to determine defined benefit obligation</i>	
Discount rate	4.25%
Select health care trend rate	4.00%
Ultimate health care trend rate	4.00%
Year rate reaches ultimate trend rate	Not applicable
Mortality assumption	0.50% at each age
<i>Weighted-average assumptions to determine defined benefit cost</i>	
Discount rate	5.00%
Select health care trend rate	4.00%
Ultimate health care trend rate	4.00%
Year rate reaches ultimate trend rate	Not applicable
Mortality assumption	0.50% at each age