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CANADA PENSION PLAN

STATUTORY ACTUARIAL REPORT NO. 10

AS AT DECEMBER 31, 1985

Canada

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ACTUARIAL REPORT AS AT DECEMBER 31, 1985

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## CANADA PENSION PLAN

### STATUTORY ACTUARIAL REPORT NO. 10

#### I. INTRODUCTION

This is the tenth actuarial report since the inception of the plan in 1966. It has been prepared in compliance with subsection 116(2) of the Canada Pension Plan which provides that, whenever any Bill is introduced in or presented to the House of Commons to amend the Act, a report shall be prepared indicating the extent to which such Bill would, if enacted by Parliament, affect any of the estimates contained in the most recent report made pursuant to subsection 116(1) before the introduction or presentation of such Bill. The most recent report made pursuant to subsection 116(1) was Statutory Actuarial Report No. 8, as at December 31, 1982, which was tabled in the House of Commons on June 5, 1984.

A number of technical amendments to the Canada Pension Plan were made in 1985. It was the purpose of Statutory Actuarial Report No.9 to indicate that these amendments could not significantly affect the estimates contained in Statutory Actuarial Report No. 8.

A report pursuant to subsection 116(2) is required in connection with Bill C-116 (an Act to amend the Canada Pension Plan and the Federal Court Act) which was given first reading in the House of Commons on June 11, 1986 and received royal assent on June 27, 1986. The amendments will come into force on a day to be fixed by proclamation which may not be issued unless the lieutenant governor in council of each of at least two-thirds of the provinces, having not less than two-thirds of the population of all the provinces, has signified the consent of such province. However, preliminary agreement on the essential amendments contained in Bill C-116 was reached at a federal-provincial meeting of Ministers of Finance in December 1985.

The remainder of this report is divided as follows: Section II summarizes the major amendments proposed in Bill C-116 and briefly comments on their effect. Section III presents the main tables of financial projections (a) for the existing plan as well as the proposed plan on the assumptions used for Statutory Actuarial Report No. 8 and (b) for the proposed plan on the assumptions adopted for purposes of this report which differ in certain areas from those of Report No. 8. Section IV provides a number of auxiliary tables to test the sensitivity of the projections to some of the major assumptions and Section V

contains certain observations and conclusions, as well as the actuarial opinion recommended by the Canadian Institute of Actuaries. The main provisions of the existing plan are summarized in Appendix A, and the assumptions and procedures underlying the tables in Section III are described in Appendix B. Finally, the contribution rate that would be applicable in a "fully funded" system and the accompanying "unfunded actuarial liability" are the subject of Appendix C.

The fund projections are dependent not only on the various economic and demographic assumptions but also on the contribution rate assumed to be in effect at any time.

For purposes of the fund projections for the existing plan, an assumption had to be made regarding the level of the contribution rate, since a continuation of the 3.6 percent contribution rate\* would result in the exhaustion of the fund in less than twenty years. For simplicity, it was assumed that the contribution rate for the existing plan would have been raised as required to prevent the fund from decreasing (Fund C projections in earlier reports). For purposes of the proposed plan, the basis of the assumed contribution rates is explained in a footnote on page 19.

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\* All contribution rates and costs shown in this report are rates applicable to "contributory earnings". For other than self-employed persons the rates are shared equally between employees and employers.

II. SUMMARY AND EFFECT OF MAJOR AMENDMENTS PROPOSED IN BILL C-116

Clause 4 of Bill C-116 and the Schedule incorporated by virtue of Clause 60 set the combined employer-employee contribution rate for future years as follows: the present rate of 3.6% will be increased by 0.2% annually from 1987 to 1991, and by 0.15% annually from 1992 to 2011. However, the rates beyond 1991 will depend on the conclusions of the quinquennial federal-provincial reviews required by Clause 56, the first of which is to take place prior to 1992 and, if possible, is to be completed within such time as to allow the Minister of Finance to make the appropriate recommendations prior to January 1, 1991.

Clause 56 provides that, at the conclusion of each quinquennial federal-provincial review, the rates for the last twenty years in the Schedule be confirmed or revised and the Schedule be extended by five years. In addition to the Schedule, the federal-provincial agreement, announced in the Release of December 13, 1985, included a formula to be prescribed by regulation which would come into operation in the absence of agreement or recommendation at subsequent quinquennial federal-provincial reviews. The formula is designed to extend the schedule for five years by means of "equal annual increases" such that, if increases of that size were in effect for a total of 15 years from the beginning of the five-year period, the fund at the end of the 15 years would be equal to twice the expenditure in the following year.

Clause 10 provides in effect that the amount of the Year's Maximum Pensionable Earnings, which has been subject to a statutory annual increase of 12.5% until such time as it reaches the average industrial wage (as measured by the annual equivalent of the average weekly wages and salaries of the Industrial Composite for Canada), is deemed to have reached that level in 1986, will increase in 1987 in accordance with the ratio of the average of the Industrial Composite during the thirty-six months period ending June 30, 1986 over the average during a corresponding period ending December 31, 1984 and will thereafter increase in accordance with the ratio of the average of the Industrial Aggregate (the new measure of average wages and salaries adopted by Statistics Canada) during the twelve months period ending June 30 of the preceding year, over the average during a corresponding period one year earlier.

The amendments relating to the Year's Maximum Pensionable Earnings (YMPE) are considered to have no effect on the projections in Statutory Actuarial Report No. 8 because, according to the underlying economic assumptions, the YMPE would have reached the Industrial Composite by 1986 and because it is believed that increases in the Industrial Aggregate will not be significantly different from those of the Industrial Composite.

\* Expressed as percentages of contributory earnings rounded to two places of decimals.

Clause 13 eases the eligibility rules for disability benefits beginning in 1987 as follows:

- (a) Contributors must have participated in at least two of the last three years or in at least five of the last ten years; up to now, contributors had to have participated in at least five of the last ten years.
- (b) The additional existing requirement for contributions to have been made for at least one third of the years in the contributory period is removed.

Clause 24 increases the flat-rate portion of disability pensions for 1987 and later to the level paid by the Quebec Pension Plan (QPP); the relevant monthly amounts for 1986 are \$91.06 and \$233.38, for the CPP and the QPP, respectively.

The proposals concerning disability benefits have a minor effect on costs, except for the increase in flat-rate benefits. The relative effect of this particular increase gradually disappears with time, because flat-rate benefits increase in accordance with prices which are assumed to increase more slowly than contributory earnings. The additional costs are expected to be about 0.17% of contributory earnings initially, increasing to 0.23% by 2010 and then decreasing gradually to 0.15% and 0.08% by year 2050 and 2100, respectively. However, the decreases in added costs may not materialize, if steps are taken to maintain the income replacement value of flat-rate benefits.

Clause 15 allows contributors to begin drawing retirement pensions (after 1986) at any time between ages 60 and 70, with "actuarial adjustments" to the amount of pension payable. The adjustment factors are to be fixed by the Minister of National Health and Welfare on the advice of the Chief Actuary of the Department of Insurance. It is intended that rates of retirement pension calculated in accordance with the normal formula be reduced by 0.5% for each month between the age when early retirement takes place and age 65, and increased by 0.5% for each month between age 65 and the age when deferred retirement takes place. For purposes of computing the unadjusted pension with respect to pensions payable before age 65, the contributory period will be assumed to end when the pension commences. An applicant for a retirement pension payable before age 65 must provide proof that he has ceased to be wholly or substantially engaged in paid employment or self-employment.

This proposed flexible retirement age provision is designed to be cost neutral but entails cost increases in the early years as high as 0.37% of contributory earnings, decreasing gradually to 0.11%, 0.07% and 0.06% for 2030, 2075 and 2100, respectively, reflecting the fact that, on the average, pensions may be expected to commence earlier which, however, will gradually be offset by somewhat lower average amounts of pension payable.

Clause 22 extends the existing provision for the optional fifty-fifty splitting of unadjusted pensionable earnings of spouses during periods of cohabitation on application (after 1986) by or on behalf of either spouse in the event of divorce or separation, as follows:

- (a) Upon a decree absolute of divorce, a judgement granting a divorce under the Divorce Act, 1985, or a judgement of nullity of a marriage, credit-splitting will be automatic, if the Minister receives the prescribed information.
- (b) When married or common law spouses have ceased to cohabit for a period of one year or one of the spouses died during that period, credit-splitting will be mandatory upon valid application by one spouse, provided the former spouses did cohabit for at least one year.

Estimates covering the existing provision for splitting unadjusted pensionable earnings on divorce or marriage breakdown were sufficient to cover changes included in the Bill with respect to such provision.

Clause 26 increases the survivor pension for a large proportion of survivors beginning in 1987.

For those survivors who have attained age 65, the existing plan provides as a basic survivor's pension the greater of

- (a) 60% of the deceased contributor's retirement pension less 40% of the survivor's retirement pension and
- (b) 37.5% of the deceased contributor's retirement pension,

subject to an overriding maximum equal to an amount which together with the survivor's own retirement pension would produce the maximum retirement pension.

The proposed provision retains the overriding maximum, but the basic survivor's pension is simply 60% of the deceased contributor's retirement pension which is clearly greater than either (a) or (b) above.

For survivors between age 60 and age 65, who will be in receipt of early retirement pensions, the ceiling on the combined pension will be the sum of the maximum retirement pension (adjusted for early retirement as provided in Clause 15) and the flat-rate survivor benefit.

The total effect of these new provisions is expected to be an increase in survivor benefits of about twenty-five percent in the long run. However, in the short term the effect of the existing limitation is rather small, since relatively few survivors are or will be entitled to substantial retirement pensions. As a result, increases in costs in respect of all survivor benefits changes are expected to be equivalent to about 0.03% of contributory earnings initially but rising gradually to 0.08% by 2000 and to a level of about 0.22% for 2030 and later.

For combined disability and survivor pensions a new ceiling is provided equal to the sum of the new flat-rate disability benefit and the maximum retirement pension; this increases the existing maximum by the amount of the new flat-rate disability benefit.

For practical purposes, the effect of this change is accounted for in the valuation of the new flat-rate disability benefit in Clause 24. In cases where maximum disability benefits are payable and the deceased spouse's retirement pension was at a maximum level, the effective limit on the combined pension may be as much as the amount of the existing flat-rate benefit. However, this is at least partially offset by cases where the earnings-related disability benefit is low; in such cases the ceiling on the combined benefit is increased by an amount which is less than the increase in the flat-rate disability benefit by an amount equal to the existing flat-rate benefit; this results in a reduction in the effective survivor pension equal to the amount of the existing flat-rate benefit.

Clause 31 eliminates the discontinuance of surviving spouses' pensions in the event of remarriage after the coming into force of the amendment. Cases previously terminated will be reinstated without retroactivity.

This change is estimated to result in a slight increase in the required contribution rates amounting to approximately 0.07% of contributory earnings by 2010 and eventually to no more than about 0.05%. These figures slightly understate the real effect of the removal of the remarriage factor, because the remarriage rates used were known to produce a slight overstatement of benefits.

Clause 33 provides that retirement pensions deemed to be earned during cohabitation will be split during the joint lifetime of the spouses, if one of the spouses so requests after 1986, provided both spouses are at least 60 years old and have ceased contributing. On the death of first spouse or in the event of divorce or separation (see Clause 22), any pension-splitting previously applied would be reversed. Clearly, this amendment has no effect on costs.

Clauses 12 and 41 remove some restrictions on children's benefits. Clause 12 changes the definition of "dependent child" by dropping the requirement that the child not be married. Clause 41 doubles the flat-rate benefit (\$91.06 per month for 1986) payable to a child in the case of a child entitled simultaneously to an orphan's and a disabled contributor's child's benefit, or to two orphans' or two disabled contributor's children's benefits.

Projections for the existing plan ignore the requirement that the child not be married but assume that 5% of the orphan's and disabled contributor's child's benefits in respect of female contributors are not payable as a result of the prohibition against double benefits. The cost of the proposed change amounts to less than 0.01% of contributory earnings in any calendar year.



III. MAIN TABLES OF FINANCIAL PROJECTIONS

This section contains the following tables:

|   | <u>Previous Assumptions</u> |                      | <u>New Assumptions</u> |                      |
|---|-----------------------------|----------------------|------------------------|----------------------|
|   | <u>Existing Plan</u>        | <u>Proposed Plan</u> | <u>Existing Plan</u>   | <u>Proposed Plan</u> |
| Fund projections*                                       | 1                           | 2                    | 3                      | 4                    |
| Expenditures by type<br>(in millions of dollars)        | 5                           | 6                    | -                      | 7                    |
| Expenditures by type<br>(as % of contributory earnings) | 8                           | 9                    | -                      | 10                   |

The "previous assumptions" are described in Appendix B of Report No. 8 (1982). Appendix B of this Report describes the "new assumptions" and, where convenient, shows both sets of assumptions. Some of the principal assumptions are as follows:

Annual increase in average earnings after 1993: 5.0%  
 Annual increase in Consumer Price Index after 1992: 3.5%

|  | <u>Previous Assumption</u> | <u>New Assumption</u>      |
|--|----------------------------|----------------------------|
| Rate of interest on new bonds after 1994:                          | 6.5%                       | 6%                         |
| Mortality projections based on:                                    | 1975-77 Canada Life Tables | 1980-82 Canada Life Tables |
| Net annual immigration for all Canada as percentage of population: | 0.320%                     | 0.302%                     |
| Total fertility rate:  | 2.0 after 1999             | 2.0 after 2009             |

\* These tables also show contributions, interest, expenditures, the difference between expenditures and contributions, which for practical purposes represents the net cash flow from the provinces, as well as the ratio of the fund to the expenditures in the following year. The net cash flow is that part of the interest payments which is not recycled into new loans and represents provincial funds only to the extent that interest reflects loans to the provinces. The actual net cash flow is somewhat more than indicated in this report to the extent that interest paid on the operating balance (three months' expenditures) during a particular year does not cover the required increase in the operating balance.

TABLE 1  
FUND PROJECTION

# 1600

EXISTING PLAN - 1982 REPORT ASSUMPTIONS

| YEAR | CONTRIBUTIONS |            | BENEFITS AND EXPENSES (3) | NET CASH FLOW FROM PROVINCES (3)-(2) | INTEREST ON FUND (5) | NEW LOANS TO PROVINCES (5)-(4) | FUND AT YEAR-END (7) | RATIO OF FUND TO EXPENDITURE** (8) |
|------|---------------|------------|---------------------------|--------------------------------------|----------------------|--------------------------------|----------------------|------------------------------------|
|      | RATE* (1)     | AMOUNT (2) |                           |                                      |                      |                                |                      |                                    |
|      | %             | \$         | \$                        | \$                                   | \$                   | \$                             | \$                   |                                    |
| 1986 | 3.60          | 5161       | 5513                      | 352                                  | 3194                 | 2842                           | 34.2                 | 5.43                               |
| 1987 | 3.60          | 5514       | 6295                      | 781                                  | 3442                 | 2661                           | 36.8                 | 5.16                               |
| 1988 | 3.60          | 5854       | 7132                      | 1278                                 | 3657                 | 2379                           | 39.2                 | 4.88                               |
| 1989 | 3.60          | 6298       | 8041                      | 1743                                 | 3825                 | 2082                           | 41.3                 | 4.58                               |
| 1990 | 3.60          | 6742       | 9011                      | 2269                                 | 3952                 | 1688                           | 43.0                 | 4.31                               |
| 1991 | 3.60          | 7220       | 9981                      | 2761                                 | 4047                 | 1288                           | 44.3                 | 4.03                               |
| 1992 | 3.60          | 7684       | 10990                     | 3306                                 | 4117                 | 811                            | 45.1                 | 3.74                               |
| 1993 | 3.60          | 8152       | 12037                     | 3885                                 | 4152                 | 267                            | 45.8                 | 3.46                               |
| 1994 | 3.73          | 8991       | 13113                     | 4152                                 | 4152                 | 0                              | 45.3                 | 3.18                               |
| 1995 | 3.97          | 10112      | 14237                     | 4125                                 | 4125                 | 0                              | 45.3                 | 2.94                               |
| 1996 | 4.19          | 11338      | 15429                     | 4091                                 | 4091                 | 0                              | 45.3                 | 2.72                               |
| 1997 | 4.40          | 12834      | 16687                     | 4053                                 | 4053                 | 0                              | 45.3                 | 2.52                               |
| 1998 | 4.59          | 14005      | 18015                     | 4010                                 | 4010                 | 0                              | 45.3                 | 2.33                               |
| 1999 | 4.77          | 15468      | 19423                     | 3955                                 | 3955                 | 0                              | 45.3                 | 2.17                               |
| 2000 | 4.95          | 17016      | 20891                     | 3873                                 | 3873                 | 0                              | 45.3                 | 2.02                               |
| 2001 | 5.12          | 18684      | 22421                     | 3737                                 | 3737                 | 0                              | 45.3                 | 1.88                               |
| 2002 | 5.30          | 20517      | 24053                     | 3536                                 | 3536                 | 0                              | 45.3                 | 1.76                               |
| 2003 | 5.47          | 22462      | 25800                     | 3328                                 | 3328                 | 0                              | 45.3                 | 1.64                               |
| 2004 | 5.61          | 24455      | 27683                     | 3228                                 | 3228                 | 0                              | 45.3                 | 1.52                               |
| 2005 | 5.75          | 26621      | 29749                     | 3128                                 | 3128                 | 0                              | 45.3                 | 1.42                               |
| 2006 | 5.89          | 28937      | 31984                     | 3047                                 | 3047                 | 0                              | 45.3                 | 1.32                               |
| 2007 | 6.03          | 31438      | 34418                     | 2982                                 | 2982                 | 0                              | 45.3                 | 1.22                               |
| 2008 | 6.20          | 34127      | 37068                     | 2939                                 | 2939                 | 0                              | 45.3                 | 1.13                               |
| 2009 | 6.38          | 37053      | 39968                     | 2915                                 | 2915                 | 0                              | 45.3                 | 1.05                               |
| 2010 | 6.52          | 40252      | 43157                     | 2905                                 | 2905                 | 0                              | 45.3                 | 0.97                               |
| 2011 | 6.72          | 43863      | 46764                     | 2901                                 | 2901                 | 0                              | 45.3                 | 0.90                               |
| 2012 | 6.92          | 47741      | 50641                     | 2900                                 | 2900                 | 0                              | 45.3                 | 0.83                               |
| 2020 | 8.78          | 92183      | 95083                     | 2900                                 | 2900                 | 0                              | 45.3                 | 0.44                               |
| 2025 | 9.91          | 134764     | 137664                    | 2900                                 | 2900                 | 0                              | 45.3                 | 0.31                               |
| 2030 | 10.78         | 189918     | 192818                    | 2900                                 | 2900                 | 0                              | 45.3                 | 0.22                               |
| 2050 | 10.41         | 549771     | 552671                    | 2900                                 | 2900                 | 0                              | 45.3                 | 0.08                               |
| 2075 | 10.69         | 2167242    | 2170142                   | 2900                                 | 2900                 | 0                              | 45.3                 | 0.02                               |
| 2100 | 10.82         | 8379301    | 8382201                   | 2900                                 | 2900                 | 0                              | 45.3                 | 0.01*                              |

\* SEE PAR. 3 ON PAGE 2 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

NOTE: FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATES AS PERCENT OF CONTRIBUTORY EARNINGS.

TABLE 2  
FUND PROJECTION

# 1791

PROPOSED PLAN - 1982 REPORT ASSUMPTIONS

| YEAR | CONTRIBUTIONS |            | BENEFITS AND EXPENSES (3) | NET CASH FLOW FROM PROVINCES (3)-(2) | INTEREST ON FUND (5) | NEW LOANS TO PROVINCES (5)-(4) | FUND AT YEAR-END (7) | RATIO OF FUND TO EXPENDITURE** (8) |
|------|---------------|------------|---------------------------|--------------------------------------|----------------------|--------------------------------|----------------------|------------------------------------|
|      | RATE* (1)     | AMOUNT (2) |                           |                                      |                      |                                |                      |                                    |
|      | %             | \$         | \$                        | \$                                   | \$                   | \$                             | \$                   |                                    |
| 1986 | 3.60          | 5161       | 5513                      | 352                                  | 3194                 | 2842                           | 34.2                 | 5.05                               |
| 1987 | 3.80          | 5800       | 6771                      | 971                                  | 3439                 | 2468                           | 36.6                 | 4.64                               |
| 1988 | 4.00          | 6469       | 7893                      | 1424                                 | 3638                 | 2214                           | 38.9                 | 4.33                               |
| 1989 | 4.20          | 7302       | 8987                      | 1685                                 | 3798                 | 2133                           | 41.0                 | 4.11                               |
| 1990 | 4.40          | 8171       | 9975                      | 1904                                 | 3936                 | 2122                           | 43.1                 | 3.94                               |
| 1991 | 4.60          | 9133       | 10932                     | 1799                                 | 4069                 | 2270                           | 45.4                 | 3.81                               |
| 1992 | 4.75          | 10024      | 11915                     | 1891                                 | 4211                 | 2320                           | 47.7                 | 3.68                               |
| 1993 | 4.90          | 10958      | 12947                     | 1989                                 | 4352                 | 2383                           | 50.1                 | 3.56                               |
| 1994 | 5.05          | 11975      | 14047                     | 2072                                 | 4490                 | 2418                           | 52.5                 | 3.43                               |
| 1995 | 5.20          | 13078      | 15301                     | 2228                                 | 4619                 | 2391                           | 54.9                 | 3.33                               |
| 1996 | 5.35          | 14273      | 16502                     | 2229                                 | 4739                 | 2510                           | 57.4                 | 3.23                               |
| 1997 | 5.50          | 15572      | 17795                     | 2223                                 | 4864                 | 2641                           | 60.0                 | 3.13                               |
| 1998 | 5.65          | 16979      | 19177                     | 2198                                 | 4992                 | 2794                           | 62.8                 | 3.04                               |
| 1999 | 5.80          | 18504      | 20660                     | 2158                                 | 5119                 | 2963                           | 65.8                 | 2.96                               |
| 2000 | 5.95          | 20121      | 22220                     | 2099                                 | 5229                 | 3130                           | 68.9                 | 2.89                               |
| 2001 | 6.10          | 21909      | 23844                     | 1935                                 | 5297                 | 3362                           | 72.3                 | 2.83                               |
| 2002 | 6.25          | 23790      | 25586                     | 1796                                 | 5313                 | 3517                           | 75.8                 | 2.76                               |
| 2003 | 6.40          | 25813      | 27459                     | 1646                                 | 5343                 | 3697                           | 79.5                 | 2.70                               |
| 2004 | 6.55          | 28020      | 29483                     | 1463                                 | 5475                 | 4012                           | 83.5                 | 2.63                               |
| 2005 | 6.70          | 30398      | 31705                     | 1307                                 | 5636                 | 4329                           | 87.8                 | 2.57                               |
| 2006 | 6.85          | 32988      | 34128                     | 1190                                 | 5837                 | 4647                           | 92.5                 | 2.52                               |
| 2007 | 7.00          | 35681      | 36757                     | 1096                                 | 6076                 | 4980                           | 97.5                 | 2.46                               |
| 2008 | 7.15          | 38459      | 39605                     | 1146                                 | 6357                 | 5211                           | 102.7                | 2.40                               |
| 2009 | 7.30          | 41515      | 42713                     | 1198                                 | 6672                 | 5474                           | 108.1                | 2.35                               |
| 2010 | 7.45          | 44805      | 46106                     | 1301                                 | 7016                 | 5715                           | 113.9                | 2.28                               |
| 2011 | 7.60          | 48303      | 49897                     | 1594                                 | 7378                 | 5784                           | 119.6                | 2.22                               |
| 2012 | 7.80          | 52367      | 53937                     | 1570                                 | 7751                 | 6181                           | 125.8                | 2.16                               |
| 2020 | 9.84          | 98289      | 99702                     | 1413                                 | 11559                | 10146                          | 188.3                | 1.75                               |
| 2025 | 10.62         | 139720     | 142744                    | 3024                                 | 15138                | 12114                          | 245.8                | 1.61                               |
| 2030 | 11.20         | 192044     | 197015                    | 4971                                 | 19270                | 14299                          | 312.0                | 1.50                               |
| 2050 | 11.12         | 569183     | 588672                    | -5511                                | 69164                | 74875                          | 1187.4               | 1.91                               |
| 2075 | 10.95         | 2151273    | 2191487                   | 40214                                | 287905               | 247691                         | 4687.0               | 2.03                               |
| 2100 | 11.00         | 8255559    | 8431655                   | 176096                               | 1068862              | 890566                         | 17344.9              | 1.96                               |

\* SEE FOOTNOTE ON PAGE 19 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

#1798

TABLE 3  
FUND PROJECTION

EXISTING PLAN - NEW ASSUMPTIONS

| YEAR | CONTRIBUTIONS |            | BENEFITS AND EXPENSES (3) | NET CASH FLOW FROM PROVINCES (3)-(2) |               | NEW LOANS TO PROVINCES (5)-(4) | FUND AT YEAR-END (7) | RATIO OF FUND TO EXPENDITURE** (8) |
|------|---------------|------------|---------------------------|--------------------------------------|---------------|--------------------------------|----------------------|------------------------------------|
|      | RATE* (1)     | AMOUNT (2) |                           | INTEREST ON FUND (5)                 | PROVINCES (4) |                                |                      |                                    |
|      | %             | \$         | \$                        | \$                                   | \$            | \$                             | \$                   |                                    |
| 1986 | 3.60          | 4900       | 5514                      | 614                                  | 3301          | 2687                           | 33.8                 | 5.41                               |
| 1987 | 3.60          | 5143       | 6246                      | 1103                                 | 3598          | 2495                           | 36.3                 | 5.18                               |
| 1988 | 3.60          | 5483       | 7009                      | 1526                                 | 3884          | 2358                           | 38.7                 | 4.93                               |
| 1989 | 3.60          | 5877       | 7850                      | 1973                                 | 4148          | 2173                           | 40.9                 | 4.68                               |
| 1990 | 3.60          | 6277       | 8724                      | 2447                                 | 4378          | 1931                           | 42.8                 | 4.46                               |
| 1991 | 3.60          | 6661       | 9580                      | 2919                                 | 4579          | 1660                           | 44.4                 | 4.25                               |
| 1992 | 3.60          | 7027       | 10450                     | 3423                                 | 4754          | 1331                           | 45.8                 | 4.02                               |
| 1993 | 3.60          | 7480       | 11376                     | 3916                                 | 4874          | 958                            | 46.7                 | 3.78                               |
| 1994 | 3.60          | 7904       | 12371                     | 4467                                 | 4938          | 471                            | 47.2                 | 3.52                               |
| 1995 | 3.64          | 8482       | 13421                     | 4939                                 | 4939          | 0                              | 47.2                 | 3.25                               |
| 1996 | 3.88          | 9629       | 14526                     | 4897                                 | 4897          | 0                              | 47.2                 | 3.01                               |
| 1997 | 4.12          | 10844      | 15694                     | 4850                                 | 4850          | 0                              | 47.2                 | 2.79                               |
| 1998 | 4.35          | 12132      | 16930                     | 4798                                 | 4798          | 0                              | 47.2                 | 2.59                               |
| 1999 | 4.58          | 13511      | 18245                     | 4734                                 | 4734          | 0                              | 47.2                 | 2.40                               |
| 2000 | 4.79          | 14998      | 19639                     | 4641                                 | 4641          | 0                              | 47.2                 | 2.24                               |
| 2001 | 4.99          | 16598      | 21089                     | 4491                                 | 4491          | 0                              | 47.2                 | 2.08                               |
| 2002 | 5.21          | 18364      | 22637                     | 4273                                 | 4273          | 0                              | 47.2                 | 1.94                               |
| 2003 | 5.40          | 20238      | 24297                     | 4059                                 | 4059          | 0                              | 47.2                 | 1.81                               |
| 2004 | 5.58          | 22161      | 26082                     | 3921                                 | 3921          | 0                              | 47.2                 | 1.68                               |
| 2005 | 5.78          | 24284      | 28015                     | 3751                                 | 3751          | 0                              | 47.2                 | 1.57                               |
| 2006 | 5.93          | 26477      | 30104                     | 3627                                 | 3627          | 0                              | 47.2                 | 1.46                               |
| 2007 | 6.11          | 28893      | 32381                     | 3488                                 | 3488          | 0                              | 47.2                 | 1.35                               |
| 2008 | 6.29          | 31511      | 34859                     | 3348                                 | 3348          | 0                              | 47.2                 | 1.26                               |
| 2009 | 6.49          | 34362      | 37579                     | 3216                                 | 3216          | 0                              | 47.2                 | 1.16                               |
| 2010 | 6.70          | 37483      | 40579                     | 3096                                 | 3096          | 0                              | 47.2                 | 1.07                               |
| 2011 | 6.93          | 41004      | 43993                     | 2989                                 | 2989          | 0                              | 47.2                 | 0.99                               |
| 2012 | 7.17          | 44780      | 47657                     | 2897                                 | 2897          | 0                              | 47.2                 | 0.91                               |
| 2020 | 9.11          | 86180      | 88970                     | 2790                                 | 2790          | 0                              | 47.2                 | 0.49                               |
| 2025 | 10.37         | 128070     | 128880                    | 2790                                 | 2790          | 0                              | 47.2                 | 0.34                               |
| 2030 | 11.33         | 177860     | 180850                    | 2790                                 | 2790          | 0                              | 47.2                 | 0.25                               |
| 2050 | 10.93         | 507261     | 510051                    | 2790                                 | 2790          | 0                              | 47.2                 | 0.09                               |
| 2075 | 10.99         | 1945118    | 1947908                   | 2790                                 | 2790          | 0                              | 47.2                 | 0.02                               |
| 2100 | 11.13         | 7484733    | 7467523                   | 2790                                 | 2790          | 0                              | 47.2                 | 0.01                               |

\* SEE PAR. 3 ON PAGE 2 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

NOTE: FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATES AS PERCENT OF CONTRIBUTORY EARNINGS.

TABLE 4  
FUND PROJECTION

#1900

PROPOSED PLAN - NEW ASSUMPTIONS

| YEAR | CONTRIBUTIONS |            | BENEFITS AND EXPENSES (3) | NET CASH FLOW FROM PROVINCES (3)-(2) |               | NEW LOANS TO PROVINCES (5)-(4) | FUND AT YEAR-END (7) | RATIO OF FUND TO EXPENDITURE** (8) |
|------|---------------|------------|---------------------------|--------------------------------------|---------------|--------------------------------|----------------------|------------------------------------|
|      | RATE* (1)     | AMOUNT (2) |                           | INTEREST ON FUND (5)                 | PROVINCES (4) |                                |                      |                                    |
|      | %             | \$         | \$                        | \$                                   | \$            | \$                             | \$                   |                                    |
| 1986 | 3.60          | 4900       | 5514                      | 614                                  | 3301          | 2687                           | 33.8                 | 4.99                               |
| 1987 | 3.80          | 5414       | 6780                      | 1366                                 | 3591          | 2225                           | 38.0                 | 4.58                               |
| 1988 | 4.00          | 6071       | 7867                      | 1796                                 | 3848          | 2052                           | 38.1                 | 4.29                               |
| 1989 | 4.20          | 6827       | 8884                      | 2047                                 | 4084          | 2037                           | 40.1                 | 4.11                               |
| 1990 | 4.40          | 7644       | 9775                      | 2131                                 | 4312          | 2181                           | 42.3                 | 4.00                               |
| 1991 | 4.60          | 8473       | 10576                     | 2101                                 | 4550          | 2449                           | 44.8                 | 3.93                               |
| 1992 | 4.75          | 9233       | 11381                     | 2148                                 | 4812          | 2664                           | 47.4                 | 3.87                               |
| 1993 | 4.90          | 10111      | 12253                     | 2142                                 | 5059          | 2917                           | 50.3                 | 3.80                               |
| 1994 | 5.05          | 11043      | 13258                     | 2213                                 | 5283          | 3070                           | 53.4                 | 3.72                               |
| 1995 | 5.20          | 12075      | 14359                     | 2284                                 | 5464          | 3180                           | 56.6                 | 3.64                               |
| 1996 | 5.35          | 13214      | 15550                     | 2328                                 | 5612          | 3276                           | 59.9                 | 3.56                               |
| 1997 | 5.50          | 14412      | 16827                     | 2415                                 | 5780          | 3345                           | 63.2                 | 3.49                               |
| 1998 | 5.65          | 15693      | 18125                     | 2432                                 | 5907          | 3475                           | 66.7                 | 3.42                               |
| 1999 | 5.80          | 17046      | 19517                     | 2471                                 | 6050          | 3579                           | 70.3                 | 3.34                               |
| 2000 | 5.95          | 18555      | 21038                     | 2483                                 | 6170          | 3687                           | 74.0                 | 3.26                               |
| 2001 | 6.10          | 20216      | 22689                     | 2453                                 | 6240          | 3787                           | 77.7                 | 3.19                               |
| 2002 | 6.25          | 21989      | 24361                     | 2422                                 | 6246          | 3824                           | 81.6                 | 3.12                               |
| 2003 | 6.40          | 23870      | 26143                     | 2273                                 | 6260          | 3987                           | 85.8                 | 3.05                               |
| 2004 | 6.55          | 25879      | 28043                     | 2164                                 | 6351          | 4197                           | 89.7                 | 2.98                               |
| 2005 | 6.70          | 28073      | 30098                     | 2025                                 | 6443          | 4418                           | 94.2                 | 2.91                               |
| 2006 | 6.85          | 30412      | 32400                     | 1988                                 | 6582          | 4594                           | 98.8                 | 2.83                               |
| 2007 | 7.00          | 32923      | 34908                     | 1983                                 | 6720          | 4737                           | 103.5                | 2.75                               |
| 2008 | 7.15          | 35602      | 37623                     | 2021                                 | 6874          | 4853                           | 108.3                | 2.67                               |
| 2009 | 7.30          | 38411      | 40590                     | 2179                                 | 7040          | 4881                           | 113.2                | 2.58                               |
| 2010 | 7.45          | 41442      | 43844                     | 2402                                 | 7208          | 4806                           | 118.0                | 2.49                               |
| 2011 | 7.60          | 44680      | 47485                     | 2805                                 | 7368          | 4563                           | 122.6                | 2.39                               |
| 2012 | 7.90          | 48975      | 51357                     | 2382                                 | 7521          | 5139                           | 127.7                | 2.30                               |
| 2020 | 10.10         | 94857      | 94720                     | -137                                 | 11097         | 11234                          | 196.2                | 1.92                               |
| 2025 | 11.07         | 123519     | 123863                    | 2366                                 | 14611         | 12245                          | 256.4                | 1.76                               |
| 2030 | 11.85         | 181605     | 187598                    | 5993                                 | 18198         | 12203                          | 317.0                | 1.60                               |
| 2050 | 11.68         | 537965     | 528943                    | -8620                                | 59975         | 68593                          | 1066.0               | 1.91                               |
| 2075 | 11.34         | 1993527    | 2006864                   | 13337                                | 247060        | 233723                         | 4354.7               | 2.05                               |
| 2100 | 11.40         | 7593907    | 7659365                   | 65458                                | 916638        | 851180                         | 16144.9              | 1.98                               |

\* SEE FOOTNOTE ON PAGE 19 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

#1600

EXISTING PLAN  
1982 REPORT ASSUMPTIONS

TABLE 5

BENEFITS AND EXPENSES OF ADMINISTRATION  
(IN \$ MILLIONS)

| YEAR | RETIREMENT<br>PENSIONS<br>(1) | DISABILITY PENSIONS  |                             |                                | SURVIVING SPOUSES'<br>PENSIONS |                             | ORPHANS'<br>BENEFITS<br>(4) | DEATH<br>BENEFITS<br>(5) | EXPENSES<br>OF<br>ADMINIS-<br>TRATION<br>(6) | TOTAL<br>(7) |
|------|-------------------------------|----------------------|-----------------------------|--------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------|--|--------------|
|      |                               | FLAT<br>RATE<br>(2A) | EARNINGS<br>RELATED<br>(2B) | CHILDREN'S<br>BENEFITS<br>(2C) | FLAT<br>RATE<br>(3A)           | EARNINGS<br>RELATED<br>(3B) |                             |                          |  |              |
| 1986 | 3616.0                        | 159.1                | 425.5                       | 62.3                           | 208.7                          | 643.8                       | 145.9                       | 123.1                    | 128.5  | 5512.9       |
| 1987 | 4182.3                        | 167.9                | 471.6                       | 65.8                           | 227.6                          | 736.4                       | 161.2                       | 140.8                    | 141.3  | 6294.8       |
| 1988 | 4793.3                        | 176.6                | 518.9                       | 69.1                           | 246.8                          | 836.3                       | 177.0                       | 159.7                    | 154.2  | 7131.8       |
| 1989 | 5458.9                        | 185.6                | 566.6                       | 72.3                           | 267.1                          | 946.5                       | 194.0                       | 179.9                    | 170.4  | 8041.2       |
| 1990 | 6171.3                        | 194.7                | 614.3                       | 75.3                           | 288.2                          | 1066.5                      | 212.2                       | 201.2                    | 187.3  | 9010.9       |
| 1991 | 6885.9                        | 207.3                | 665.3                       | 77.2                           | 308.7                          | 1193.5                      | 221.7                       | 220.8                    | 200.5  | 9981.2       |
| 1992 | 7627.2                        | 220.7                | 719.1                       | 78.7                           | 329.7                          | 1329.7                      | 231.5                       | 241.4                    | 213.5  | 10990.4      |
| 1993 | 8393.4                        | 234.4                | 774.7                       | 80.0                           | 350.9                          | 1472.0                      | 241.4                       | 263.2                    | 226.4  | 12037.4      |
| 1994 | 9177.7                        | 248.7                | 833.0                       | 81.3                           | 372.3                          | 1622.2                      | 251.1                       | 286.2                    | 240.4  | 13112.7      |
| 1995 | 9995.5                        | 263.1                | 892.4                       | 82.6                           | 394.8                          | 1782.2                      | 261.2                       | 310.6                    | 255.0  | 14237.3      |
| 1996 | 10851.6                       | 278.8                | 956.8                       | 86.0                           | 419.6                          | 1956.8                      | 271.7                       | 337.0                    | 270.7  | 15428.8      |
| 1997 | 11750.9                       | 295.8                | 1026.7                      | 89.9                           | 445.9                          | 2143.0                      | 282.6                       | 365.2                    | 287.4  | 16687.5      |
| 1998 | 12696.3                       | 313.8                | 1101.1                      | 94.4                           | 473.7                          | 2341.4                      | 294.0                       | 395.0                    | 305.2  | 18014.9      |
| 1999 | 13691.1                       | 334.5                | 1186.5                      | 99.2                           | 503.0                          | 2552.0                      | 305.9                       | 426.7                    | 324.2  | 19422.9      |
| 2000 | 14726.5                       | 357.2                | 1282.6                      | 104.3                          | 533.7                          | 2765.5                      | 318.0                       | 459.7                    | 343.8  | 20891.2      |
| 2005 | 20931.7                       | 506.5                | 1924.9                      | 128.4                          | 706.5                          | 4042.8                      | 388.1                       | 657.8                    | 462.9  | 29749.3      |
| 2010 | 30838.3                       | 701.5                | 2833.9                      | 153.8                          | 927.6                          | 5691.4                      | 461.0                       | 932.6                    | 617.2  | 43157.3      |
| 2015 | 47767.2                       | 903.8                | 3902.4                      | 184.6                          | 1190.5                         | 7805.6                      | 551.2                       | 1316.7                   | 810.0  | 64432.1      |
| 2020 | 72941.1                       | 1124.9               | 5203.1                      | 225.3                          | 1481.0                         | 10551.2                     | 670.4                       | 1833.9                   | 1052.8                                       | 95083.1      |
| 2025 | 108805.7                      | 1324.5               | 6551.0                      | 278.2                          | 1782.6                         | 14190.4                     | 825.5                       | 2545.9                   | 1360.4                                       | 137663.6     |
| 2030 | 155764.4                      | 1481.9               | 7858.9                      | 342.8                          | 2076.9                         | 19012.1                     | 1014.5                      | 3499.1                   | 1765.7                                       | 192815.6     |
| 2050 | 449574.5                      | 3389.7               | 24283.1                     | 750.3                          | 3903.1                         | 52640.0                     | 2199.3                      | 10671.8                  | 5280.1                                       | 552670.9     |
| 2075 | 1806453.0                     | 9029.6               | 93196.3                     | 2009.2                         | 10118.3                        | 181606.7                    | 5978.4                      | 41584.7                  | 20276.6                                      | 2170142.0    |
| 2100 | 7039621.0                     | 23978.9              | 354963.9                    | 5361.6                         | 27005.3                        | 676759.2                    | 15688.5                     | 161384.2                 | 77446.1                                      | 8382201.0    |

#1791

TABLE 6

BENEFITS AND EXPENSES OF ADMINISTRATION  
(IN \$ MILLIONS)

| YEAR | RETIREMENT<br>PENSIONS<br>(1) | DISABILITY PENSIONS  |                             |                                | SURVIVING SPOUSES'<br>PENSIONS |                             |       | ORPHANS'<br>BENEFITS<br>(4) | DEATH<br>BENEFITS<br>(5) | EXPENSES<br>OF<br>ADMINIS-<br>TRATION-<br>(6) | TOTAL<br>(7) |
|------|-------------------------------|----------------------|-----------------------------|--------------------------------|--------------------------------|-----------------------------|-------|-----------------------------|--------------------------|---|--------------|
|      |                               | FLAT<br>RATE<br>(2A) | EARNINGS<br>RELATED<br>(2B) | CHILDREN'S<br>BENEFITS<br>(2C) | FLAT<br>RATE<br>(3A)           | EARNINGS<br>RELATED<br>(3B) |       |                             |                          |   |              |
| 1986 | 3616                          | 159                  | 426                         | 62                             | 209                            | 644                         | 148   | 123                         | 129                      | 5513  |              |
| 1987 | 4385                          | 427                  | 472                         | 66                             | 228                            | 750                         | 163   | 141                         | 141                      | 6771  |              |
| 1988 | 5256                          | 449                  | 519                         | 69                             | 249                            | 859                         | 179   | 160                         | 153                      | 7893  |              |
| 1989 | 6057                          | 472                  | 566                         | 72                             | 272                            | 982                         | 197   | 180                         | 169                      | 8967  |              |
| 1990 | 6775                          | 495                  | 614                         | 75                             | 297                            | 1118                        | 215   | 201                         | 186                      | 9975  |              |
| 1991 | 7435                          | 526                  | 665                         | 77                             | 322                            | 1263                        | 224   | 220                         | 199                      | 10932   |              |
| 1992 | 8099                          | 564                  | 719                         | 79                             | 348                            | 1420                        | 234   | 241                         | 211                      | 11915   |              |
| 1993 | 8793                          | 605                  | 777                         | 80                             | 374                            | 1588                        | 244   | 262                         | 224                      | 12947   |              |
| 1994 | 9540                          | 647                  | 837                         | 82                             | 401                            | 1765                        | 254   | 285                         | 237                      | 14047   |              |
| 1995 | 10422                         | 685                  | 897                         | 84                             | 431                            | 1958                        | 264   | 309                         | 251                      | 15301   |              |
| 1996 | 11220                         | 730                  | 963                         | 88                             | 461                            | 2164                        | 275   | 335                         | 267                      | 16502   |              |
| 1997 | 12080                         | 778                  | 1034                        | 92                             | 493                            | 2384                        | 286   | 363                         | 283                      | 17795   |              |
| 1998 | 13004                         | 829                  | 1110                        | 97                             | 526                            | 2620                        | 298   | 393                         | 301                      | 19177   |              |
| 1999 | 13990                         | 886                  | 1198                        | 103                            | 561                            | 2871                        | 310   | 424                         | 319                      | 20660   |              |
| 2000 | 15025                         | 948                  | 1296                        | 108                            | 598                            | 3128                        | 322   | 457                         | 338                      | 22220   |              |
| 2005 | 21260                         | 1354                 | 1950                        | 134                            | 813                            | 4696                        | 393   | 651                         | 454                      | 31705   |              |
| 2010 | 31363                         | 1890                 | 2873                        | 161                            | 1082                           | 6758                        | 467   | 922                         | 601                      | 46106   |              |
| 2015 | 48140                         | 2424                 | 3958                        | 193                            | 1397                           | 9469                        | 558   | 1297                        | 787                      | 68222   |              |
| 2020 | 72854                         | 3016                 | 5276                        | 236                            | 1741                           | 13080                       | 678   | 1802                        | 1020                     | 99702   |              |
| 2025 | 107577                        | 3549                 | 8640                        | 291                            | 2094                           | 17948                       | 835   | 2495                        | 1318                     | 142744  |              |
| 2030 | 151654                        | 3971                 | 7968                        | 359                            | 2439                           | 24462                       | 1027  | 3424                        | 1715                     | 197015  |              |
| 2050 | 437115                        | 9070                 | 24595                       | 784                            | 4616                           | 69742                       | 2226  | 10406                       | 5119                     | 563672  |              |
| 2075 | 1748533                       | 24137                | 94462                       | 2100                           | 10896                          | 244284                      | 5949  | 40485                       | 19646                    | 2191487                                       |              |
| 2100 | 6801894                       | 64095                | 359821                      | 5605                           | 31730                          | 920590                      | 15876 | 157000                      | 75051                    | 8431655                                       |              |

PROPOSED PLAN  
NEW ASSUMPTIONS  
#1900

TABLE 7

BENEFITS AND EXPENSES OF ADMINISTRATION  
(IN \$ MILLIONS)

| YEAR | RETIREMENT<br>PENSIONS<br>(1) | DISABILITY PENSIONS  |                             |                                | SURVIVING SPOUSES'<br>PENSIONS |                             |       | ORPHANS'<br>BENEFITS<br>(4) | DEATH<br>BENEFITS<br>(5) | EXPENSES<br>OF<br>ADMINIS-<br>TRATION<br>(6) | TOTAL<br>(7) |
|------|-------------------------------|----------------------|-----------------------------|--------------------------------|--------------------------------|-----------------------------|-------|-----------------------------|--------------------------|--|--------------|
|      |                               | FLAT<br>RATE<br>(2A) | EARNINGS<br>RELATED<br>(2B) | CHILDREN'S<br>BENEFITS<br>(2C) | FLAT<br>RATE<br>(3A)           | EARNINGS<br>RELATED<br>(3B) |       |                             |                          |  |              |
| 1986 | 3549                          | 181                  | 468                         | 75                             | 198                            | 820                         | 175   | 112                         | 138                      | 5514   |              |
| 1987 | 4311                          | 494                  | 519                         | 83                             | 214                            | 708                         | 181   | 127                         | 142                      | 8780   |              |
| 1988 | 5178                          | 519                  | 566                         | 90                             | 230                            | 802                         | 187   | 144                         | 152                      | 7867   |              |
| 1989 | 5952                          | 546                  | 615                         | 97                             | 248                            | 908                         | 194   | 161                         | 163                      | 8884   |              |
| 1990 | 6995                          | 574                  | 661                         | 103                            | 267                            | 1022                        | 201   | 180                         | 174                      | 9775   |              |
| 1991 | 7144                          | 601                  | 706                         | 105                            | 286                            | 1144                        | 208   | 196                         | 184                      | 10576  |              |
| 1992 | 7689                          | 628                  | 752                         | 107                            | 307                            | 1274                        | 216   | 214                         | 194                      | 11381 ✓                                      |              |
| 1993 | 8281                          | 659                  | 801                         | 107                            | 327                            | 1414                        | 224   | 232                         | 206                      | 12253 ✓                                      |              |
| 1994 | 8974                          | 694                  | 856                         | 107                            | 350                            | 1569                        | 234   | 252                         | 219                      | 13258 ✓                                      |              |
| 1995 | 9748                          | 730                  | 913                         | 107                            | 375                            | 1736                        | 244   | 273                         | 232                      | 14359 ✓                                      |              |
| 1996 | 10584                         | 770                  | 975                         | 110                            | 399                            | 1814                        | 254   | 297                         | 247                      | 15550 ✓                                      |              |
| 1997 | 11478                         | 813                  | 1043                        | 114                            | 426                            | 2105                        | 265   | 322                         | 262                      | 16827 ✓                                      |              |
| 1998 | 12363                         | 861                  | 1119                        | 118                            | 454                            | 2308                        | 276   | 348                         | 278                      | 18125 ✓                                      |              |
| 1999 | 13306                         | 917                  | 1207                        | 122                            | 483                            | 2524                        | 287   | 377                         | 294                      | 19517 ✓                                      |              |
| 2000 | 14328                         | 977                  | 1303                        | 125                            | 516                            | 2769                        | 300   | 407                         | 312                      | 21038 ✓                                      |              |
| 2005 | 20457                         | 1367                 | 1941                        | 132                            | 697                            | 4144                        | 357   | 584                         | 419                      | 30098 ✓                                      |              |
| 2010 | 30259                         | 1890                 | 2862                        | 158                            | 922                            | 5947                        | 420   | 832                         | 556                      | 43844 ✓                                      |              |
| 2015 | 46632                         | 2415                 | 3913                        | 187                            | 1187                           | 8309                        | 501   | 1177                        | 727                      | 65047 ✓                                      |              |
| 2020 | 70098                         | 3033                 | 5257                        | 230                            | 1478                           | 11433                       | 614   | 1637                        | 939                      | 94720 ✓                                      |              |
| 2025 | 103726                        | 3586                 | 6630                        | 288                            | 1780                           | 15634                       | 762   | 2274                        | 1206                     | 135885 ✓                                     |              |
| 2030 | 146415                        | 3984                 | 7881                        | 352                            | 2072                           | 21288                       | 935   | 3133                        | 1559                     | 187598 ✓                                     |              |
| 2050 | 415388                        | 8926                 | 23860                       | 765                            | 3833                           | 60431                       | 2006  | 9533                        | 4006                     | 529345 ✓                                     |              |
| 2075 | 1814832                       | 23640                | 91120                       | 2026                           | 9751                           | 206459                      | 5308  | 36154                       | 17580                    | 2006864 ✓                                    |              |
| 2100 | 6283455                       | 62065                | 343003                      | 5364                           | 25792                          | 770087                      | 14054 | 138936                      | 66613                    | 7659365 ✓                                    |              |

EXISTING PLAN  
1982 REPORT ASSUMPTIONS

1600

TABLE 8

BENEFITS AND EXPENSES OF ADMINISTRATION  
(EXPRESSED AS PERCENTAGES OF CONTRIBUTORY EARNINGS)

| YEAR | RETIREMENT<br>PENSIONS<br>(1) | DISABILITY PENSIONS  |                             |                                | SURVIVING SPOUSES'<br>PENSIONS |                             |      | ORPHANS'<br>BENEFITS<br>(4) | DEATH<br>BENEFITS<br>(5) | EXPENSES<br>OF<br>ADMINIS-<br>TRATION-<br>(6) | TOTAL<br>(7) |
|------|-------------------------------|----------------------|-----------------------------|--------------------------------|--------------------------------|-----------------------------|------|-----------------------------|--------------------------|---|--------------|
|      |                               | FLAT<br>RATE<br>(2A) | EARNINGS<br>RELATED<br>(2B) | CHILDREN'S<br>BENEFITS<br>(2C) | FLAT<br>RATE<br>(3A)           | EARNINGS<br>RELATED<br>(3B) |      |                             |                          |   |              |
| 1986 | 2.52                          | 0.11                 | 0.30                        | 0.04                           | 0.14                           | 0.45                        | 0.10 | 0.09                        | 0.09                     | 3.85  |              |
| 1987 | 2.73                          | 0.11                 | 0.31                        | 0.04                           | 0.15                           | 0.48                        | 0.11 | 0.09                        | 0.09                     | 4.11  |              |
| 1988 | 2.95                          | 0.11                 | 0.32                        | 0.04                           | 0.15                           | 0.51                        | 0.11 | 0.10                        | 0.09                     | 4.39  |              |
| 1989 | 3.12                          | 0.11                 | 0.32                        | 0.04                           | 0.16                           | 0.55                        | 0.11 | 0.10                        | 0.10                     | 4.60  |              |
| 1990 | 3.30                          | 0.10                 | 0.33                        | 0.04                           | 0.16                           | 0.57                        | 0.11 | 0.11                        | 0.10                     | 4.81  |              |
| 1991 | 3.43                          | 0.10                 | 0.33                        | 0.04                           | 0.16                           | 0.60                        | 0.11 | 0.11                        | 0.10                     | 4.98  |              |
| 1992 | 3.57                          | 0.10                 | 0.34                        | 0.04                           | 0.16                           | 0.63                        | 0.11 | 0.11                        | 0.10                     | 5.15  |              |
| 1993 | 3.71                          | 0.10                 | 0.34                        | 0.04                           | 0.16                           | 0.65                        | 0.11 | 0.12                        | 0.10                     | 5.32  |              |
| 1994 | 3.82                          | 0.10                 | 0.35                        | 0.03                           | 0.15                           | 0.68                        | 0.10 | 0.12                        | 0.10                     | 5.45  |              |
| 1995 | 3.82                          | 0.10                 | 0.35                        | 0.03                           | 0.15                           | 0.70                        | 0.10 | 0.12                        | 0.10                     | 5.58  |              |
| 2000 | 4.28                          | 0.10                 | 0.37                        | 0.03                           | 0.16                           | 0.81                        | 0.09 | 0.13                        | 0.10                     | 6.08  |              |
| 2005 | 4.52                          | 0.11                 | 0.42                        | 0.03                           | 0.16                           | 0.87                        | 0.08 | 0.14                        | 0.10                     | 6.43  |              |
| 2010 | 5.00                          | 0.11                 | 0.46                        | 0.02                           | 0.15                           | 0.92                        | 0.07 | 0.15                        | 0.10                     | 6.99  |              |
| 2015 | 5.90                          | 0.11                 | 0.48                        | 0.02                           | 0.15                           | 0.97                        | 0.07 | 0.16                        | 0.10                     | 7.95  |              |
| 2020 | 6.93                          | 0.11                 | 0.49                        | 0.02                           | 0.15                           | 1.00                        | 0.08 | 0.17                        | 0.10                     | 9.03  |              |
| 2025 | 8.00                          | 0.10                 | 0.48                        | 0.02                           | 0.13                           | 1.05                        | 0.06 | 0.19                        | 0.10                     | 10.12   |              |
| 2030 | 8.82                          | 0.08                 | 0.45                        | 0.02                           | 0.12                           | 1.08                        | 0.06 | 0.20                        | 0.10                     | 10.82   |              |
| 2050 | 8.51                          | 0.06                 | 0.46                        | 0.01                           | 0.08                           | 1.00                        | 0.04 | 0.20                        | 0.10                     | 10.47   |              |
| 2075 | 8.91                          | 0.04                 | 0.46                        | 0.01                           | 0.05                           | 0.90                        | 0.03 | 0.21                        | 0.10                     | 10.70   |              |
| 2100 | 9.09                          | 0.03                 | 0.46                        | 0.01                           | 0.03                           | 0.87                        | 0.02 | 0.21                        | 0.10                     | 10.82   |              |

#1600

TABLE 9

PROPOSED PLAN  
1982 REPORT ASSUMPTIONS

#1791

BENEFITS AND EXPENSES OF ADMINISTRATION  
(EXPRESSED AS PERCENTAGES OF CONTRIBUTORY EARNINGS)

| YEAR | RETIREMENT<br>PENSIONS<br>(1) | DISABILITY PENSIONS  |                             |                                | SURVIVING SPOUSES'<br>PENSIONS |                             |      | ORPHANS'<br>BENEFITS<br>(4) | DEATH<br>BENEFITS<br>(5) | EXPENSES<br>OF<br>ADMINIS-<br>TRATION-<br>(6) | TOTAL<br>(7) | PROPOSED<br>CONTRIBUTION<br>RATE* |
|------|-------------------------------|----------------------|-----------------------------|--------------------------------|--------------------------------|-----------------------------|------|-----------------------------|--------------------------|---|--------------|-----------------------------------|
|      |                               | FLAT<br>RATE<br>(2A) | EARNINGS<br>RELATED<br>(2B) | CHILDREN'S<br>BENEFITS<br>(2C) | FLAT<br>RATE<br>(3A)           | EARNINGS<br>RELATED<br>(3B) |      |                             |                          |   |              |                                   |
| 1986 | 2.52                          | 0.11                 | 0.30                        | 0.04                           | 0.14                           | 0.45                        | 0.10 | 0.09                        | 0.09                     | 3.85  | 3.80         |                                   |
| 1987 | 2.87                          | 0.28                 | 0.31                        | 0.04                           | 0.15                           | 0.49                        | 0.11 | 0.09                        | 0.09                     | 4.44  | 3.80         |                                   |
| 1988 | 3.25                          | 0.28                 | 0.32                        | 0.04                           | 0.15                           | 0.54                        | 0.11 | 0.10                        | 0.09                     | 4.88  | 4.00         |                                   |
| 1989 | 3.48                          | 0.27                 | 0.33                        | 0.04                           | 0.18                           | 0.57                        | 0.11 | 0.10                        | 0.10                     | 5.18  | 4.20         |                                   |
| 1990 | 3.85                          | 0.27                 | 0.33                        | 0.04                           | 0.18                           | 0.60                        | 0.12 | 0.11                        | 0.10                     | 5.37  | 4.40         |                                   |
| 1991 | 3.74                          | 0.27                 | 0.33                        | 0.04                           | 0.18                           | 0.63                        | 0.11 | 0.11                        | 0.10                     | 5.51  | 4.60         |                                   |
| 1992 | 3.84                          | 0.27                 | 0.34                        | 0.04                           | 0.17                           | 0.67                        | 0.11 | 0.11                        | 0.10                     | 5.85  | 4.75         |                                   |
| 1993 | 3.93                          | 0.27                 | 0.35                        | 0.04                           | 0.17                           | 0.71                        | 0.11 | 0.12                        | 0.10                     | 5.79  | 4.90         |                                   |
| 1994 | 4.02                          | 0.27                 | 0.35                        | 0.03                           | 0.17                           | 0.75                        | 0.11 | 0.12                        | 0.10                     | 5.92  | 5.05         |                                   |
| 1995 | 4.15                          | 0.27                 | 0.36                        | 0.03                           | 0.17                           | 0.78                        | 0.11 | 0.12                        | 0.10                     | 6.09  | 5.20         |                                   |
| 2000 | 4.44                          | 0.28                 | 0.38                        | 0.03                           | 0.17                           | 0.92                        | 0.10 | 0.13                        | 0.10                     | 6.57  | 5.95         |                                   |
| 2005 | 4.69                          | 0.30                 | 0.43                        | 0.03                           | 0.18                           | 1.03                        | 0.09 | 0.14                        | 0.10                     | 6.99  | 6.70         |                                   |
| 2010 | 5.21                          | 0.31                 | 0.48                        | 0.03                           | 0.18                           | 1.12                        | 0.08 | 0.15                        | 0.10                     | 7.67  | 7.45         |                                   |
| 2015 | 6.12                          | 0.31                 | 0.50                        | 0.02                           | 0.18                           | 1.20                        | 0.07 | 0.18                        | 0.10                     | 8.67  | 8.40         |                                   |
| 2020 | 7.15                          | 0.30                 | 0.52                        | 0.02                           | 0.17                           | 1.28                        | 0.07 | 0.18                        | 0.10                     | 9.78  | 9.64         |                                   |
| 2025 | 8.18                          | 0.27                 | 0.50                        | 0.02                           | 0.16                           | 1.36                        | 0.06 | 0.19                        | 0.10                     | 10.85   | 10.62        |                                   |
| 2030 | 9.84                          | 0.23                 | 0.46                        | 0.02                           | 0.14                           | 1.43                        | 0.06 | 0.20                        | 0.10                     | 11.49   | 11.20        |                                   |
| 2050 | 8.54                          | 0.18                 | 0.48                        | 0.02                           | 0.09                           | 1.36                        | 0.04 | 0.20                        | 0.10                     | 11.01   | 11.12        |                                   |
| 2075 | 8.90                          | 0.12                 | 0.48                        | 0.01                           | 0.06                           | 1.25                        | 0.03 | 0.21                        | 0.10                     | 11.15   | 10.95        |                                   |
| 2100 | 9.08                          | 0.09                 | 0.48                        | 0.01                           | 0.05                           | 1.22                        | 0.02 | 0.21                        | 0.10                     | 11.23   | 11.00        |                                   |

\* A FOOTNOTE ON PAGE 19 EXPLAINS THE STATUS OF THE RATES IN THIS COLUMN FROM 1992 TO 2011  
AND THE FORMULA USED TO DETERMINE THE RATES AFTER 2011



#1900

TABLE 10

PROPOSED PLAN  
NEW ASSUMPTIONS

BENEFITS AND EXPENSES OF ADMINISTRATION  
(EXPRESSED AS PERCENTAGES OF CONTRIBUTORY EARNINGS)

| YEAR | RETIREMENT PENSIONS<br>(1) | DISABILITY PENSIONS |                          |                             | SURVIVING SPOUSES' PENSIONS |                          |      | ORPHANS' BENEFITS<br>(4) | DEATH BENEFITS<br>(5) | EXPENSES OF ADMINISTRATION<br>(6) | TOTAL<br>(7) | PROPOSED CONTRIBUTION RATE* |
|------|----------------------------|---------------------|--------------------------|-----------------------------|-----------------------------|--------------------------|------|--------------------------|-----------------------|-----------------------------------|--------------|-----------------------------|
|      |                            | FLAT RATE<br>(2A)   | EARNINGS RELATED<br>(2B) | CHILDREN'S BENEFITS<br>(2C) | FLAT RATE<br>(3A)           | EARNINGS RELATED<br>(3B) |      |                          |                       |                                   |              |                             |
| 1986 | 2.61                       | 0.13                | 0.34                     | 0.05                        | 0.14                        | 0.46                     | 0.13 | 0.08                     | 0.10                  | 4.05                              | 3.60         |                             |
| 1987 | 3.03                       | 0.35                | 0.36                     | 0.06                        | 0.15                        | 0.49                     | 0.13 | 0.08                     | 0.10                  | 4.76                              | 3.80         |                             |
| 1988 | 3.41                       | 0.34                | 0.37                     | 0.06                        | 0.15                        | 0.52                     | 0.12 | 0.09                     | 0.10                  | 5.18                              | 4.00         |                             |
| 1989 | 3.86                       | 0.34                | 0.38                     | 0.06                        | 0.15                        | 0.56                     | 0.12 | 0.10                     | 0.10                  | 5.46                              | 4.20         |                             |
| 1990 | 3.80                       | 0.33                | 0.38                     | 0.06                        | 0.16                        | 0.59                     | 0.12 | 0.10                     | 0.10                  | 5.63                              | 4.40         |                             |
| 1991 | 3.88                       | 0.33                | 0.38                     | 0.06                        | 0.16                        | 0.62                     | 0.11 | 0.11                     | 0.10                  | 5.74                              | 4.60         |                             |
| 1992 | 3.98                       | 0.32                | 0.39                     | 0.05                        | 0.16                        | 0.65                     | 0.11 | 0.11                     | 0.10                  | 5.86                              | 4.75         |                             |
| 1993 | 4.01                       | 0.32                | 0.39                     | 0.05                        | 0.16                        | 0.69                     | 0.11 | 0.11                     | 0.10                  | 5.94                              | 4.90         |                             |
| 1994 | 4.10                       | 0.32                | 0.39                     | 0.05                        | 0.16                        | 0.72                     | 0.11 | 0.12                     | 0.10                  | 6.06                              | 5.05         |                             |
| 1995 | 4.20                       | 0.31                | 0.39                     | 0.05                        | 0.16                        | 0.75                     | 0.10 | 0.12                     | 0.10                  | 6.18                              | 5.20         |                             |
| 2000 | 4.59                       | 0.31                | 0.42                     | 0.04                        | 0.16                        | 0.89                     | 0.10 | 0.13                     | 0.10                  | 6.75                              | 5.95         |                             |
| 2005 | 4.88                       | 0.33                | 0.46                     | 0.03                        | 0.16                        | 0.99                     | 0.09 | 0.14                     | 0.10                  | 7.18                              | 6.70         |                             |
| 2010 | 5.44                       | 0.34                | 0.51                     | 0.03                        | 0.17                        | 1.07                     | 0.08 | 0.15                     | 0.10                  | 7.88                              | 7.45         |                             |
| 2015 | 6.42                       | 0.33                | 0.54                     | 0.03                        | 0.16                        | 1.14                     | 0.07 | 0.16                     | 0.10                  | 8.95                              | 8.80         |                             |
| 2020 | 7.48                       | 0.32                | 0.56                     | 0.02                        | 0.16                        | 1.21                     | 0.07 | 0.17                     | 0.10                  | 10.09                             | 10.10        |                             |
| 2025 | 8.60                       | 0.30                | 0.55                     | 0.02                        | 0.15                        | 1.29                     | 0.06 | 0.19                     | 0.10                  | 11.27                             | 11.07        |                             |
| 2030 | 9.39                       | 0.28                | 0.51                     | 0.02                        | 0.14                        | 1.36                     | 0.06 | 0.20                     | 0.10                  | 12.03                             | 11.65        |                             |
| 2050 | 9.02                       | 0.19                | 0.52                     | 0.02                        | 0.08                        | 1.31                     | 0.04 | 0.21                     | 0.10                  | 11.49                             | 11.88        |                             |
| 2075 | 9.19                       | 0.13                | 0.52                     | 0.01                        | 0.06                        | 1.18                     | 0.03 | 0.21                     | 0.10                  | 11.42                             | 11.34        |                             |
| 2100 | 9.36                       | 0.09                | 0.51                     | 0.01                        | 0.04                        | 1.16                     | 0.02 | 0.21                     | 0.10                  | 11.50                             | 11.40        |                             |

\* A FOOTNOTE ON PAGE 19 EXPLAINS THE STATUS OF THE RATES IN THIS COLUMN FROM 1992 TO 2011 AND THE FORMULA USED TO DETERMINE THE RATES AFTER 2011

IV. AUXILIARY FUND PROJECTIONS

The following four tables are presented for purposes of testing the effect of certain assumptions. They are based on assumptions that differ from those used for purposes of Table 4 in the following respects:

| <u>Table</u>   | <u>Table 4 Assumption</u> |
|--|---------------------------|
| 11 Interest rate on new bonds one percentage point lower than for Table 4 but not less than 6% | see page 38               |
| 12 Ultimate annual rates of interest, earnings increases and price increases 8.5%/8%/6%*       | 6%/5%/3.5%                |
| 13 Net immigration 75,000 p.a.   | 0.302% of population      |
| 14 Total fertility rates All Canada/Quebec:1.7/1.5   | rising to 2.0/2.0 by 2010 |

\* These were the assumptions adopted by the Business Committee on Pension Policy in its 1983 Cost Study of Pension Reform Proposals.

**TABLE 11**  
**AUXILIARY FUND PROJECTIONS**  
**PROPOSED PLAN**

**DIFFERENCE IN ASSUMPTIONS**  
**INTEREST ON NEW BONDS ONE PER-**  
**CENTAGE POINT LOWER THAN FOR**  
**TABLE 4, BUT NOT LESS THAN 6%**

| YEAR | CONTRIBUTIONS |               | BENEFITS<br>AND<br>EXPENSES<br>(3) | NET CASH<br>FLOW FROM<br>PROVINCES<br>(3)-(2)<br>(4) | INTEREST<br>ON FUND<br>(5) | NEW LOANS<br>TO<br>PROVINCES<br>(5)-(4)<br>(6) | FUND<br>AT<br>YEAR-<br>END<br>(7) | RATIO OF<br>FUND TO<br>EXPEN-<br>DITURE**<br>(8) |
|------|---------------|---------------|------------------------------------|--|----------------------------|--|-----------------------------------|--|
|      | RATE*<br>(1)  | AMOUNT<br>(2) |                                    |  |                            |  |                                   |  |
|      | %             | \$            |                                    |  |                            |  |                                   |  |
| 1986 | 3.60          | 4900          | 5514                               | 614  | 3293                       | 2679   | 33.8                              | 4.99   |
| 1987 | 3.80          | 5414          | 6780                               | 1366   | 3553                       | 2186   | 36.0                              | 4.58   |
| 1988 | 4.00          | 6071          | 7867                               | 1796   | 3777                       | 1982   | 38.0                              | 4.27   |
| 1989 | 4.20          | 6837          | 8884                               | 2047   | 3979                       | 1932   | 39.9                              | 4.08   |
| 1990 | 4.40          | 7644          | 9775                               | 2131   | 4168                       | 2037   | 41.9                              | 3.97   |
| 1991 | 4.60          | 8475          | 10576                              | 2101   | 4363                       | 2262   | 44.2                              | 3.88   |
| 1992 | 4.75          | 9233          | 11381                              | 2148   | 4575                       | 2427   | 46.6                              | 3.81   |
| 1993 | 4.90          | 10112         | 12253                              | 2142   | 4767                       | 2625   | 49.3                              | 3.72   |
| 1994 | 5.05          | 11043         | 13256                              | 2213   | 4931                       | 2718   | 52.0                              | 3.62   |
| 1995 | 5.20          | 12074         | 14359                              | 2284   | 5059                       | 2775   | 54.8                              | 3.52   |
| 1996 | 5.35          | 13214         | 15550                              | 2336   | 5182                       | 2846   | 57.6                              | 3.42   |
| 1997 | 5.50          | 14412         | 16827                              | 2415   | 5304                       | 2889   | 60.5                              | 3.34   |
| 1998 | 5.65          | 15693         | 18125                              | 2432   | 5425                       | 2992   | 63.5                              | 3.25   |
| 1999 | 5.80          | 17046         | 19517                              | 2471   | 5538                       | 3067   | 66.5                              | 3.16   |
| 2000 | 5.95          | 18555         | 21038                              | 2483   | 5627                       | 3144   | 69.7                              | 3.07   |
| 2001 | 6.10          | 20216         | 22689                              | 2453   | 5665                       | 3212   | 72.9                              | 2.99   |
| 2002 | 6.25          | 21939         | 24361                              | 2422   | 5637                       | 3215   | 76.1                              | 2.91   |
| 2003 | 6.40          | 23670         | 26143                              | 2273   | 5614                       | 3341   | 79.5                              | 2.83   |
| 2004 | 6.55          | 25879         | 28043                              | 2164   | 5676                       | 3512   | 83.0                              | 2.76   |
| 2005 | 6.70          | 28073         | 30098                              | 2025   | 5717                       | 3692   | 86.7                              | 2.67   |
| 2006 | 6.85          | 30412         | 32400                              | 1988   | 5820                       | 3832   | 90.5                              | 2.59   |
| 2007 | 7.00          | 32923         | 34906                              | 1983   | 5942                       | 3960   | 94.5                              | 2.51   |
| 2008 | 7.15          | 35602         | 37623                              | 2021   | 6080                       | 4060   | 98.5                              | 2.43   |
| 2009 | 7.30          | 38411         | 40590                              | 2179   | 6229                       | 4050   | 102.6                             | 2.34   |
| 2010 | 7.45          | 41443         | 42844                              | 2402   | 6380                       | 3979   | 106.5                             | 2.24   |
| 2011 | 7.60          | 44680         | 47485                              | 2805   | 6525                       | 3719   | 110.3                             | 2.15   |
| 2012 | 7.81          | 49037         | 51357                              | 2320   | 6668                       | 4348   | 114.6                             | 2.06   |
| 2020 | 10.19         | 95703         | 94720                              | -983   | 10112                      | 11094  | 179.4                             | 1.76   |
| 2025 | 11.21         | 135208        | 135885                             | 677  | 13691                      | 13014  | 241.4                             | 1.66   |
| 2030 | 11.76         | 183320        | 187598                             | 4278   | 17579                      | 13301  | 307.4                             | 1.55   |
| 2050 | 11.68         | 537985        | 529345                             | -8620  | 60486                      | 69086  | 1074.7                            | 1.92   |
| 2075 | 11.34         | 1993526       | 2006864                            | 13338  | 246416                     | 233078   | 4343.4                            | 2.05   |
| 2100 | 11.40         | 7593904       | 7659265                            | 65461  | 913879                     | 848418   | 16096.1                           | 1.97   |

\* SEE FOOTNOTE ON PAGE 19 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

**TABLE 12**  
**AUXILIARY FUND PROJECTION**  
**PROPOSED PLAN**

**DIFFERENCE IN**  
**ULTIMATE ASSUMPTIONS**  
**THIS TABLE**      **TABLE 4**  
INTEREST      8.5%      6.0%  
EARNINGS      8.0%      5.0%  
CPI      6.0%      3.5%

| YEAR | CONTRIBUTIONS |               | BENEFITS<br>AND<br>EXPENSES<br>(3) | NET CASH<br>FLOW FROM<br>PROVINCES<br>(3)-(2)<br>(4) | INTEREST<br>ON FUND<br>(5) | NEW LOANS<br>TO<br>PROVINCES<br>(5)-(4)<br>(6) | FUND<br>AT<br>YEAR-<br>END<br>(7) | RATIO OF<br>FUND TO<br>EXPEN-<br>DITURE**<br>(8) |
|------|---------------|---------------|------------------------------------|--|----------------------------|--|-----------------------------------|--|
|      | RATE*<br>(1)  | AMOUNT<br>(2) |                                    |  |                            |  |                                   |  |
|      | %             | \$            |                                    |  |                            |  |                                   |  |
| 1986 | 3.60          | 4900          | 5514                               | 614  | 3301                       | 2686   | 33.8                              | 4.99   |
| 1987 | 3.80          | 5414          | 6781                               | 1366   | 3591                       | 2225   | 36.0                              | 4.58   |
| 1988 | 4.00          | 6071          | 7867                               | 1796   | 3848                       | 2053   | 38.1                              | 4.29   |
| 1989 | 4.20          | 6837          | 8884                               | 2047   | 4084                       | 2037   | 40.1                              | 4.11   |
| 1990 | 4.40          | 7644          | 9775                               | 2131   | 4312                       | 2180   | 42.3                              | 4.00   |
| 1991 | 4.60          | 8475          | 10577                              | 2101   | 4550                       | 2449   | 44.8                              | 3.93   |
| 1992 | 4.75          | 9233          | 11381                              | 2148   | 4812                       | 2664   | 47.4                              | 3.85   |
| 1993 | 4.90          | 10247         | 12317                              | 2070   | 5065                       | 2995   | 50.4                              | 3.73   |
| 1994 | 5.05          | 11482         | 13502                              | 2021   | 5329                       | 3309   | 53.7                              | 3.59   |
| 1995 | 5.20          | 12967         | 14949                              | 1982   | 5611                       | 3629   | 57.4                              | 3.46   |
| 1996 | 5.35          | 14587         | 16564                              | 1977   | 5914                       | 3937   | 61.3                              | 3.34   |
| 1997 | 5.50          | 16262         | 18337                              | 2075   | 6238                       | 4168   | 65.5                              | 3.24   |
| 1998 | 5.65          | 18218         | 20211                              | 1993   | 6583                       | 4590   | 70.0                              | 3.14   |
| 1999 | 5.80          | 20401         | 22279                              | 1879   | 6955                       | 5076   | 75.1                              | 3.05   |
| 2000 | 5.95          | 22907         | 24606                              | 1698   | 7344                       | 5645   | 80.8                              | 2.97   |
| 2001 | 6.10          | 25559         | 27152                              | 1593   | 7726                       | 6133   | 86.9                              | 2.91   |
| 2002 | 6.25          | 28562         | 29902                              | 1340   | 8092                       | 6752   | 93.7                              | 2.85   |
| 2003 | 6.40          | 31936         | 32903                              | 967  | 8522                       | 7556   | 101.2                             | 2.80   |
| 2004 | 6.55          | 35632         | 36206                              | 574  | 9091                       | 8517   | 109.7                             | 2.75   |
| 2005 | 6.70          | 39798         | 39879                              | 81   | 9716                       | 9635   | 119.4                             | 2.71   |
| 2006 | 6.85          | 44319         | 44054                              | -265   | 10475                      | 10740  | 130.1                             | 2.67   |
| 2007 | 7.00          | 49350         | 48718                              | -632   | 11334                      | 11965  | 142.1                             | 2.64   |
| 2008 | 7.15          | 54840         | 53910                              | -931   | 12300                      | 13230  | 155.3                             | 2.60   |
| 2009 | 7.30          | 60955         | 59724                              | -1231  | 13377                      | 14608  | 169.9                             | 2.56   |
| 2010 | 7.45          | 67646         | 66257                              | -1389  | 14573                      | 15962  | 185.9                             | 2.52   |
| 2011 | 7.60          | 75012         | 73722                              | -1290  | 15881                      | 17171  | 203.0                             | 2.48   |
| 2012 | 7.80          | 83460         | 81924                              | -1536  | 17304                      | 18840  | 221.9                             | 2.44   |
| 2020 | 9.40          | 190726        | 188417                             | -2309  | 35056                      | 37264  | 449.2                             | 2.15   |
| 2025 | 10.20         | 305898        | 310869                             | 4972   | 52610                      | 47638  | 667.8                             | 1.95   |
| 2030 | 10.71         | 477772        | 493707                             | 15935  | 74223                      | 58288  | 935.5                             | 1.74   |
| 2050 | 10.77         | 2494647       | 2443356                            | -51291   | 398229                     | 449520   | 5121.7                            | 1.93   |
| 2075 | 10.55         | 18862160      | 18769712                           | -92448   | 3263809                    | 3356257  | 41730.9                           | 2.05   |
| 2100 | 10.60         | 145239360     | 144931184                          | -306176  | 24579632                   | 24887608                                       | 313988.6                          | 1.98   |

\* SEE FOOTNOTE ON PAGE 19 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

NOTE: FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATES AS PERCENT OF CONTRIBUTORY EARNINGS.

**TABLE 13**  
AUXILIARY FUND PROJECTIONS  
PROPOSED PLAN

**DIFFERENCE IN ASSUMPTIONS**  
NET IMMIGRATION 75,000 P.A. RATHER THAN  
0.302% OF POPULATION AS IN TABLE 4

| YEAR | CONTRIBUTIONS |         | BENEFITS<br>AND<br>EXPENSES | NET CASH<br>FLOW FROM<br>PROVINCES<br>(3)-(2) | INTEREST<br>ON FUND | NEW LOANS<br>TO<br>PROVINCES<br>(5)-(4) | FUND<br>AT<br>YEAR-<br>END | RATIO OF<br>FUND TO<br>EXPEN-<br>DITURE** |
|------|---------------|---------|-----------------------------|---|---------------------|---|----------------------------|---|
|      | RATE*         | AMOUNT  |                             |   |                     |   |                            |   |
|      | (1)           | (2)     | (3)                         | (4)   | (5)                 | (6)                                     | (7)                        | (8)                                       |
|      | %             | \$      | \$                          | \$  | \$                  | \$                                      | \$                         |   |
| 1986 | 3.60          | 4892    | 5514                        | 622   | 3300                | 2678                                    | 33.8                       | 4.99                                      |
| 1987 | 3.80          | 5413    | 6779                        | 1366  | 3590                | 2224                                    | 36.0                       | 4.58                                      |
| 1988 | 4.00          | 6069    | 7865                        | 1796  | 3847                | 2051                                    | 38.1                       | 4.29                                      |
| 1989 | 4.20          | 6832    | 8881                        | 2049  | 4083                | 2034                                    | 40.1                       | 4.11                                      |
| 1990 | 4.40          | 7636    | 9771                        | 2135  | 4310                | 2175                                    | 42.3                       | 4.00                                      |
| 1991 | 4.60          | 8464    | 10571                       | 2107  | 4548                | 2441                                    | 44.7                       | 3.93                                      |
| 1992 | 4.75          | 9217    | 11374                       | 2157  | 4809                | 2652                                    | 47.4                       | 3.87                                      |
| 1993 | 4.90          | 10090   | 12245                       | 2155  | 5055                | 2900                                    | 50.3                       | 3.80                                      |
| 1994 | 5.05          | 11015   | 13244                       | 2229  | 5277                | 3048                                    | 53.3                       | 3.72                                      |
| 1995 | 5.20          | 12038   | 14843                       | 2305  | 5457                | 3152                                    | 56.5                       | 3.64                                      |
| 1996 | 5.35          | 13169   | 15532                       | 2363  | 5603                | 3240                                    | 59.7                       | 3.55                                      |
| 1997 | 5.50          | 14355   | 16804                       | 2449  | 5749                | 3300                                    | 63.0                       | 3.48                                      |
| 1998 | 5.65          | 15623   | 18098                       | 2478  | 5894                | 3421                                    | 66.4                       | 3.41                                      |
| 1999 | 5.80          | 16981   | 19482                       | 2521  | 6032                | 3511                                    | 70.0                       | 3.33                                      |
| 2000 | 5.95          | 18446   | 20994                       | 2548  | 6148                | 3600                                    | 73.6                       | 3.25                                      |
| 2001 | 6.10          | 20085   | 22816                       | 2531  | 6213                | 3682                                    | 77.2                       | 3.18                                      |
| 2002 | 6.25          | 21784   | 24299                       | 2515  | 6213                | 3698                                    | 80.9                       | 3.10                                      |
| 2003 | 6.40          | 23686   | 26070                       | 2384  | 6219                | 3835                                    | 84.8                       | 3.03                                      |
| 2004 | 6.55          | 25662   | 27957                       | 2295  | 6310                | 4015                                    | 88.8                       | 2.96                                      |
| 2005 | 6.70          | 27818   | 29998                       | 2180  | 6381                | 4201                                    | 93.0                       | 2.88                                      |
| 2006 | 6.85          | 30114   | 32284                       | 2170  | 6507                | 4337                                    | 97.3                       | 2.80                                      |
| 2007 | 7.00          | 32576   | 34773                       | 2197  | 6629                | 4432                                    | 101.8                      | 2.72                                      |
| 2008 | 7.15          | 35198   | 37470                       | 2272  | 6764                | 4493                                    | 106.2                      | 2.63                                      |
| 2009 | 7.30          | 37944   | 40414                       | 2470  | 6908                | 4438                                    | 110.7                      | 2.54                                      |
| 2010 | 7.45          | 40903   | 43644                       | 2741  | 7051                | 4310                                    | 115.0                      | 2.43                                      |
| 2011 | 7.60          | 44058   | 47257                       | 3199  | 7179                | 3980                                    | 119.0                      | 2.33                                      |
| 2012 | 7.82          | 48369   | 51088                       | 2729  | 7299                | 4570                                    | 123.5                      | 2.24                                      |
| 2020 | 10.32         | 94801   | 94043                       | -558  | 10677               | 11235                                   | 189.0                      | 1.87                                      |
| 2025 | 11.40         | 133241  | 134681                      | 1440  | 14274               | 12834                                   | 251.1                      | 1.74                                      |
| 2030 | 12.04         | 180459  | 185473                      | 5014  | 18082               | 13068                                   | 315.7                      | 1.61                                      |
| 2050 | 12.12         | 319504  | 312632                      | -6872   | 58335               | 65207                                   | 1035.7                     | 1.92                                      |
| 2075 | 11.84         | 1849968 | 1867968                     | 18000   | 231022              | 213022                                  | 4067.9                     | 2.07                                      |
| 2100 | 12.04         | 8774891 | 8811112                     | 36221   | 836272              | 800051                                  | 14747.0                    | 2.04                                      |

\* SEE FOOTNOTE ON PAGE 19 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

NOTE: FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATES AS PERCENT OF CONTRIBUTORY EARNINGS.

**TABLE 14**  
AUXILIARY FUND PROJECTION  
PROPOSED PLAN

**DIFFERENCE IN ASSUMPTIONS**  
TOTAL FERTILITY RATES FOR  
CANADA/QUEBEC 1.7/1.5 RATHER  
THAN RISING TO 2.0/2.0 BY 2010  
AS IN TABLE 4

| YEAR | CONTRIBUTIONS |         | BENEFITS<br>AND<br>EXPENSES | NET CASH<br>FLOW FROM<br>PROVINCES<br>(3)-(2) | INTEREST<br>ON FUND | NEW LOANS<br>TO<br>PROVINCES<br>(5)-(4) | FUND<br>AT<br>YEAR-<br>END | RATIO OF<br>FUND TO<br>EXPEN-<br>DITURE** |
|------|---------------|---------|-----------------------------|---|---------------------|---|----------------------------|---|
|      | RATE*         | AMOUNT  |                             |   |                     |   |                            |   |
|      | (1)           | (2)     | (3)                         | (4)   | (5)                 | (6)                                     | (7)                        | (8)                                       |
|      | %             | \$      | \$                          | \$  | \$                  | \$                                      | \$                         |   |
| 1986 | 3.60          | 4900    | 5514                        | 614   | 3301                | 2687                                    | 33.8                       | 4.99                                      |
| 1987 | 3.80          | 5414    | 6781                        | 1367  | 3591                | 2224                                    | 36.0                       | 4.58                                      |
| 1988 | 4.00          | 6072    | 7868                        | 1796  | 3848                | 2052                                    | 38.1                       | 4.29                                      |
| 1989 | 4.20          | 6837    | 8884                        | 2047  | 4084                | 2037                                    | 40.1                       | 4.10                                      |
| 1990 | 4.40          | 7644    | 9776                        | 2132  | 4311                | 2179                                    | 42.3                       | 4.00                                      |
| 1991 | 4.60          | 8475    | 10577                       | 2102  | 4550                | 2448                                    | 44.8                       | 3.93                                      |
| 1992 | 4.75          | 9233    | 11381                       | 2148  | 4812                | 2664                                    | 47.4                       | 3.87                                      |
| 1993 | 4.90          | 10112   | 12254                       | 2142  | 5058                | 2916                                    | 50.3                       | 3.80                                      |
| 1994 | 5.05          | 11043   | 13255                       | 2212  | 5282                | 3070                                    | 53.4                       | 3.72                                      |
| 1995 | 5.20          | 12074   | 14357                       | 2283  | 5464                | 3181                                    | 56.6                       | 3.64                                      |
| 1996 | 5.35          | 13215   | 15548                       | 2333  | 5612                | 3279                                    | 59.9                       | 3.56                                      |
| 1997 | 5.50          | 14415   | 16825                       | 2410  | 5760                | 3350                                    | 63.2                       | 3.49                                      |
| 1998 | 5.65          | 15697   | 18121                       | 2424  | 5908                | 3484                                    | 66.7                       | 3.42                                      |
| 1999 | 5.80          | 17055   | 19512                       | 2457  | 6050                | 3593                                    | 70.3                       | 3.34                                      |
| 2000 | 5.95          | 18551   | 21029                       | 2478  | 6171                | 3693                                    | 74.0                       | 3.27                                      |
| 2001 | 6.10          | 20211   | 22658                       | 2447  | 6242                | 3795                                    | 77.8                       | 3.19                                      |
| 2002 | 6.25          | 21933   | 24348                       | 2415  | 6249                | 3834                                    | 81.6                       | 3.12                                      |
| 2003 | 6.40          | 23861   | 26127                       | 2266  | 6283                | 3997                                    | 85.6                       | 3.05                                      |
| 2004 | 6.55          | 25866   | 28024                       | 2159  | 6365                | 4206                                    | 89.8                       | 2.99                                      |
| 2005 | 6.70          | 28050   | 30075                       | 2025  | 6447                | 4422                                    | 94.2                       | 2.91                                      |
| 2006 | 6.85          | 30376   | 32373                       | 1997  | 6586                | 4589                                    | 98.8                       | 2.83                                      |
| 2007 | 7.00          | 32870   | 34875                       | 2005  | 6723                | 4718                                    | 103.5                      | 2.75                                      |
| 2008 | 7.15          | 35524   | 37587                       | 2083  | 6876                | 4813                                    | 108.4                      | 2.67                                      |
| 2009 | 7.30          | 38302   | 40549                       | 2247  | 7040                | 4793                                    | 113.2                      | 2.58                                      |
| 2010 | 7.45          | 41293   | 43797                       | 2504  | 7203                | 4699                                    | 117.9                      | 2.48                                      |
| 2011 | 7.60          | 44480   | 47430                       | 2950  | 7355                | 4405                                    | 122.3                      | 2.38                                      |
| 2012 | 7.91          | 48770   | 51295                       | 2525  | 7500                | 4975                                    | 127.2                      | 2.29                                      |
| 2020 | 10.27         | 94829   | 94544                       | -285  | 10990               | 11275                                   | 194.4                      | 1.91                                      |
| 2025 | 11.43         | 134071  | 135559                      | 1488  | 14615               | 13127                                   | 257.1                      | 1.77                                      |
| 2030 | 12.17         | 181872  | 187012                      | 5140  | 18529               | 13389                                   | 323.5                      | 1.63                                      |
| 2050 | 12.89         | 328120  | 323117                      | -5003   | 60027               | 65030                                   | 1064.2                     | 1.93                                      |
| 2075 | 12.99         | 1818606 | 1841368                     | 22762   | 222891              | 200129                                  | 3920.7                     | 2.03                                      |
| 2100 | 13.19         | 8238535 | 8307092                     | 68557   | 773147              | 704590                                  | 13607.6                    | 2.04                                      |

\* SEE FOOTNOTE ON PAGE 19 FOR DETERMINATION OF RATE  
\*\* EXPENDITURE IS TAKEN FROM FOLLOWING YEAR

V. OBSERVATIONS, CONCLUSIONS AND ACTUARIAL OPINION

1. The following table shows samples taken from Tables 8, 9, and 10 of projected expenditures (benefits and expenses) expressed as percentages of contributory earnings (pay-as-you-go rates) and, for comparison, the proposed contribution rates. The pay-as-you-go rates would be required only if there were no fund and are not shown in the corresponding fund projections (Tables 1, 2 and 4).

*Separate table*

| Year | Expenditures as Percentages of Contributory Earnings |               |                 | Proposed Contribution Rates** |
|------|--|---------------|-----------------|-------------------------------|
|      | Previous Assumptions*                                |               | New Assumptions |                               |
|      | Existing Plan  | Proposed Plan | Proposed Plan   |                               |
| 1987 | 4.11   | 4.44          | 4.76            | 3.80                          |
| 1988 | 4.39   | 4.88          | 5.18            | 4.00                          |
| 1989 | 4.60   | 5.16          | 5.46            | 4.20                          |
| 1990 | 4.81   | 5.37          | 5.63            | 4.40                          |
| 1991 | 4.98   | 5.51          | 5.74            | 4.60                          |
| 1992 | 5.15   | 5.65          | 5.86            | 4.75                          |
| 1993 | 5.32   | 5.79          | 5.94            | 4.90                          |
| 1994 | 5.45   | 5.92          | 6.06            | 5.05                          |
| 1995 | 5.58   | 6.09          | 6.18            | 5.20                          |
| 2000 | 6.08   | 6.57          | 6.75            | 5.95                          |
| 2005 | 6.43   | 6.99          | 7.18            | 6.70                          |
| 2010 | 6.99   | 7.67          | 7.88            | 7.45                          |
| 2020 | 9.03   | 9.78          | 10.09           | 10.10                         |
| 2025 | 10.12  | 10.85         | 11.27           | 11.07                         |
| 2030 | 10.92  | 11.49         | 12.03           | 11.65                         |
| 2050 | 10.47  | 11.01         | 11.49           | 11.68                         |
| 2075 | 10.70  | 11.15         | 11.42           | 11.34                         |
| 2100 | 10.82  | 11.23         | 11.50           | 11.40                         |

\* Basis of Statutory Actuarial Report No. 8

\*\* The contribution rates from 1987 to 2011 are included in the proposed Schedule to the Act; however, the rates for the years 1992 to 2011 as well as for later years are subject to quinquennial federal-provincial reviews. For purposes of determining the contribution rates for the proposed plan it is assumed that all the rates in the Schedule will go into effect and that the Schedule will be extended in accordance with the formula described on page 3.

2. The above table shows costs projected for the proposed plan on the new assumptions reaching about 6.8%, 12.0% and 11.5% of contributory earnings for the years 2000, 2030 and 2100, respectively. They exceed those projected for the existing plan in Statutory Actuarial Report No. 8 by a margin of about 0.7% of contributory earnings by the year 2000, increasing to about 1.1% of contributory earnings by 2030 and then decreasing again to 0.7% by 2100.

In the long run between about one-half and two-thirds of this increase - in the short run a little more - is attributable to the modifications in benefit provisions and the remainder to experience since Report No. 8 and to changes in assumptions.

3. Differences between actual experience and the underlying assumptions would, of course, result in deviations from the above table. Examples of such differences are discussed below in connection with Tables 12, 13 and 14. However, it is important to note that the contribution rates in the above table are nearly independent of the level of inflation, provided the gap between increases in earnings and increases in the Consumer Price Index ( a measure of the real rate of increase in earnings) remains as assumed.
4. The Canada Pension Plan provides that funds in excess of estimated expenditures for the ensuing three months shall be available for the purchase of securities of the provinces. The term to maturity of the securities is 20 years or such lesser term as may be fixed by the Minister of Finance on the recommendation of the Chief Actuary when he deems it necessary in order to meet any payments that will be required.

Table 4 indicates that the proposed schedule of contribution rates together with the implicit long-term objective of a fund equalling twice the expected expenditures in the following year are likely to result in a fund which will increase into the foreseeable future, so that there should be no need to shorten the terms of the securities.

5. The ratio of the year-end fund to expenditure for the following year rises to a somewhat higher level on the new assumptions than on the previous assumptions (see column 8 of Tables 2 and 4). This is largely the result of lower rates of price and earnings increases that have occurred since Report No. 8 and are expected to persist for a few years. However, by the year 2011 the ratio is only slightly higher because of the effect of a somewhat lower ultimate rate of interest assumed on new bonds. Clearly, the fund/expenditure ratio is affected by many factors. Comparing column 8 of Table 4 with column 8 of Table 11 reveals that if interest rates on new bonds were one percentage point lower than assumed for Table 4 but never less than 6%, the fund/expenditure ratio in 2011 would be 2.15 rather than 2.39 as for Table 4. Similar results could be obtained, for example, if earnings increases or price increases were lower than assumed for Table 4.
6. Table 12 was included to show what the projected operation of the plan might be, if the economic assumptions used by the Business Committee on Pension Policy in its 1983 Cost Study of Pension Reform Proposals were realized after 1993.

As might be expected, long-range costs\* expressed as percentage of contributory earnings would be somewhat lower (by 0.36%, 0.90% and 0.94% of contributory earnings for 2000, 2025 and 2050, respectively) than those shown in Table 10, because the gap between the assumed rates of increase in earnings and prices is 2% for Table 12 rather than 1.5% as for Table 10 and because the higher assumed rate of increase in the YMPE results in a lower 3-year average YMPE relative to current earnings and therefore in lower emerging pensions relative to current earnings.

The fund/expenditure ratio is fairly similar to that for Table 4 reaching 2.48 in 2011 as compared to 2.39 in Table 4.

7. The migration assumptions underlying the Main Tables on the new assumptions (Tables 3, 4, 7 and 10) imply a constant ratio of net immigrants to population of 0.302% for all Canada. Table 13 is based on a constant level of net immigrants of 75,000 p.a. instead of the said constant ratio (based on 75,000 net immigrants assumed for 1981). A constant number of net immigrants at that level, of course, results not only in a smaller total population but in a ratio of net immigrants to current population which declines to about 0.19% by the year 2050 and 0.16% by 2100. This would gradually lead to an excess in costs\* implicit in Table 13 over those in Table 10 of 0.6% of contributory earnings by 2100.

The constraints of the contribution rate scenario adopted for purposes of this report means that the contribution rates for Table 13 begin to be slightly greater than those for Table 4 in 2012, the difference rising to 0.44% of contributory earnings by 2050 and to 0.64% by 2100.

8. As noted in Appendix B, the population projections underlying the Main Tables on the new assumptions (Tables 3, 4, 7 and 10) reflect a total fertility rate that over the next twenty-five years will gradually return to 2.0, the level of about 1972 and 1970 for all Canada and Quebec, respectively. Table 14 is based on a projected total fertility rate of 1.7 for all Canada and 1.5 for Quebec, i.e., a continuation of the historically low rates experienced over the last few years. Costs\* implicit in Table 14 begin to exceed those in Table 10 about 2010, the extra cost reaching about 1.3% of contributory earnings by 2050 and about 1.8% by 2100.

Similar to the case of Table 13, the constraints on the contribution rates adopted for purposes of this report mean that the contribution rates begin to be greater than those for Table 4 in 2012. In this case the differences are more substantial, rising to 0.52%, 1.21% and 1.79% of contributory earnings by 2030, 2050 and 2100, respectively.

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\* Pay-as-you-go costs are not shown in Table 12, 13, and 14, but they are available on request or may be obtained by multiplying col. (1) by col. (3) and dividing by col. (2).

9. It is possible that two or more individual adverse factors could operate together to increase costs. On the other hand, the opposite is also possible. Perhaps most likely, there may be some offsetting factors. For example, a continuing low birth rate may be offset by relatively higher immigration.
10. For purposes of all tables relating to the proposed plan the contribution rates are based on the assumption that all the rates in the Schedule will come into effect and that the Schedule will be extended by means of the formula to be prescribed (see page 3). Under these circumstances, as indicated in Table 4, the contribution rate may be expected to reach a maximum of 11.95% of contributory earnings about the year 2036 and then to decline gradually to an ultimate level of about 11.4%. Clearly, many other scenarios are possible depending on the conclusions of successive federal-provincial reviews and the evolving experience of the plan.

11. Actuarial Opinion

In my opinion, for the purposes of this actuarial report,

1. the assumptions which have been used are adequate and appropriate;
2. the methods employed are consistent with sound actuarial principles.

This report has been prepared and this opinion has been given in accordance with generally accepted actuarial principles and the Recommendations of the Canadian Institute of Actuaries.

Respectfully submitted,

*Walter Riese*

Walter Riese, F.S.A., F.C.I.A.  
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August 22, 1986



Appendix A

MAIN PROVISIONS OF THE EXISTING PLAN

1. Coverage and Contributions

In general, the Canada Pension Plan which came into force on January 1, 1966, applies to virtually all paid members of the labour force in Canada (both employees and self-employed persons) between the ages of 18 and 70, other than persons in the province of Quebec who are covered by the Quebec Pension Plan\*. The main exceptions are:

- (a) persons with earnings less than the "Year's Basic Exemption",
- (b) persons to whom a retirement or disability pension is payable pursuant to the Act, and
- (c) members of certain religious sects.

For those who are eligible, contributions in any year are required in respect of all earnings between the "Year's Basic Exemption" and the "Year's Maximum Pensionable Earnings".

The rate of contribution as respects these "contributory earnings" which has been in effect since the inception of the Plan is 1.8% for employees and a like amount for their employers and 3.6% in respect of self-employed earnings.

2. Canada Pension Plan Account and Investment Fund

Charges and credits with respect to the plan are made to the Canada Pension Plan Account in the Consolidated Revenue Fund.

At the end of each quarter, the excess of the balance to the credit of the Account over (a) the balance in the Canada Pension Plan Investment Fund and (b) the estimated amount required in the ensuing three months to pay benefits and administration costs is available for loans to the provinces in proportion to contributions made by the residents of the various provinces. Any part of this excess not borrowed by the provinces is invested in federal securities.

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\* All members of the Canadian Forces and the Royal Canadian Mounted Police are subject to the Canada Pension Plan.

The securities are non-negotiable obligations payable to the Canada Pension Plan Investment Fund. The term to maturity is twenty years, unless the Minister of Finance on the recommendation of the Chief Actuary of the Department of Insurance deems it appropriate to fix a lesser period in order to meet the projected payments. The rate of interest applicable to the securities is based on the average yield to maturity on all outstanding Government of Canada bonds maturing in twenty years or more and is payable semi-annually.

3. Definition of Terms Relating to Earnings

Six terms relating to the earnings of contributors that are used in this report are defined and described below.

Year's Maximum Pensionable Earnings (YMPE)

"Year's Maximum Pensionable Earnings" for any calendar year means the upper limit above which that year's earnings are not subject to contributions and do not affect benefits. The YMPE for a particular calendar year is prorated in individual cases to allow for the periods before age 18, after age 70 or death and while on retirement or disability pension.

For 1966 and 1967, the YMPE was \$5,000. Beginning in 1968 it was adjusted upward in steps of integral hundreds of dollars in accordance with increases in the "Pension Index", reaching \$5,600 in 1973. It was fixed at \$6,600 and \$7,400 for 1974 and 1975, respectively. For each year after 1975 it is determined as being equal to 112.5% of the YMPE for the preceding year but not more than the quantity

$$52(I_{z-1})(I_{z-3}+I_{z-2}+I_{z-1}) / (I_{z-4.5}+I_{z-3.5}+I_{z-2.5})$$

where  $I_{z-1}$  is the average of the Industrial Composite (Statistics Canada: average weekly wages and salaries) for the 12 months ending June 30 in the preceding year. Once the YMPE is linked to average industrial earnings\* in this manner, the latter formula is to be continued and the former increase of 12.5% per annum is to be abandoned. If the amount calculated by formula is not a multiple of \$100, the nearest lower multiple of \$100 is used. However, the YMPE is not allowed to decrease.

Year's Basic Exemption (YBE)

"Year's Basic Exemption" for any calendar year means the lower limit below which that year's earnings are not subject to contributions. It is calculated as 12% of the YMPE for each year from 1966 to 1974 inclusive and 10% thereafter (rounded if necessary to the nearest lower multiple of \$100) and is subject to adjustment in individual cases similar to the YMPE.

\* This happened in 1986.

### Contributory Earnings

"Contributory earnings" for any calendar year means the earnings of a contributor on which contributions are payable, i.e., earnings between the YBE and the YMPE for that year.

### Contributory Period

The "contributory period" is the number of months from attainment of age 18 or from January 1, 1966, if later, to

- (a) age 65, for purposes of retirement pensions,
- (b) the date of commencement of disability pension for purposes of establishing entitlement to and the amount of disability pensions,
- (c) age 65 but not beyond the month of death, for purposes of survivors' pensions and orphans' and death benefits,

less the number of months for which a disability pension was payable, or during which the contributor had at least one child under the age of 7 and had earnings less than one twelfth of the YBE or which if dropped out would increase his/her average pensionable earnings.

### Unadjusted Pensionable Earnings

"Unadjusted pensionable earnings" for any calendar month means all earnings of a contributor in the calendar month up to one twelfth of the YMPE applicable to the corresponding calendar year, provided that required contributions have been made for that month. The unadjusted pensionable earnings are zero for any month during which contributions are not required or not made. Earnings in a month in excess of one twelfth of the YMPE are applied to the extent required to maximize the unadjusted pensionable earnings in other months in the same calendar year. In case of dissolution of marriage by divorce or legal annulment after January 1, 1978, and upon application by either spouse within three years, earnings credits of spouses acquired during their marriage may be added and divided equally between them.

### Pensionable Earnings

"Pensionable earnings" for a given calendar month means "unadjusted pensionable earnings" of that month multiplied by the ratio that the average YMPE for the year when a retirement pension or other earnings-related benefit becomes payable under the Act and for the two preceding years bears to the YMPE for the year to which the given month belongs.

#### 4. Automatic Adjustment features

Several elements of the Plan are subject to automatic adjustment in accordance with changes in specified indices. These elements include

- (a) the YMPE and, dependent thereon, pensionable earnings upon which all earnings-related benefits going into payment are based, the upper limit on the amount of death benefit and the Year's Basic Exemption,
- (b) all monthly benefits payable.

Annual adjustments of all elements subject to automatic adjustment depend on changes in the Pension Index constructed as described in the next following paragraph, with two exceptions. Firstly, annual adjustments of the contributory earnings limits (YMPE and YBE) after 1973 and of unadjusted pensionable earnings to obtain pensionable earnings are as described above. Secondly, the monthly amount of any earnings-related benefit that emerged prior to 1974 equals the initial monthly amount multiplied by the Pension Index for the year of payment and divided by the average of the Consumer Price Indices (CPI) for the twelve months ending with June of the year preceding the year of emergence.

For 1967, the Pension Index was computed as the average of the CPI's for Canada for the twelve months ending with June 1966. For each year from 1968 through 1973, it was computed as the average of the CPI's for the twelve months ending with June of the preceding year or 1.02 times the Pension Index for the preceding year, whichever was the lesser. (In practice, the latter formula was always applicable). The Pension Index for 1974 equals the average of the CPI's for the twelve months ending with June 1972, multiplied by the average of the CPI's for the sixteen months ending with October 1973, and divided by the corresponding average for the sixteen months ending with June 1972\*. The Pension Index for 1975 and later years equals the average of the CPI's for the twelve months ending with October of the preceding year in each case, except that the Pension Index for the preceding year is retained if a reduction in its value would otherwise occur.

#### 5. Retirement Pension

Generally, a contributor aged 65 or over becomes entitled to a retirement pension upon application. Disability pensions payable to contributors before they attain age 65 are automatically replaced by retirement pensions at age 65. After a retirement pension becomes payable or, in any event, after age 70 a contributor is not eligible to contribute under the Plan. Thus, except for adjustment of the amount of pension in payment in accordance with changes in the Pension Index, the amount of pension is fixed at the time the pension first becomes payable.

\* The Pension Index for 1974 is defined differently in the Act, but it is used in such a way as to produce the same benefit amounts as the procedure described here.

In general, the initial amount of retirement pension payable to a contributor is based on the whole history of his "pensionable earnings" from January 1, 1966, or from attainment of age 18, if later, until the month preceding the one in respect of which the first pension payment is due.

A convenient formula for determining the initial amount of retirement pension involves the use of an "average earnings ratio", as follows:

Formula for Retirement Pension

The initial amount of annual pension is equal to 25% of the average YMPE for the three years ending with the year in which the pension commences, multiplied by the "average earnings ratio" which is the average of a number of the highest "monthly earnings ratios", such number being determined as follows:

| <u>Months in<br/>Contributory<br/>Period</u> | <u>Number of highest "monthly<br/>earnings ratios" used in calculating<br/>average earnings ratio</u>   |
|--|---|
| less than 120                                | (a) the number of months in the contributory period or<br><br>(b) 120 less the number of months for which a disability pension was payable, if greater  |
| 120 or more                                  | (a) 85% of the months in the contributory period less the number of months during which the contributor had at least one child less than seven years of age and had earnings less than one twelfth of the YBE or which if dropped out would increase his "average earnings ratio" or<br><br>(b) 120, if greater |

In any calendar month, the "monthly earnings ratio" referred to above is the ratio of "unadjusted pensionable earnings" to one twelfth of the YMPE for that calendar year. It should be noted that if no contributions are made during a calendar year, each "monthly earnings ratio" for that year is zero; and for any year in which a contributor's earnings exceed the YMPE each ratio is one.

Examination of the above formula will make it clear that, in addition to the whole period during which a disability pension is payable, a certain number of months associated with the lowest recorded "monthly earnings ratios" will normally be excluded in the benefit calculations by reason of contributions made after age 65 and by reason of the 15% and child raising "drop-out" provisions; however, the drop-out must not reduce the total number of months to less than 120.

6. Disability Pension

A contributor aged less than 65, who becomes disabled within the meaning\* of the disability provisions of the Plan, is entitled to a disability pension, under the following conditions:

| <u>Number of calendar years included wholly or partly in contributory period</u> | <u>Minimum number of calendar years for which contributions must have been made</u>  |
|--|--|
| less than 10   | 5  |
| 10 to 30   | 5 of last 10, and in total at least 1/3 of the number of calendar years included wholly or partly in the contributory period |
| 30 or more   | 5 of last 10, and in total at least 10   |

Disability pensions commence with the fourth month following the month of disablement and are payable until age 65 or until death or recovery from disability at an earlier age.

The amount of pension payable is composed of two parts, namely, a flat-rate part depending only on the year in which the disability pension is payable, and an earnings-related part depending initially only on the pensionable earnings record of the contributor as of the date of commencement of the disability pension. The initial flat-rate part is determined as \$25 per month adjusted in accordance with the increase in the Pension Index from 1967 to the year in which the disability pension commences; for example, it is \$91.06 for pensions payable in 1986. The initial earnings-related part is equal to 75% of a pension calculated in the manner described earlier for retirement pensions, except that the number of years to be taken into account in determining the "average earnings ratio" is as follows:

\* A person is considered disabled if he is determined in a prescribed manner to be suffering from a severe and prolonged mental or physical disability. A disability is considered severe if by reason thereof the person is incapable regularly of pursuing any substantially gainful occupation, and a disability is considered prolonged if it is likely to be long continued and of indefinite duration or likely to result in death.

| <u>Months in<br/>Contributory Period</u> | <u>Number of highest "monthly earnings<br/>ratios" used in calculating<br/>average earnings ratio</u>   |
|--|---|
| less than 120                            | the number of months in the contributory period   |
| 120 or more                              | (a) 85% of the months in the contributory period less the number of months during which the contributor had at least one child less than seven years of age and had earnings less than one twelfth of the YBE or which if dropped out would increase his "average earnings ratio" or<br><br>(b) 120, if greater |

7. Disabled Contributor's Child's Benefit

An unmarried child of a contributor who is entitled to a disability pension is entitled to a benefit provided the child

- (i) is under age 18, or
- (ii) is aged 18 or over but under age 25 and has been attending school full-time and substantially without interruption since attainment of age 18 or the time of the contributor's disability, whichever occurred later.

The amount of pension payable in respect of each child is equal to the flat-rate benefit payable to the disabled contributor. However, only one child's benefit is payable in respect of each child, even if both parents are entitled to a disability pension; furthermore, a child may not simultaneously receive a disabled contributor's child's benefit and an orphan's benefit (see 8(c) below).

8. Survivor's Pension and Orphan's Benefit

(a) General

A surviving spouse and an orphan may become entitled to a "survivor's pension" and an "orphan's benefit", respectively. For entitlement to such a pension, the deceased contributor must have made contributions during the lesser of

- (i) ten calendar years, or
- (ii) one-third of the number of years included wholly or partly in his (her) contributory period but not less than three years.

A surviving spouse may become entitled to a survivor's pension by reason of having dependent children, being disabled or simply being over age 35 at the date of the contributor's death. The amount of pension payable to a surviving spouse who becomes entitled to a survivor's pension for more than one reason is the largest to which she or he is entitled for any one of such reasons.

A surviving spouse who becomes entitled to both a survivor's pension and either a disability pension or a retirement pension is subject to an overriding limitation on all dual pensions (see 9 below).

A survivor's pension is suspended during any period of remarriage.

(b) Survivor's Pension

(i) Definition of "Surviving spouse with dependent children"

A "surviving spouse with dependent children" means a widow or widower who wholly or substantially maintains an unmarried child of the deceased contributor where the child is



- A. under age 18,
- B. aged 18 or over but under age 25 and has been attending school full-time and substantially without interruption since attainment of age 18 or the time of the contributor's death, whichever occurred later, or
- C. aged 18 or over and is disabled, having been disabled without interruption since attainment of age 18 or the time of the contributor's death, whichever occurred later.

(ii) Surviving spouses aged between 45 and 65 at date of contributor's death

A surviving spouse aged between 45 and 65 at widowhood (widowerhood) is entitled to a survivor's pension.

The amount of pension payable until the surviving spouse attains age 65 is composed of two parts, namely, a flat-rate part depending only on the year in which the survivor's pension is payable and an earnings-related part depending initially only on the pensionable earnings record of the contributor to the date of his or her death. The initial flat-rate part is determined as \$25 per month adjusted in accordance with the increase in the Pension Index from 1967 to the year in which the death of the contributor occurs. The initial earnings-related part is equal to 37.5% of an earnings-related pension based on the contributor's pensionable earnings record calculated as at the date of the contributor's death or commencement of his retirement pension, whichever is the earlier, except that in the latter case the calculated pension is adjusted in accordance with the increase in the Pension Index from the year in which the contributor's retirement pension became payable to the year of his death.

In general, the amount of the contributor's earnings-related pension is calculated in the manner described earlier for retirement pensions, except that the number of months to be taken into account in determining the "average earnings ratio" is as described above for disability pension.

- (iii) Surviving spouses aged less than 45 at the beginning of widowhood (widowerhood) without dependent children and not disabled

A surviving spouse without dependent children and not disabled, aged less than 35 years at widowhood (widowerhood), is not entitled to a survivor's pension.

A surviving spouse without dependent children and not disabled, aged 35 or more years but less than 45 at widowhood (widowerhood) is entitled to an amount of pension, calculated as described in (ii) above, reduced by 1/120th of such amount for each month that the surviving spouse's age at the beginning of widowhood (widowerhood) is less than 45.

- (iv) Surviving spouses aged less than 45 at the beginning of widowhood (widowerhood) with dependent children

A surviving spouse aged less than 45 at widowhood (widowerhood), with dependent children, is entitled to a survivor's pension calculated as described in (ii) above.

If a surviving spouse in receipt of a survivor's pension ceases to be a "surviving spouse with dependent children" before attaining age 45 and is not disabled at that time, the amount of the survivor's pension is discontinued or reduced in the manner described in (iii) above in accordance with the surviving spouse's age at the time she or he ceased to be a "surviving spouse with dependent children".

- (v) Disabled surviving spouses aged less than 65

A surviving spouse aged less than 65 is entitled to a survivor's pension, if she or he either is disabled at the date of death of the contributor or becomes disabled at a later date.

The disabled surviving spouse's pension is payable from the month following the month in which the contributor dies or from the month following the month in which the surviving spouse becomes disabled, whichever is later.

If the disabled surviving spouse recovers from disability before age 45, the amount of the survivor's pension is discontinued or reduced in the manner described in (iii) above in accordance with the surviving spouse's age at the time of recovery.

The initial amount of pension is calculated as described in (ii) above, except that, in the case where the surviving spouse becomes disabled subsequent to the death of the contributor, the pension so calculated is adjusted in accordance with changes in the Pension Index from the year in which the contributor died to the year in which disability occurs.

(vi) Surviving spouses aged 65 or over

At age 65, or upon widowhood (widowerhood) at a later age, a surviving spouse who is not then in receipt of an age retirement pension and to whom such a pension does not become payable immediately, is entitled to an amount of pension equal to 60% of an earnings-related pension\* based on the pensionable earnings record of the deceased spouse.

At the time a surviving spouse becomes entitled to both a survivor's pension and a retirement pension or to either one while in receipt of the other, the total amount of pension is equal to the greater of

- A. 60% of the surviving spouse's own retirement pension plus 60% of an earnings-related pension\* based on the pensionable earnings record of the deceased spouse, or
- B. 100% of the surviving spouse's own retirement pension plus 37.5% of an earnings-related pension\* based on the pensionable earnings record of the deceased spouse,

subject to the limit on the maximum initial amount payable in respect of dual pensions, as explained in 9 below.

\*An earnings-related pension, calculated as described in (ii) above, adjusted, where applicable, in accordance with changes in the Pension Index from the year in which the contributor died to the year in which the surviving spouse attains age 65 or the year in which a retirement pension becomes payable to her (him) while in receipt of a survivor's pension.

(c) Orphan's Benefit

The provisions for orphans are analogous to those described earlier for children of disabled contributors.

For purposes of orphans' benefits, an "orphan" means an unmarried child of a deceased contributor, where the child is

- (i) under age 18, or
- (ii) aged 18 or over but under age 25 and has been attending school full-time and substantially without interruption since attainment of age 18 or the time of the contributor's death, whichever occurred later.

The amount of pension payable in respect of each orphan is \$25 per month adjusted in accordance with changes in the Pension Index from 1967 to the year in which the benefit is payable. However, only one orphan's benefit is payable in respect of each child, even if both deceased parents were contributors; furthermore as noted in 7 above, a child may not simultaneously receive both an orphan's benefit and a disabled contributor's child's benefit.

9. Dual Pensions

Benefits payable to persons who became entitled to both a survivor's pension and either a disability or a retirement pension are subject to an overriding limit. The total annual amount of the two pensions cannot initially exceed an amount equal to 25% of the average of the YMPE for the three years ending with the year in which the later of the two pensions commences (that is, an amount equal to the maximum retirement pension applicable for that year).

10. Death Benefit

A lump-sum benefit is payable to the estate of a deceased contributor who made contributions in at least the minimum number of calendar years required for entitlement to a survivor's pension.

The amount of benefit is equal to

- (a) in respect of a contributor to whom a retirement pension was payable at the time of death, one-half of the annual amount of pension payable in the year of

death, adjusted to exclude any reduction that may have arisen by reason of commencement of pension within the ten-year transitional period ending December 31, 1975, or

- (b) in respect of any other contributor, one-half of the annual amount of an earnings-related pension calculated in the manner described for retirement pensions,

subject to the limitation that the amount of benefit cannot exceed 10% of the YMPE applicable in the year of the contributor's death.

#### 11. Amendments

Any major amendment providing for changes in benefits or contributions cannot become effective until the first day of the third year following the year in which notice of intention to introduce such a measure was laid before Parliament and requires the consent of two-thirds of the provinces having in aggregate at least two-thirds of the population of Canada excluding the Yukon and the Northwest Territories.

Appendix B

Assumptions and Procedures

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Appendix B

ASSUMPTIONS AND PROCEDURES

1. General

The practice first adopted for Statutory Actuarial Report No.3 (December 31, 1973) of basing the Main Tables on one set of what we regard as reasonably realistic demographic assumptions and long-term relationships between the various economic factors had to be modified slightly. As noted in the introduction, the Act requires estimates for the existing and proposed plans on the assumptions of the preceding report. However, it seemed desirable on the basis of experience and revised expectations to make changes in a number of assumptions; projections based on these new assumptions would be the reference point for projections relating to any subsequent proposed amendments.

As in preceding reports, certain auxiliary fund projections<sup>o</sup> are presented (Section IV) to allow an appreciation of the sensitivity of the projections to certain major assumptions.

2. Economic Assumptions

The new economic assumptions used for the Main Tables differ somewhat from those used for purposes of Report No.8. They reflect the mid-range assumptions of the budget of February 26, 1986 for the years to 1991 and where linked to the ultimate assumptions over the following two to four years.

The most significant feature of the ultimate level of the economic assumptions is a gap of 1.5% between increases in earnings (5%) and increases in prices (3.5%) after 1993 which remains unchanged. It is interesting to note that the two intermediate actuarial cost projections made for the United States social security system (OASDI) in recent years have been based on assumptions for real increases in earnings in the long term of 1.5% and 2% respectively.

As noted in Section V of the Report, the assumed level of inflation is of relatively slight practical significance in determining the level of costs expressed as a percentage of contributory earnings, as long as real increases in earnings are not affected.

It was decided to reduce the assumed ultimate annual rate of interest on new investments from 6.5% to 6%. The new assumption, coupled with an assumption of 3.5% for increases in the Consumer Price Index, implies an

assumed real rate of investment earnings of 2.5% per annum (more exactly 2.415%). For a fund invested entirely at rates reflecting long term Government of Canada bond rates, this real rate is closer to the rate that might be expected to be earned over long periods on the basis of past experience. In any event, it must be recognized that, while rates of interest may have a significant effect on the ratio of the fund to expenditures, rates of interest do not have a significant effect on contribution rates, unless a relatively high degree of funding is contemplated.

The assumed rate of interest is highly significant in the calculation of the contribution rate on an "actuarially funded" basis and of the related unfunded actuarial liability (see Appendix C); however, since the primary purpose of such calculation is to compare the cost of CPP benefits with costs of private pension plans, an assumed real rate of investment earnings of 3% p.a. may be more appropriate for this purpose.

The three key economic assumptions\* used for the main tables are as follows:

| Year           | Annual increase in CPI (%) |     | Annual increase in average earnings (%) |     | Annual rate of interest on new bonds (%) |      |
|----------------|----------------------------|-----|---|-----|--|------|
|                | Previous                   | New | Previous                                | New | Previous                                 | New  |
|                | 1983*                      | 5.8 | 5.8                                     | 7.4 | 7.4                                      | 11.6 |
| 1984*          | 5.2                        | 4.4 | 5.2                                     | 4.3 | 10.5                                     | 13.3 |
| 1985*          | 5.3                        | 4.4 | 5.4                                     | 3.5 | 9.6                                      | 11.6 |
| 1986           | 4.8                        | 4.3 | 5.0                                     | 4.0 | 8.7                                      | 10.6 |
| 1987           | 4.5                        | 3.6 | 5.1                                     | 4.1 | 8.0                                      | 10.5 |
| 1988           | 4.6                        | 4.1 | 5.5                                     | 4.3 | 7.4                                      | 10.5 |
| 1989           | 4.5                        | 3.7 | 5.5                                     | 4.7 | 6.9                                      | 10.3 |
| 1990           | 4.2                        | 3.4 | 5.3                                     | 4.5 | 6.7                                      | 10.0 |
| 1991           | 4.0                        | 3.1 | 5.2                                     | 4.3 | 6.6                                      | 10.0 |
| 1992           | 3.8                        | 3.3 | 5.1                                     | 4.6 | 6.5                                      | 9.0  |
| 1993           | 3.5                        | 3.5 | 5.0                                     | 4.9 | 6.5                                      | 8.0  |
| 1994           | 3.5                        | 3.5 | 5.0                                     | 5.0 | 6.5                                      | 7.0  |
| 1995 and later | 3.5                        | 3.5 | 5.0                                     | 5.0 | 6.5                                      | 6.0  |

\* Rates for 1983 and in the case of the new assumptions for 1984 and 1985 are actual experience rates.



3. Population Projection

(a) General

The populations required for the Canada Pension Plan pertain to Canada excluding Quebec, but including all members of the Canadian Forces and the Royal Canadian Mounted Police. The population projections used for purposes of the financial estimates were obtained by simple subtraction of the projected populations for Quebec from the projected populations for Canada. Consequently, the projected populations do not make allowance for members of the Canadian Forces and Royal Canadian Mounted Police resident in Quebec. However, provision for this group was made implicitly in the development of the participation rates given in Section 4 of this appendix.

Populations were projected from the 1981 census, after first applying adjustment factors to compensate for the 1981 census undercount. The projections carry forward to the year 2100, which provides a period of 115 years from the effective date of this examination.

Detailed figures for selected years by sex and age-group are given in Schedules 5, 6 and 7 of this appendix following the description of the underlying fertility, mortality and migration assumptions. Schedule 1 below shows census and projected total populations for selected years for Canada, excluding Quebec, as well as some of the noteworthy projected demographic relationships.

Schedule 1\*

| <u>Middle<br/>of<br/>Year</u> | <u>Census and Projected<br/>Populations</u><br>(in thousands) |               |              | <u>Ratio of<br/>Population Aged<br/>65 and over to<br/>Population Aged<br/>20 to 64</u><br>(%) | <u>Birth<br/>Rate<br/>per 1000</u> |
|-------------------------------|---|---------------|--------------|--|------------------------------------|
|                               | <u>Male</u>   | <u>Female</u> | <u>Total</u> |  |                                    |
| 1961                          | 6,587   | 6,392         | 12,979       | 16.4   | 26.1                               |
| 1971                          | 7,801   | 7,740         | 15,541       | 16.4   | 17.6                               |
| 1981**                        | 9,104   | 9,155         | 18,259       | 17.1   | 15.4                               |
| 1990                          | 10,104  | 10,227        | 20,331       | 18.6   | 15.3                               |
| 2000                          | 11,098  | 11,310        | 22,408       | 20.2   | 13.2                               |
| 2025                          | 13,251  | 13,673        | 26,924       | 32.1   | 12.6                               |
| 2050                          | 14,878  | 15,473        | 30,351       | 35.6   | 12.7                               |
| 2100                          | 18,693  | 19,288        | 37,981       | 35.5   | 12.7                               |

(b) Fertility

The ultimate total fertility rate of 2.0 used for the preceding report was retained. However, the year from which that rate was assumed to apply was deferred from 2000 to 2010. For the years from 1985 to 2009 the rates were obtained by linear interpolation between the actual 1984 values of 1.686 for All Canada and 1.460 for Quebec and the assumed value of 2.0 for 2010. For the years 1982 to 1984 the actual rates were used in the population projections. For purposes of distributing the ultimate total fertility rate into age-specific rates, the methodology of the preceding report was retained, namely, rates for All Canada for age-groups below 20 and above 34 and rates for Quebec above 34 were set approximately equal to the rates for 1980 and the remainder was distributed in the same proportion as the averages for 1981 and 1982 combined.

\* All figures shown are for Canada excluding Quebec.

\*\* 1981 starting population adjusted for undercount of 1981 census.

Schedule 2

Selected Fertility Rates  
(Number of live births per 1000 females in age group)

| <u>Canada*</u>                              |             |             |             |             |             | Fertility Rates Assumed for 2010 and later |
|---|-------------|-------------|-------------|-------------|-------------|--|
| <u>Recently Experienced Fertility Rates</u> |             |             |             |             |             |  |
| <u>Age Group</u>                            | <u>1970</u> | <u>1975</u> | <u>1980</u> | <u>1983</u> | <u>1984</u> |  |
| 15-19                                       | 42.8        | 35.3        | 27.6        | 24.9        | 24.4        | 28.0                                       |
| 20-24                                       | 143.3       | 112.7       | 100.1       | 92.4        | 88.8        | 115.4                                      |
| 25-29                                       | 147.2       | 131.2       | 129.4       | 124.6       | 126.0       | 151.4                                      |
| 30-34                                       | 81.8        | 64.4        | 69.3        | 70.5        | 73.3        | 82.0                                       |
| 35-39                                       | 39.0        | 21.6        | 19.4        | 20.5        | 21.5        | 20.0                                       |
| 40-44                                       | 11.3        | 4.8         | 3.1         | 3.0         | 3.0         | 3.0  |
| 45-49                                       | 0.9         | 0.4         | 0.2         | 0.2         | 0.1         | 0.2  |
| Total                                       | 2331.5      | 1852.0      | 1745.5      | 1680.5      | 1685.5      | 2000.0                                     |

  

| <u>Province of Quebec</u>                   |             |             |             |             |             | Fertility Rates Assumed for 2010 and later |
|---|-------------|-------------|-------------|-------------|-------------|--|
| <u>Recently Experienced Fertility Rates</u> |             |             |             |             |             |  |
| <u>Age Group</u>                            | <u>1970</u> | <u>1975</u> | <u>1980</u> | <u>1983</u> | <u>1984</u> |  |
| 15-19                                       | 20.7        | 19.5        | 16.1        | 14.4        | 14.3        | 20.0                                       |
| 20-24                                       | 113.9       | 96.4        | 92.7        | 80.3        | 76.6        | 110.9                                      |
| 25-29                                       | 131.0       | 136.2       | 137.2       | 118.6       | 118.9       | 162.8                                      |
| 30-34                                       | 77.4        | 69.4        | 70.6        | 61.3        | 62.5        | 84.1                                       |
| 35-39                                       | 39.0        | 23.4        | 19.8        | 16.5        | 17.1        | 19.0                                       |
| 40-44                                       | 11.8        | 5.2         | 3.0         | 2.1         | 2.5         | 3.0  |
| 45-49                                       | 1.0         | 0.6         | 0.2         | 0.2         | 0.1         | 0.2  |
| Total                                       | 1974.0      | 1753.5      | 1698.0      | 1467.0      | 1460.0      | 2000.0                                     |

\* Newfoundland is excluded because of unavailability of data.

C. N. B. 1981

The ultimate mortality table used in our population projections is in part based on work done by the Office of the Actuary of the U.S. Social Security Administration. "Actuarial Study No. 95 - United States Population Projections for OASDHI Cost Estimates" derives mortality rates for the year 2050 by considering death rates, by age-group and sex, in ten broad groups of causes of death, and by combining the assumed percentage reductions for each cause of death to obtain average reductions in mortality by age-group and sex for all causes combined. For the current Canada Pension Plan projections on the new assumptions, the same relative improvements in mortality from 1985 levels as implicit in Alternative II (medium) in Actuarial Study No. 95 were assumed to be applicable to the 1980-82 Canada Life Table. The resulting ultimate table (assumed applicable to the year 2050 and later) produces an expectation of life at birth of 76.6 for males and 83.8 for females, compared to 71.9 and 79.0, respectively, for the 1980-82 Canada Life Table. At age 65 the expectation of life according to the ultimate table is 17.3 for males and 22.4 for females, compared to 14.6 and 18.9, respectively, for the 1980-82 Canada Life Table. Sample values of the ultimate mortality rates as well as the values of mortality rates on the basis of the 1940-42 and 1980-82 Canada Life Tables and the previously assumed rates for 1981 are given in Schedule 3.

Schedule 3

Comparison of Mortality Rates for the Province of Quebec and for Canada  
(Annual deaths per 1,000 persons)

| Age            | Males | 1940-42<br>Canada<br>Life<br>Tables | 1980-82 Canada<br>Life Tables |        | Previously<br>Assumed Rates<br>for 1981 |        | Rates Assumed<br>for Year 2050 |        |
|----------------|-------|-------------------------------------|-------------------------------|--------|---|--------|--------------------------------|--------|
|                |       |                                     | Province<br>of<br>Quebec      | Canada | Province<br>of<br>Quebec                | Canada | Previous                       | New    |
| 0              |       | 62.50                               | 9.79                          | 10.92  | 14.18                                   | 14.28  | 8.67                           | 5.59   |
| 1              |       | 7.21                                | 0.77                          | 0.81   | 1.19                                    | 0.99   | 0.57                           | 0.53   |
| 5              |       | 1.98                                | 0.39                          | 0.39   | 0.62                                    | 0.46   | 0.30                           | 0.25   |
| 10             |       | 1.22                                | 0.26                          | 0.22   | 0.34                                    | 0.28   | 0.22                           | 0.12   |
| 20             |       | 2.41                                | 1.49                          | 1.53   | 1.84                                    | 1.79   | 1.59                           | 1.17   |
| 30             |       | 2.60                                | 1.41                          | 1.32   | 1.59                                    | 1.44   | 1.22                           | 1.05   |
| 40             |       | 4.28                                | 2.39                          | 2.23   | 2.73                                    | 2.63   | 1.70                           | 1.38   |
| 50             |       | 8.95                                | 6.90                          | 6.28   | 7.79                                    | 7.08   | 4.37                           | 4.17   |
| 60             |       | 20.29                               | 18.17                         | 16.28  | 20.06                                   | 17.89  | 11.85                          | 10.57  |
| 70             |       | 47.59                               | 43.06                         | 39.07  | 45.65                                   | 41.36  | 28.65                          | 27.96  |
| 80             |       | 117.38                              | 94.77                         | 89.41  | 98.32                                   | 92.93  | 67.18                          | 64.61  |
| 90             |       | 250.48                              | n.a.                          | 189.75 | 214.38                                  | 205.30 | 136.08                         | 136.21 |
| <u>Females</u> |       |                                     |                               |        |   |        |                                |        |
| 0              |       | 49.31                               | 8.03                          | 8.43   | 11.58                                   | 11.44  | 6.52                           | 4.29   |
| 1              |       | 6.34                                | 0.61                          | 0.66   | 0.95                                    | 0.90   | 0.59                           | 0.40   |
| 5              |       | 1.57                                | 0.30                          | 0.27   | 0.49                                    | 0.36   | 0.23                           | 0.16   |
| 10             |       | 0.90                                | 0.21                          | 0.18   | 0.27                                    | 0.22   | 0.15                           | 0.10   |
| 20             |       | 1.80                                | 0.44                          | 0.47   | 0.52                                    | 0.54   | 0.41                           | 0.38   |
| 30             |       | 2.60                                | 0.57                          | 0.57   | 0.69                                    | 0.63   | 0.42                           | 0.37   |
| 40             |       | 3.86                                | 1.29                          | 1.32   | 1.44                                    | 1.45   | 0.86                           | 0.76   |
| 50             |       | 7.01                                | 3.39                          | 3.38   | 3.69                                    | 3.65   | 2.41                           | 2.21   |
| 60             |       | 15.28                               | 8.35                          | 8.04   | 9.15                                    | 8.49   | 5.84                           | 5.71   |
| 70             |       | 38.12                               | 20.67                         | 19.83  | 23.49                                   | 21.11  | 14.28                          | 14.08  |
| 80             |       | 101.96                              | 56.72                         | 54.01  | 62.97                                   | 57.72  | 35.75                          | 33.30  |
| 90             |       | 233.91                              | n.a.                          | 143.51 | 87.56                                   | 159.38 | 85.90                          | 92.33  |

The 1980-82 Canada Life Tables for Canada, the corresponding tables for Quebec, and the ultimate mortality tables constructed as above consist of one-year probabilities of mortality for individual ages 0 to 109. The 1981 census population data for Canada and Quebec, available by individual ages up to 89, were adjusted to spread the 90+ age-group by individual ages to 109. Survivors of the population for a particular year were then obtained by simply applying the probabilities of survival for that year to the given population.

(d) Migration

Immigration as well as emigration are generally recognized to be rather volatile parameters of future population growth, since they are subject to a variety of demographic, economic, social and political factors and immigration is subject to government control. During the period from April 1, 1971 to March 31, 1984, for example, immigration to Canada varied from 83,000 to 214,000 p.a. and emigration from Canada is estimated to have fluctuated between 42,000 and 84,000 p.a. Net immigration during the period averaged about 79,000 p.a.

For purposes of this report it was decided to assume 125,000 immigrants and 50,000 emigrants for 1981 and both these figures were increased with time so as to maintain a constant ratio of net immigration to total current Canadian population of 0.302%. This assumption was used for all projections based on the new assumptions except Table 13 which is based on a constant number of net immigrants of 75,000 annually.

For purposes of projecting the population of Quebec it was assumed that 16% of both immigrants to and emigrants from Canada would be attributable to that province; statistics based on Employment and Immigration Canada data for 1984 showed 16.9% of immigrants and 16.1% of emigrants attributable to Quebec.

In addition it was assumed that Quebec would experience net interprovincial emigration of 20,000 in 1981 decreasing uniformly to zero by the year 2010. The starting figure of 20,000 was based on the mean of the 1975 to 1984 experience excluding the year 1977 which reflected an unrepresentative high level of emigration following the 1976 provincial election.

The distributions of immigrants and emigrants by age-group and sex used for purposes of the projections in Report No.8 were based on Statistics Canada data for 1977-1980. The distributions for 1980-1983 indicated average ages somewhat higher for immigrants and somewhat lower for emigrants. However, it was decided to await further experience before modifying our assumptions. The distributions used are shown in Schedule 4.

Schedule 4

Distributions of Immigrants and Emigrants by Age-Group and Sex

| <u>Age-Group</u> | <u>Immigrants</u>   |                       | <u>Emigrants</u>    |                       |
|------------------|---------------------|-----------------------|---------------------|-----------------------|
|                  | <u>Males</u><br>(%) | <u>Females</u><br>(%) | <u>Males</u><br>(%) | <u>Females</u><br>(%) |
| 0- 4             | 4.511               | 4.337                 | 3.367               | 3.182                 |
| 5- 9             | 4.155               | 3.857                 | 4.054               | 3.936                 |
| 10-14            | 4.022               | 3.692                 | 3.773               | 3.710                 |
| 15-19            | 5.480               | 6.091                 | 3.551               | 3.968                 |
| 20-24            | 7.342               | 8.665                 | 3.524               | 6.280                 |
| 25-29            | 6.900               | 6.639                 | 6.201               | 8.110                 |
| 30-34            | 4.339               | 3.872                 | 7.183               | 6.599                 |
| 35-39            | 2.561               | 2.235                 | 4.423               | 4.533                 |
| 40-44            | 1.533               | 1.511                 | 3.373               | 2.958                 |
| 45-49            | 1.206               | 1.699                 | 2.462               | 2.200                 |
| 50-54            | 1.206               | 2.153                 | 1.853               | 2.002                 |
| 55-59            | 1.386               | 2.213                 | 1.495               | 1.697                 |
| 60-64            | 1.649               | 1.893                 | 1.162               | 1.222                 |
| 65-69            | 1.004               | 1.319                 | 0.972               | 0.899                 |
| 70+              | 0.911               | 1.527                 | 0.557               | 0.721                 |
| Total:           | 48.205              | 51.703                | 47.950              | 52.017                |

(e) Populations

In Schedules 5, 6 and 7 are shown for Canada, the Province of Quebec and Canada excluding Quebec, respectively, the 1981 starting population\* and the projected populations for 1990, 2000, 2025, 2050, 2075 and 2100. The populations shown are distributed by sex and broad age groups. These populations were used for all projections based on the new assumptions except Tables 13 and 14.

\* 1981 census adjusted for undercount.

SCHEDULE 5

POPULATIONS FOR ALL CANADA\*  
(IN THOUSANDS)

| MIDDLE<br>OF<br>YEAR |         | TOTAL | 14 AND UNDER | 15 - 19 | 20 - 24 | 25 - 59 | 60 - 64 | 65 - 69 | 70 AND OVER | RATIOS TO POPULATION<br>AGED 20 TO 64 |                 |
|----------------------|---------|-------|--------------|---------|---------|---------|---------|---------|-------------|---------------------------------------|-----------------|
|                      |         |       |              |         |         |         |         |         |             | AGE 19                                | AGE 65          |
|                      |         |       |              |         |         |         |         |         |             | AND UNDER<br>(%)                      | AND OVER<br>(%) |
| 1981                 | MALES   | 12353 | 2848         | 1219    | 1245    | 5558    | 467     | 393     | 625         | 58.0                                  | 14.0            |
|                      | FEMALES | 12475 | 2700         | 1165    | 1228    | 5469    | 522     | 457     | 904         | 53.3                                  | 18.8            |
|                      | TOTAL   | 24828 | 5548         | 2384    | 2473    | 11055   | 989     | 850     | 1529        | 54.6                                  | 16.4            |
| 1990                 | MALES   | 13523 | 2983         | 964     | 1060    | 6692    | 559     | 473     | 792         | 47.5                                  | 15.2            |
|                      | FEMALES | 13742 | 2820         | 916     | 1019    | 6617    | 603     | 565     | 1202        | 45.3                                  | 21.4            |
|                      | TOTAL   | 27675 | 5803         | 1880    | 2079    | 13309   | 1162    | 1038    | 1994        | 46.4                                  | 18.3            |
| 2000                 | MALES   | 14670 | 3094         | 1032    | 994     | 7444    | 588     | 508     | 1010        | 45.7                                  | 16.8            |
|                      | FEMALES | 15005 | 2945         | 976     | 955     | 7372    | 627     | 572     | 1558        | 43.8                                  | 23.8            |
|                      | TOTAL   | 29875 | 6039         | 2008    | 1949    | 14816   | 1215    | 1080    | 2568        | 44.8                                  | 20.3            |
| 2025                 | MALES   | 17155 | 3412         | 1114    | 1093    | 7828    | 1139    | 984     | 1785        | 45.9                                  | 28.1            |
|                      | FEMALES | 17746 | 3231         | 1046    | 1046    | 7454    | 1206    | 1118    | 2645        | 44.1                                  | 38.8            |
|                      | TOTAL   | 34901 | 6643         | 2160    | 2139    | 15082   | 2345    | 2102    | 4430        | 45.0                                  | 33.4            |
| 2050                 | MALES   | 18938 | 3766         | 1231    | 1242    | 8411    | 1058    | 922     | 2308        | 46.7                                  | 30.1            |
|                      | FEMALES | 19705 | 3557         | 1163    | 1191    | 8185    | 1100    | 1000    | 3509        | 45.1                                  | 43.0            |
|                      | TOTAL   | 38641 | 7323         | 2394    | 2433    | 16596   | 2158    | 1922    | 5815        | 45.9                                  | 36.5            |
| 2075                 | MALES   | 21012 | 4164         | 1374    | 1396    | 9375    | 1153    | 1016    | 2534        | 46.4                                  | 29.8            |
|                      | FEMALES | 21681 | 3932         | 1300    | 1338    | 9102    | 1192    | 1090    | 3727        | 45.0                                  | 41.4            |
|                      | TOTAL   | 42693 | 8096         | 2674    | 2734    | 18477   | 2345    | 2106    | 6261        | 45.7                                  | 35.5            |
| 2100                 | MALES   | 23355 | 4617         | 1532    | 1557    | 10414   | 1281    | 1124    | 2850        | 46.5                                  | 30.0            |
|                      | FEMALES | 24071 | 4359         | 1450    | 1491    | 10102   | 1302    | 1211    | 4158        | 45.0                                  | 41.6            |
|                      | TOTAL   | 47426 | 8976         | 2982    | 3048    | 20516   | 2583    | 2335    | 7008        | 45.8                                  | 35.8            |

\* THESE POPULATIONS WERE USED FOR TABLES 3, 4, 7, 10, 11 AND 12



SCHEDULE 6

POPULATIONS FOR QUEBEC\*  
(IN THOUSANDS)

| MIDDLE<br>OF<br>YEAR |         | TOTAL | 14 AND UNDER | 15 - 19 | 20 - 24 | 25 - 59 | 60 - 64 | 65 - 69 | 70 AND OVER | RATIOS TO POPULATION<br>AGED 20 TO 64 |                    |
|----------------------|---------|-------|--------------|---------|---------|---------|---------|---------|-------------|---------------------------------------|--------------------|
|                      |         |       |              |         |         |         |         |         |             | AGE 19<br>AND UNDER                   | AGE 65<br>AND OVER |
| 1981                 | MALES   | 3249  | 727          | 326     | 342     | 1499    | 118     | 95      | 142         | 53.8                                  | 12.1               |
|                      | FEMALES | 3320  | 686          | 313     | 338     | 1510    | 136     | 117     | 220         | 50.4                                  | 17.0               |
|                      | TOTAL   | 6569  | 1413         | 639     | 680     | 3009    | 254     | 212     | 362         | 52.0                                  | 14.6               |
| 1990                 | MALES   | 3419  | 721          | 228     | 261     | 1761    | 144     | 118     | 186         | 43.8                                  | 14.0               |
|                      | FEMALES | 3515  | 679          | 217     | 249     | 1757    | 163     | 146     | 304         | 41.3                                  | 20.7               |
|                      | TOTAL   | 6934  | 1400         | 445     | 510     | 3518    | 307     | 264     | 490         | 42.6                                  | 17.4               |
| 2000                 | MALES   | 3572  | 694          | 239     | 245     | 1871    | 150     | 129     | 244         | 41.2                                  | 16.5               |
|                      | FEMALES | 3695  | 658          | 227     | 234     | 1854    | 165     | 153     | 404         | 39.3                                  | 24.7               |
|                      | TOTAL   | 7267  | 1352         | 466     | 479     | 3725    | 315     | 282     | 648         | 40.2                                  | 20.6               |
| 2025                 | MALES   | 3904  | 740          | 247     | 238     | 1700    | 284     | 249     | 446         | 44.4                                  | 31.3               |
|                      | FEMALES | 4073  | 699          | 230     | 226     | 1652    | 298     | 284     | 684         | 42.7                                  | 44.5               |
|                      | TOTAL   | 7977  | 1439         | 477     | 464     | 3352    | 582     | 533     | 1130        | 43.6                                  | 37.8               |
| 2050                 | MALES   | 4058  | 790          | 259     | 259     | 1781    | 228     | 204     | 537         | 46.3                                  | 32.7               |
|                      | FEMALES | 4232  | 743          | 243     | 246     | 1723    | 235     | 220     | 822         | 44.7                                  | 47.3               |
|                      | TOTAL   | 8290  | 1533         | 502     | 505     | 3504    | 463     | 424     | 1359        | 45.5                                  | 39.9               |
| 2075                 | MALES   | 4327  | 845          | 279     | 282     | 1920    | 243     | 217     | 541         | 46.0                                  | 31.0               |
|                      | FEMALES | 4449  | 793          | 262     | 268     | 1853    | 250     | 231     | 792         | 44.5                                  | 43.1               |
|                      | TOTAL   | 8776  | 1638         | 541     | 550     | 3773    | 493     | 448     | 1333        | 45.2                                  | 37.0               |
| 2100                 | MALES   | 4662  | 909          | 301     | 306     | 2071    | 257     | 229     | 589         | 45.9                                  | 31.1               |
|                      | FEMALES | 4783  | 852          | 283     | 291     | 1996    | 263     | 245     | 853         | 44.5                                  | 43.1               |
|                      | TOTAL   | 9445  | 1761         | 584     | 597     | 4067    | 520     | 474     | 1442        | 45.2                                  | 37.0               |

\* THESE POPULATIONS WERE USED FOR TABLES 3, 4, 7, 10, 11 AND 12

SCHEDULE 7

POPULATIONS FOR CANADA EXCLUDING QUEBEC\*  
(IN THOUSANDS)

| MIDDLE<br>OF<br>YEAR |         | TOTAL | 14 AND UNDER | 15 - 19 | 20 - 24 | 25 - 59 | 60 - 64 | 65 - 69 | 70 AND OVER | RATIOS TO POPULATION<br>AGED 20 TO 64 |                    |
|----------------------|---------|-------|--------------|---------|---------|---------|---------|---------|-------------|---------------------------------------|--------------------|
|                      |         |       |              |         |         |         |         |         |             | AGE 19<br>AND UNDER                   | AGE 65<br>AND OVER |
| 1981                 | MALES   | 9104  | 2121         | 893     | 908     | 4057    | 349     | 298     | 483         | 56.8                                  | 14.7               |
|                      | FEMALES | 9155  | 2014         | 852     | 890     | 3989    | 386     | 340     | 684         | 54.4                                  | 19.4               |
|                      | TOTAL   | 18259 | 4135         | 1745    | 1793    | 8046    | 735     | 638     | 1167        | 55.6                                  | 17.1               |
| 1990                 | MALES   | 10104 | 2282         | 736     | 799     | 4931    | 415     | 355     | 606         | 48.8                                  | 15.6               |
|                      | FEMALES | 10227 | 2141         | 699     | 770     | 4860    | 440     | 419     | 898         | 46.8                                  | 21.7               |
|                      | TOTAL   | 20331 | 4403         | 1435    | 1569    | 9791    | 855     | 774     | 1504        | 47.8                                  | 18.6               |
| 2000                 | MALES   | 11098 | 2400         | 793     | 749     | 5573    | 438     | 379     | 766         | 47.2                                  | 16.9               |
|                      | FEMALES | 11310 | 2297         | 749     | 721     | 5518    | 462     | 419     | 1154        | 45.3                                  | 23.5               |
|                      | TOTAL   | 22408 | 4697         | 1542    | 1470    | 11091   | 900     | 798     | 1920        | 46.3                                  | 20.2               |
| 2025                 | MALES   | 13251 | 2672         | 867     | 855     | 5928    | 855     | 735     | 1339        | 46.3                                  | 27.2               |
|                      | FEMALES | 13673 | 2532         | 816     | 820     | 5802    | 908     | 834     | 1981        | 44.5                                  | 37.1               |
|                      | TOTAL   | 26924 | 5204         | 1683    | 1675    | 11730   | 1763    | 1569    | 3300        | 45.4                                  | 32.1               |
| 2050                 | MALES   | 14678 | 2976         | 972     | 983     | 6630    | 830     | 718     | 1789        | 46.8                                  | 29.5               |
|                      | FEMALES | 15473 | 2814         | 920     | 945     | 6482    | 865     | 780     | 2687        | 45.1                                  | 41.9               |
|                      | TOTAL   | 30151 | 5790         | 1892    | 1928    | 13092   | 1695    | 1498    | 4456        | 46.0                                  | 35.6               |
| 2075                 | MALES   | 16685 | 3319         | 1095    | 1114    | 7455    | 910     | 799     | 1993        | 46.6                                  | 29.5               |
|                      | FEMALES | 17232 | 3139         | 1038    | 1070    | 7249    | 942     | 859     | 2935        | 45.1                                  | 41.0               |
|                      | TOTAL   | 33917 | 6458         | 2133    | 2184    | 14704   | 1852    | 1658    | 4928        | 45.8                                  | 35.1               |
| 2100                 | MALES   | 18693 | 3708         | 1231    | 1251    | 8343    | 1004    | 895     | 2281        | 46.8                                  | 29.8               |
|                      | FEMALES | 19288 | 3507         | 1167    | 1200    | 8106    | 1039    | 966     | 3303        | 45.2                                  | 41.3               |
|                      | TOTAL   | 37981 | 7215         | 2398    | 2451    | 16449   | 2043    | 1861    | 5584        | 45.9                                  | 35.5               |

\* THESE POPULATIONS WERE USED FOR TABLES 3, 4, 7, 10, 11 AND 12

4. Participation Rates and Modified Average Earnings

- (a) For each of the years 1979-83, inclusive, the CPP Division of the Department of Supply and Services provided us with a cumulative distribution of contributors and of earnings (for each of eleven age-groups subdivided by sex) over some eighty earnings ranges, expressed as percentages of the average earnings for the "sex/age-group cell" involved. We took the averages of the five years of experience, for each cell separately, and assumed that these would represent cumulative distributions of contributors (C-distribution) and of earnings (E-distribution) applicable to that cell indefinitely in the future. For illustrative purposes, the data might indicate that 60% of contributors for a particular cell earn less than 120% of average earnings for the cell (C-distribution) and account for 40% of total earnings for the cell (E-distribution). By interpolation between the various points of the distributions, we could then determine for any percentage of average earnings of any cell what percentage of contributors earn less than such percentage of average earnings, and what percentage of total earnings for the cell are earned by such contributors.
- (b) Superficially, one might expect that there would be few, if any, contributors earning less than the Year's Basic Exemption (YBE), since, except in unusual circumstances, the contributions of such contributors are refundable and their earnings are not counted for purposes of calculating pensionable earnings. Surprisingly perhaps, the data revealed a very large number of contributors earning less than the YBE, as large or almost as large as one might expect if there were no YBE. The likely reason for this is that most contributors who earn less than the YBE during a year have low yearly earnings because they work for only a small fraction of the year, but during that fraction they have monthly earnings in excess of 1/12 of the YBE. Employer and employee contributions must be deducted at source for any month during which earnings exceed 1/12 of the YBE (unless the year's maximum has already been deducted), and while the employee contributions may be refundable if the employee earns less than the YBE during the year, the employer contributions are not. Hence, the bulk of earners earning less than the YBE in any year would seem to have employer contributions to their credit, and therefore have a record of their earnings for that year maintained on the CPP Record of Earnings, even though such earnings are not countable for pensionable earnings purposes. For this reason, it appeared reasonable to consider the cumulative distributions of contributors (C) and of their earnings (E), developed in (a) above, as being cumulative distributions of earners and of their earnings, for purposes of subsequent analysis.
- (c) For 1966 to 1983, we obtained experience participation rates assuming no YBE for each "year/sex/age-group cell", by dividing the total number of contributors (assumed to be the total number of

earners) by the estimated\* populations. We projected these participation rates from 1984 to 2100, taking into account the trend in such rates during the 1970-80 period, the continued increase in participation by females, and our expectation as to likely changes in the future. The result was a complete set of participation rates assuming no YBE for each "year/sex/age-group cell" running from 1966 to 2100.

- (d) We obtained annual average earnings assuming no YBE, for each year from 1971 to 1983 for each "year/sex/age-group cell", by dividing total earnings by total number of contributors (assumed to be total number of earners). Average earnings for 1966 to 1970 were obtained from other data available (i.e. T4 slips).

For years subsequent to 1983 it was assumed that total average earnings (for all age-groups and both sexes combined) would increase at the same annual rate as the Industrial Composite\*\* (average wages and salaries) for Canada. For 1983-84 and 1984-85 we used the known rate of increase in the Industrial Composite and, for subsequent years, the rates of increase in average earnings postulated in the economic assumptions (see 2 above).

However, we did not apply such aggregate rates of increase to each "sex/age-group cell", because we expect a gradual narrowing of the gap between earnings for males and females. Hence, we developed rates of increase in average earnings for each "sex/age-group cell" that would (i) produce an aggregate rate of increase equal to the rate postulated in the economic assumptions, (ii) produce rates of increase for each age-group, both sexes combined, that would be the same for all age-groups, and (iii) produce separate rates of increase for male and female average earnings for each age-group such that the ratio of female to male average earnings would move 1% of the way to unity each year.

In this manner average earnings, assuming no YBE, were calculated for each "year/sex/age-group cell" from the year of inception, 1966, to 2100 (see (h) below).

- (e) The YMPE of \$25,800 for 1986 was projected for each year in the future in accordance with the formula described on page 24 and with the assumed increases in average earnings, rounded down to the nearest lower multiple of \$100, if not a multiple of \$100.

Future YBE's were taken as 10% of the projected YMPE's rounded down to the nearest lower multiple of \$100 if not a multiple of \$100.

\* Census populations, adjusted for undercount, and estimated intercensal values.

\*\* To be replaced by the Industrial Aggregate for years after 1987.

(f) For any "year/sex/age-group cell", the YBE could then be expressed as a percentage of average earnings and, using the C-distribution described in (a), we could calculate the proportion of earners earning less than the YBE. Applying the complements of such proportions to the participation rates assuming no YBE, yielded participation rates excluding earners earning less than the YBE, which are the participation rates used in subsequent calculations. Sample values of such participation rates are shown in Schedule 8 below.

Schedule 8

Participation Rates

|         | <u>Age Group</u> | <u>1985</u><br>(%) | <u>2000</u><br>(%) | <u>2025</u><br>(%) | <u>2050</u><br>(%) | <u>2100</u><br>(%) |
|---------|------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Males   | 18-19            | 68.1               | 68.6               | 68.3               | 67.9               | 67.4               |
|         | 20-24            | 86.1               | 86.5               | 86.4               | 86.2               | 85.9               |
|         | 25-29            | 92.3               | 94.3               | 94.2               | 94.1               | 93.9               |
|         | 30-34            | 95.6               | 95.9               | 95.9               | 95.7               | 95.6               |
|         | 35-39            | 94.5               | 95.7               | 95.6               | 95.5               | 95.3               |
|         | 40-44            | 93.9               | 93.9               | 93.8               | 93.7               | 93.6               |
|         | 45-49            | 90.9               | 91.9               | 91.8               | 91.7               | 91.5               |
|         | 50-54            | 88.9               | 89.2               | 89.1               | 89.0               | 88.8               |
|         | 55-59            | 82.2               | 83.3               | 83.2               | 83.1               | 83.0               |
|         | 60-64            | 68.4               | 50.7               | 50.6               | 50.5               | 50.4               |
| 65-69   | 15.4             | 14.1               | 14.1               | 14.0               | 14.0               |                    |
| Females | 18-19            | 58.5               | 60.9               | 63.9               | 64.3               | 64.9               |
|         | 20-24            | 70.1               | 72.8               | 76.6               | 76.9               | 77.2               |
|         | 25-29            | 64.8               | 67.6               | 71.5               | 72.5               | 72.8               |
|         | 30-34            | 63.7               | 68.1               | 72.1               | 73.9               | 74.3               |
|         | 35-39            | 63.6               | 70.6               | 74.8               | 77.3               | 77.8               |
|         | 40-44            | 64.8               | 70.7               | 74.9               | 78.2               | 78.6               |
|         | 45-49            | 59.9               | 68.0               | 72.1               | 76.1               | 76.4               |
|         | 50-54            | 52.9               | 63.4               | 67.5               | 71.3               | 72.4               |
|         | 55-59            | 42.8               | 53.0               | 59.7               | 63.5               | 65.3               |
|         | 60-64            | 29.9               | 29.0               | 36.4               | 40.0               | 42.4               |
| 65-69   | 5.4              | 4.7                | 4.8                | 4.8                | 4.9                |                    |

The above rates vary slightly from those developed for purposes of Report No. 8.

- (g) The next step was to calculate Modified Average Earnings for each "year/sex/age-group cell"; these are average unadjusted pensionable earnings of contributors earning more than the YBE based on average earnings excluding portions of earnings above the YMPE. The formula used is

$$MAE = \frac{AE(EU - EL) + YMPE(1 - CU)}{1 - CL}$$

where

MAE = Modified Average Earnings

AE = Average earnings (developed in (d) above)

CL = Proportion of earners earning less than the YBE  
(calculated from C-distribution in (a) above)

CU = Proportion of earners earning less than the YMPE  
(calculated similarly to CL)

EL = Proportion of total earnings attributable to persons  
earning less than the YBE (calculated from E-  
distribution in (a) above)

EU = Proportion of total earnings attributable to persons  
earning less than the YMPE (calculated similarly to EL)

YMPE = Year's Maximum Pensionable Earnings, as developed in  
(e) above.

- (h) The element of unemployment was not introduced explicitly into the calculations, because it was felt that to do so would not measurably enhance the projections in the long run. Unemployment, however, affects the derived participation rates and average earnings, and substantial changes could affect the fund projections. In developing Modified Average Earnings, average earnings determined as above were increased by one percent for 1984, two percent for 1985 etc to seven percent for 1990 and later, in order to gradually remove the effect of unusually high levels of unemployment and disabilities in 1983.

Sample values of Modified Average Earnings, which are the earnings used for purposes of all the tables except Table 12 and those based on the assumptions of Report No. 8 are shown below.

Schedule 9

Modified Average Earnings

|                |                  | <u>1985</u> | <u>2000</u> | <u>2025</u> | <u>2050</u> | <u>2100</u> |
|----------------|------------------|-------------|-------------|-------------|-------------|-------------|
|                | <u>Y.M.P.E.</u>  | \$23400     | \$47300     | \$160400    | \$543100    | \$6228300   |
|                | <u>Age Group</u> |             |             |             |             |             |
| <u>Males</u>   | 18-19            | 9513        | 18800       | 63420       | 212486      | 2400286     |
|                | 20-24            | 13026       | 25689       | 86707       | 290366      | 3278741     |
|                | 25-29            | 17638       | 34944       | 117774      | 394700      | 4458129     |
|                | 30-34            | 19243       | 38291       | 128913      | 431940      | 4878687     |
|                | 35-39            | 19838       | 39590       | 133047      | 446009      | 5035436     |
|                | 40-44            | 19905       | 39779       | 133556      | 447386      | 5048683     |
|                | 45-49            | 19735       | 39467       | 132452      | 443621      | 5000176     |
|                | 50-54            | 19499       | 39075       | 131188      | 439518      | 4952196     |
|                | 55-59            | 18983       | 37995       | 127936      | 428566      | 4826733     |
|                | 60-64            | 17813       | 35642       | 120574      | 403793      | 4547423     |
|                | 65-69            | 13266       | 26233       | 88666       | 297529      | 3374290     |
| <u>Females</u> | 18-19            | 7945        | 16116       | 56325       | 193697      | 2264046     |
|                | 20-24            | 11112       | 22507       | 78930       | 271722      | 3180969     |
|                | 25-29            | 14540       | 29698       | 104709      | 361649      | 4241904     |
|                | 30-34            | 14952       | 30898       | 109534      | 379168      | 4448250     |
|                | 35-39            | 14936       | 31281       | 111623      | 387455      | 4558738     |
|                | 40-44            | 14872       | 31423       | 112562      | 391521      | 4615805     |
|                | 45-49            | 14672       | 31173       | 111883      | 389775      | 4599095     |
|                | 50-54            | 14477       | 30901       | 111106      | 387266      | 4568948     |
|                | 55-59            | 14129       | 30065       | 108657      | 378674      | 4467928     |
|                | 60-64            | 13644       | 28852       | 104504      | 364023      | 4291146     |
|                | 65-69            | 10465       | 21559       | 77236       | 269701      | 3210455     |

Annual earnings ratios (see page 27) based on the above table tend to be somewhat lower than corresponding values implicit in Report No. 8.

5. Contributions and Expenses of Administration

- (a) Contributory earnings were calculated as being the product of (i) Modified Average Earnings less the Year's Basic Exemption, (ii) participation rates, and (iii) projected populations.
- (b) Logic would seem to indicate that contributory earnings calculated in this fashion, to be used for the purpose of estimating contributions, should be increased somewhat to allow for the fact that contributions may be collected from other sources, e.g., (i) contributions made by an employer in respect of an employee earning less than the YBE are not refundable, (ii) excess contributions made by an employer in respect of an employee earning more than the YMPE are refundable only to the extent that the employee had earnings with that particular employer in excess of the YMPE, and (iii) in cases where employees or employers entitled to refunds do not claim such refunds, they are not made. However, while in the early years of the Plan contributions estimated in accordance with the above method were always less than contributions actually collected, from 1977 to 1981 there was virtually no difference. In 1982 actual contributions jumped to 108% of expected only to fall to 91% in 1983, but this seems to be attributable to the fact that nearly all contributions related to 1982 earnings were made in 1982, while 1983 was subject to the customary delay of receipts to the early months of the following calendar year. For the purposes of this report, it was decided to estimate contributions for all future years in the manner described above, on an accrual basis without adjustment.
- (c) The contribution rates assumed in the fund accumulations were applied to contributory earnings to estimate contributions.
- (d) Costs of administration continued to be assumed as 0.1% of contributory earnings.

6. Retirement Pension

- (a) For the cohorts of contributors reaching age 65 in each of the quinary calendar years from 1990 to 2100, the average unadjusted pensionable earnings history of an "average male" and an "average female" was determined by multiplying modified average earnings by participation rates for each year of the contributory period for purposes of retirement pension (i.e., the period running from January 1, 1966, or attainment of age 18, whichever is later, to attainment of age 65).



- (b) The average unadjusted pensionable earnings for each year of the history were divided by the Year's Maximum Pensionable Earnings (YMPE) for the year involved and multiplied by the average of the three consecutive YMPE's ending with the year of attainment of age 65 to obtain the average adjusted pensionable earnings history.
- (c) Average benefit factors for age 65 and for each quinary calendar year are calculated as equal to 25% of (i) the sum of the average adjusted pensionable earnings of the particular cohort less earnings that have to be dropped out in accordance with the 15% drop-out provision, divided by (ii) 85% of the contributory period. It should be noted that by summing the average adjusted pensionable earnings for a cohort, we obtain the average sum of all the pensionable earnings of individuals belonging to the cohort, which is what is desired. Unfortunately, there is no automatic way of determining what earnings have to be dropped out from this sum. The earnings that have to be dropped out for an individual belonging to a cohort are the lowest earnings of that individual for a number of years equal to 15% of the contributory period. We could make a reasonably accurate estimate of a maximum and a minimum value of the earnings to be dropped out for a cohort. The minimum value is 0, provided participation rates do not average more than 85%. The maximum value is the product of the lowest adjusted pensionable earnings value and the lowest participation rate over the contributory period, plus the product of the next lowest adjusted pensionable earnings value and the next lowest participation rate, and so on for a number of years equal to 15% of the contributory period. For males it was assumed that the earnings to be dropped would equal half of the maximum value. For females it was assumed that each female would have at least 15% years of nil earnings, so that no earnings were dropped.
- (d) After slightly increasing the average benefit factors for age 65 developed pursuant to (c) to allow for the disability drop-out provisions of the plan, interpolation techniques were used to convert the factors applicable to age 65 into factors applicable to age-groups 65-69, 70-74 and so on in quinquennial attained years.

- (e) Starting on January 1, 1987, contributors will be entitled to receive retirement benefits before age 65 with "actuarial" reductions\* applying to the regular computed amount of pension. For that purpose, it was assumed that ultimately about 25% of males and 45% of females would elect to start receiving CPP retirement benefits between ages 60 and 65, and that they would do so at age 62.5 on the average. Specific benefit factors were calculated for age-group 60-64 taking into account these assumptions and the consequent average reduction of 15% in retirement pension. Some adjustments were also applied for 1987 to account for the backlog effect associated with those electing early retirement in the first year (1987).
- (f) Some contributors continue to participate in the plan for a while between age 65 and age 70. The benefit factors for age-group 65-69 were accordingly reduced by the proportion of those in the age-groups 65-69 who are not yet receiving the retirement pension but could be eligible to receive it since they reached age 65. This proportion is assumed equal to one fifth of those in the age-group 65-69 who have earnings above the YBE.

Starting in 1987, contributors retiring after age 65 will be entitled to an increase\* in their regular pensions depending on the age at which they will start receiving the retirement pension. Because very few contributors are expected to take advantage of this provision and of the small effect this provision would ultimately have even if used very extensively, its effect was ignored in the projections. On the basis of various tests, the 6% p.a. increase factor was deemed to be almost cost-neutral.

- (g) The above described techniques were used to develop benefit factors for benefits that would emerge at quinquennial years after 1985. For benefits already in pay at the end of 1985, benefit factors for quinary age-groups were developed by dividing benefits paid in that year by the projected populations for that year. These benefit factors were also deemed to be applicable to those of the 1985 pensioners who survive to future years, subject to adjustment of the factors for age-group 65-69 to take into account that not all eligible persons in that age-group would have applied for benefits by 1985.

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\* 0.5% for each month between the age when the pension commences and age sixty-five.

- (h) These benefit factors, when applied to the projected populations aged 60 and over, yielded estimated benefits payable in all future quinquennial years. Lagrange interpolation was then used to obtain benefits payable in non-quinquennial years.
- (i) The benefits were thereafter increased by the required Pension Index escalation.

## 7. Disability Pension

### (a) General Procedure

The general procedure used to estimate disability benefits was to (i) project flat-rate and earnings-related benefits in pay at the end of 1985 (see (b) below) using the disability termination rates shown in (f) below) and augmenting benefits payable to such survivors according to Pension Index increases; (ii) estimate flat-rate benefits emerging in years subsequent to 1985 by application of disability incidence rates (see (e) below), probabilities of being insured for disability benefit (see (c) below), and flat-rate benefit amounts, to the projected populations developed as described in 3 above, (iii) estimate earnings-related benefits emerging in years subsequent to 1985 by application of the same disability incidence rates, proportions of earnings insured for disability benefits (see (d) below), and earnings-related benefit factors (see (g) below), to the same projected populations; and (iv) project flat-rate and earnings-related benefits emerging in years subsequent to 1985 to future years in a manner similar to that used in projecting benefits in pay at the end of 1985, as described in (i).

The estimate of benefits paid in any particular future year would of course be equal to the sum of the benefits projected to that year.

### (b) Benefits Paid in 1985

These were derived from special tabulations subdivided by age, sex and duration, using data prepared for us by the CPP Division of the Department of Supply and Services. Since the totals were somewhat out of line with known amounts of disability benefits paid in 1985 available from other sources, the data were adjusted to ensure consistency with such amounts.

### (c) Probabilities of being insured for disability benefits

Since the main requirement to be insured for disability benefits under the proposed plan is to have made contributions for at least five of the last ten years or at least two of the last three years, such probabilities are heavily dependent upon the levels of participation rates for those few years preceding disability and, since such probabilities may be higher or lower than such levels depending upon working patterns, it was decided to assume that an

individual's probability of being insured for disability benefits in any given year would be equal to the larger of the following two values: (1) Probability of having participated in at least five of the last ten years: the average of the most recent ten participation rates for the cohort, and (2) Probability of having participated in at least two of the last three years:

$$\frac{P^2(3-2P)(10+9P)+P}{20}$$

for both sexes where "P" is the current participation rate assumed for the age-sex-year cell. This formula was obtained by assuming that

- (i) the proportion of individuals who never participated in the plan is equal to  $(1-P)/2$
- (ii) the proportion of individuals who participated without interruption since the beginning of the contributory period is equal to  $P/20$
- (iii) the proportion of individuals who participated randomly since the beginning of the contributory period is equal to the complement of the sum of (i) and (ii) above, that is  $(9P+10)/20$

and by setting the probability of having participated in at least two of the last three years, for individuals covered in (iii), equal to  $3P^2-2P^3$  and for those covered in (i) and (ii), equal to 0 and 1, respectively.

Sample probabilities are shown below.

Schedule 10

Probability of Being Insured  
for Disability Benefits

| Males          | Age  | 22    | 25    | 30    | 35    | 40    | 50    | 55    | 60    |
|----------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
|                | 1990 | 0.894 | 0.965 | 0.977 | 0.974 | 0.961 | 0.917 | 0.890 | 0.833 |
|                | 2050 | 0.885 | 0.961 | 0.974 | 0.972 | 0.958 | 0.921 | 0.902 | 0.817 |
|                | 2100 | 0.882 | 0.959 | 0.973 | 0.971 | 0.957 | 0.920 | 0.901 | 0.816 |
| <b>Females</b> |      |       |       |       |       |       |       |       |       |
|                | 1990 | 0.698 | 0.621 | 0.674 | 0.660 | 0.649 | 0.626 | 0.560 | 0.465 |
|                | 2050 | 0.770 | 0.709 | 0.735 | 0.776 | 0.787 | 0.759 | 0.721 | 0.633 |
|                | 2100 | 0.774 | 0.713 | 0.739 | 0.781 | 0.792 | 0.768 | 0.737 | 0.656 |

(d) Proportions of earnings insured for disability benefits

Since insured contributors will generally have higher aggregate earnings than uninsured contributors, such proportions should be higher than the probabilities of being insured for disability benefits. Basically, they were set equal to probabilities of being insured for disability benefits plus a percentage of the difference between unity and these probabilities. This percentage varies from 50% to 80% according to age and calendar year. Sample values of proportions assumed are shown below.

Schedule 11

Proportion of Earnings  
Insured for Disability Benefits

| Males   | Age  | 22    | 25    | 30    | 35    | 40    | 50    | 55    | 60    |
|---------|------|-------|-------|-------|-------|-------|-------|-------|-------|
|         | 1990 | 0.979 | 0.993 | 0.995 | 0.994 | 0.988 | 0.971 | 0.961 | 0.942 |
|         | 2050 | 0.977 | 0.992 | 0.994 | 0.993 | 0.987 | 0.969 | 0.956 | 0.909 |
|         | 2100 | 0.976 | 0.992 | 0.994 | 0.993 | 0.987 | 0.968 | 0.955 | 0.908 |
| Females |      |       |       |       |       |       |       |       |       |
|         | 1990 | 0.940 | 0.924 | 0.927 | 0.915 | 0.895 | 0.869 | 0.846 | 0.813 |
|         | 2050 | 0.954 | 0.942 | 0.940 | 0.944 | 0.936 | 0.904 | 0.875 | 0.817 |
|         | 2100 | 0.955 | 0.943 | 0.941 | 0.945 | 0.938 | 0.907 | 0.882 | 0.828 |

(e) Disability Incidence Rates

The rates used previously (Statutory Actuarial Report No.8) were based on the CPP experience of 1975. The new rates are based on the CPP experience of 1976 to 1984 giving weights of seven to the years 1976 to 1981 inclusive and of one to the years 1982 to 1984 inclusive. They were calculated by dividing emerging disability beneficiaries by the product of the populations and the assumed probabilities of being insured for disability benefits. Sample values are as follows:

Schedule 12

Disability Incidence Rates per 1000

| <u>Age</u> | <u>Males</u>    |            | <u>Females</u>  |            |
|------------|-----------------|------------|-----------------|------------|
|            | <u>Previous</u> | <u>New</u> | <u>Previous</u> | <u>New</u> |
| 25         | 0.342           | 0.459      | 0.206           | 0.257      |
| 30         | 0.457           | 0.555      | 0.310           | 0.350      |
| 35         | 0.758           | 0.882      | 0.478           | 0.617      |
| 40         | 1.355           | 1.517      | 0.890           | 1.277      |
| 45         | 2.208           | 2.513      | 1.680           | 2.163      |
| 50         | 4.542           | 4.747      | 3.298           | 4.185      |
| 55         | 9.005           | 10.029     | 6.694           | 8.131      |
| 60         | 17.484          | 22.138     | 13.505          | 18.647     |

(f) Disability Termination Rates

Since CPP experience to date is now quite extensive, it was decided to use graduated rates derived from CPP experience from 1976 to 1984, giving weights of seven and one to the 1976-81 and 1982-84 periods, respectively.

Schedule 13

Disability Termination Rates per 1000

(i) Previous Basis

| <u>Males</u>   | <u>Age</u> | <u>Year of Disability</u> |          |          |          |          | <u>Ultimate</u> | <u>Attained Age</u> |
|----------------|------------|---------------------------|----------|----------|----------|----------|-----------------|---------------------|
|                |            | <u>1</u>                  | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |                 |                     |
|                | 25         | 115.9                     | 176.0    | 105.1    | 61.3     | 40.3     | 29.2            | 30                  |
|                | 30         | 116.8                     | 164.3    | 97.4     | 58.1     | 41.1     | 28.7            | 35                  |
|                | 35         | 118.9                     | 158.6    | 95.5     | 59.0     | 43.8     | 31.0            | 40                  |
|                | 40         | 117.4                     | 144.0    | 88.0     | 58.1     | 46.2     | 35.2            | 45                  |
|                | 45         | 120.8                     | 126.6    | 78.9     | 57.6     | 49.4     | 41.5            | 50                  |
|                | 50         | 118.6                     | 109.4    | 72.8     | 60.5     | 56.0     | 52.6            | 55                  |
|                | 55         | 113.3                     | 97.4     | 71.9     | 66.3     | 65.7     | 64.7            | 60                  |
|                | 60         | 102.8                     | 89.6     | 75.7     | 74.1     | 74.5     | -               | 65                  |
| <u>Females</u> |            |                           |          |          |          |          |                 |                     |
|                | 25         | 70.8                      | 98.8     | 65.3     | 39.3     | 26.5     | 19.2            | 30                  |
|                | 30         | 63.1                      | 87.3     | 58.5     | 38.3     | 28.5     | 22.3            | 35                  |
|                | 35         | 68.4                      | 87.7     | 58.6     | 39.4     | 29.6     | 22.8            | 40                  |
|                | 40         | 74.4                      | 90.5     | 59.4     | 38.1     | 29.2     | 22.6            | 45                  |
|                | 45         | 78.9                      | 85.7     | 55.3     | 37.2     | 30.1     | 25.8            | 50                  |
|                | 50         | 75.3                      | 72.7     | 47.4     | 35.5     | 31.7     | 30.0            | 55                  |
|                | 55         | 68.9                      | 61.2     | 43.9     | 37.0     | 35.2     | 34.4            | 60                  |
|                | 60         | 60.6                      | 54.7     | 43.2     | 39.0     | 37.8     | -               | 65                  |

(ii) New Basis

| <u>Males</u>   | <u>Age</u> | <u>Year of Disability</u> |          |          |          |          | <u>Ultimate</u> | <u>Attained Age</u> |
|----------------|------------|---------------------------|----------|----------|----------|----------|-----------------|---------------------|
|                |            | <u>1</u>                  | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |                 |                     |
|                | 20         | 159.127                   | 259.097  | 198.892  | 136.995  | 116.666  | 74.186          | 25                  |
|                | 25         | 165.739                   | 220.505  | 163.220  | 109.592  | 91.429   | 55.114          | 30                  |
|                | 30         | 162.422                   | 183.128  | 128.509  | 92.378   | 74.248   | 42.859          | 35                  |
|                | 35         | 153.050                   | 154.046  | 107.713  | 78.870   | 65.100   | 45.221          | 40                  |
|                | 40         | 149.565                   | 136.153  | 89.401   | 73.095   | 61.626   | 48.910          | 45                  |
|                | 45         | 156.299                   | 123.501  | 73.150   | 61.200   | 55.278   | 48.823          | 50                  |
|                | 50         | 160.574                   | 106.975  | 66.607   | 57.333   | 55.339   | 54.705          | 55                  |
|                | 55         | 137.068                   | 89.167   | 62.309   | 59.214   | 58.254   | 58.750          | 60                  |
|                | 60         | 106.517                   | 74.890   | 59.131   | 58.582   | 59.135   | -               | 65                  |
| <u>Females</u> |            |                           |          |          |          |          |                 |                     |
|                | 20         | 168.004                   | 174.145  | 141.477  | 118.224  | 94.203   | 72.333          | 25                  |
|                | 25         | 132.162                   | 136.804  | 108.318  | 90.355   | 71.904   | 50.146          | 30                  |
|                | 30         | 124.300                   | 119.583  | 88.169   | 69.713   | 51.722   | 35.305          | 35                  |
|                | 35         | 140.362                   | 117.220  | 77.266   | 64.565   | 53.183   | 43.154          | 40                  |
|                | 40         | 139.110                   | 106.243  | 67.362   | 58.701   | 50.815   | 43.437          | 45                  |
|                | 45         | 126.520                   | 86.942   | 53.963   | 47.616   | 41.928   | 36.754          | 50                  |
|                | 50         | 110.660                   | 78.263   | 45.411   | 41.244   | 37.283   | 33.768          | 55                  |
|                | 55         | 81.800                    | 59.568   | 37.581   | 34.767   | 32.574   | 30.928          | 60                  |
|                | 60         | 57.353                    | 41.410   | 31.680   | 30.984   | 29.929   | -               | 65                  |

(g) Earnings-related benefit factors

Such factors were developed in a manner similar to that used in the development of retirement benefit factors described in 6 above, multiplied by 0.75, to allow for the difference in the benefit formula.

(h) Final adjustment

For age group 60-64, benefits were reduced appropriately to account for those assumed to start receiving retirement benefits in that age-group after 1986.

8. Disabled Contributor's Child's Benefit\*

- (a) It was assumed that all children under age 18 would be entitled to benefits if a parent was in receipt of a disability pension, but that no children age 18 or over would be entitled; it was further assumed that no parent would be disabled at the time of a child's birth.
- (b) For quinquennial years and quinary age-groups and each sex separately, adult disability beneficiaries who had become disabled within the last 'n' years ( $n=5, 10, 15$  or  $20$ ), were estimated using techniques similar to those described in 7 above for the estimation of flat-rate disability benefits. The projection of adult beneficiaries was therefore based on the existing adult beneficiaries at December 31, 1985, and on estimates of future emerging beneficiaries.
- (c) The beneficiaries in (b) were divided by estimates of the population 'n' years earlier to obtain probabilities that an individual of given sex and age-group in a given year would become a disability beneficiary within the next 'n' years and survive as such to the end of the 'n' years.
- (d) A distribution of fathers and mothers of new-born children by age had been developed earlier from Vital Statistics data for 1965-69 and 1970-74, respectively. This distribution (of fathers and mothers of new-born children for male and female contributors, respectively) was applied to the above probabilities, to yield probabilities that an n-year-old child in a given year will have a father or a mother who became a disability beneficiary after the birth of the child and who survived as such to the given year.

\* Methodology unchanged from Statutory Actuarial Report No.8, except that for purposes of the proposed plan the 5% reduction in respect of children of female contributors to exclude dual benefits was removed for 1987 and later.



- (e) Summing such probabilities over all ages of the parent yielded the probability that the child would have a parent who is a disability beneficiary in a given year, and therefore the probability that the child would be entitled to a disabled contributor's child's benefit in respect of that parent in that given year.
- (f) Interpolation between the pivotal probabilities for age 'n' of the child developed in (e) yielded probabilities that a child aged 0-4, 5-9, 10-14 or 15-17 years in the given year would be entitled to a disabled contributor's child's benefit in respect of a parent of a given sex.
- (g) Applying such probabilities to the projected children's populations yielded disabled contributor's child beneficiaries; Lagrange interpolation was used to determine beneficiaries for non-quinquennial years, and beneficiaries were multiplied by the applicable amount of flat-rate benefits to yield benefits.

9. Surviving Spouse's Pension

- (a) For quinquennial years (after 1980) of first spouse's death, male deaths (for widows' benefits) and female deaths (for widowers' benefits) were derived, for each quinary age except 0, 5 and 10, consistent with the population projections described in 3 above and multiplied by proportions married at death to obtain married deaths. The proportions married at death were derived from actual experience as shown in Vital Statistics for the particular calendar years 1960, 1965, 1970, 1975 and 1980. For the years after 1980, proportions were extrapolated on the basis of these five series of actual values. Sample values are shown below.

Schedule 14

Proportions Married at Death  
(percent)

| AGE   | MALES       |             |              | FEMALES     |             |              |
|-------|-------------|-------------|--------------|-------------|-------------|--------------|
|       | <u>1975</u> | <u>2000</u> | <u>2015+</u> | <u>1975</u> | <u>2000</u> | <u>2015+</u> |
| 20-24 | 19          | 13          | 13           | 35          | 18          | 18           |
| 25-29 | 49          | 30          | 30           | 59          | 46          | 45           |
| 30-34 | 62          | 55          | 54           | 72          | 55          | 54           |
| 35-39 | 68          | 62          | 62           | 75          | 62          | 62           |
| 40-44 | 73          | 63          | 63           | 77          | 68          | 68           |
| 45-49 | 75          | 67          | 67           | 79          | 76          | 76           |
| 50-54 | 76          | 68          | 68           | 76          | 74          | 74           |
| 55-59 | 77          | 74          | 74           | 70          | 71          | 71           |
| 60-64 | 77          | 76          | 76           | 63          | 62          | 62           |
| 65-69 | 75          | 77          | 77           | 52          | 51          | 51           |
| 70-74 | 70          | 74          | 74           | 40          | 41          | 41           |
| 75-79 | 65          | 70          | 70           | 28          | 27          | 27           |
| 80-84 | 55          | 63          | 64           | 19          | 16          | 16           |
| 85-89 | 42          | 58          | 59           | 10          | 10          | 10           |
| 90+   | 29          | 33          | 33           | 4           | 3           | 3            |

- (b) To determine numbers of emerging widows and widowers eligible for flat-rate benefits, married deaths were multiplied by an estimated probability of the deceased spouse being insured for the spouse's benefit, based on participation rates during his/her contributory period.
- (c) For earnings-related benefit purposes, married deaths were multiplied by earnings-related benefit factors, developed by a procedure similar to that used for retirement benefit factors described in 6 above. Theoretically, as for earnings-related disability benefits, they should also be multiplied by proportions of earnings insured for spouse's benefits. However, since the eligibility requirements are less severe than those for disability benefits, it was felt that such proportions would be close to unity and that this refinement was not necessary.
- (d) Both numbers of insured married deaths and emerging earnings-related benefits were then distributed by age of surviving spouse using relative age distributions of husbands and wives as derived from the 1976-80 experience under the Plan.

- (e) Comparisons of actual benefits that emerged during the 1976-80 period with those estimated to emerge, using the above techniques, indicated that our procedures and assumptions tend to overestimate benefits emerging, for that period at least. There may be several reasons for this. For example, no allowance was made for considerations such as (i) the mortality of married contributors possibly being lighter than general population mortality, (ii) the fact that not all eligible survivors apply for benefits, and (iii) the non-entitlement or the reduced entitlement to benefits of survivors under age 65 because of the absence of children and disability while the survivor is under age 45. However, it was also felt that the importance of some of these factors would diminish with time. Consequently, it was decided to reduce our estimates of benefits emerging, determined by the above methods, by application of the following factors varying by sex, type of benefit and year of emergence:

Schedule 15

| Calendar<br>Year | Widows        |                      | Widowers      |                      |
|------------------|---------------|----------------------|---------------|----------------------|
|                  | Flat-<br>Rate | Earnings-<br>Related | Flat-<br>Rate | Earnings-<br>Related |
| 1990             | 0.95          | 0.90                 | 0.65          | 0.50                 |
| 1995             | 1.00          | 0.95                 | 0.70          | 0.55                 |
| 2000+            | 1.00          | 0.95                 | 0.75          | 0.60                 |

- (f) These quinquennially emerging surviving spouses and their earnings-related benefits were then projected to subsequent quinquennial years using mortality rates described in paragraph 3(c) above. For purposes of the existing plan the assumed remarriage rates were as follows:

For widows, rates described in the paper "Remarriage Experience under the Pension Act of Canada" (Transactions of the Society of Actuaries, Volume XII), based on the 1940-1957 experience which are somewhat lower than the rates experienced across Canada in more recent periods and consequently may result in some overstatement of widows' benefits, and

for widowers, rates of remarriage developed from some rather scanty data available in the Vital Statistics publications and adjusted so as to produce approximately the same proportionate overstatement in benefits as the rates used in the valuation of widows' benefits.

- (g) Survivors under age 65 were multiplied by flat-rate benefit amounts, and both earnings-related benefits and flat-rate benefits were increased by the required Pension Index escalation.

Reductions to benefits in respect of survivors under age 45 who are without dependent children and not disabled were ignored.

- (h) For surviving spouses entitled to a retirement benefit, there is a two-step limit on the combined surviving spouses' and retirement pensions available. Since the full retirement pension is assumed to be payable in our estimates of retirement pensions, estimates of surviving spouses' pensions had to be reduced to take this limit into account. The required reductions were estimated on the basis of hypothetical distributions of surviving spouses' and retirement pensions around their mean value.

Surviving spouses under age 65 who are also entitled to disability pensions are subject to a similar limit on their combined pensions, but this was ignored.

- (i) The foregoing steps produce earnings-related benefits and flat-rate benefits for each quinquennial calendar year following each quinquennial year of widowhood after 1980. Interpolating between the figures for quinquennial years of widowhood and summing the results, produced benefits for all quinquennial years following each year of widowhood after 1980. Benefits actually in pay at the end of 1980 were projected to subsequent quinquennial years using the mortality and, in case of the existing plan, the remarriage factors mentioned in (f) and making due allowance for Pension Index escalation and the change in benefit formula at age 65. These were then added to the survivors of subsequently emerging benefits to obtain total benefits payable in quinquennial attained years. Lagrange interpolation between these results yielded benefit estimates for the intervening years.

#### 10. Orphan's Benefit\*

- (a) It was assumed that all children under age 18 of deceased insured parents would be entitled to benefits, but that no children over age 18 would be entitled.
- (b) Age distributions of fathers and mothers of new-born children\*\* were projected "n" years (n=5, 10, 15 or 20) to determine probabilities that a child has a deceased father or mother who would have belonged

\* see footnote on page 63

\*\* see 8(d) above

to a certain age-group if he or she had survived. Such probabilities were reduced for early years of the Plan to exclude the probability of dying before January 1, 1968 since such deaths would not have been insured.

- (c) The probabilities developed in (b) were multiplied by the proportions of parents insured for orphans' benefits at date of death, taken as a uniform .98 for fathers but varying according to year and age at death for mothers; the year and age at death were assumed to be at the mid-point of the period of exposure to death inherent in the probabilities developed in (b). The percentages of mothers insured for orphans' benefits are as follows:

| <u>Age-Group</u> | <u>1975</u> | <u>2000</u> | <u>2025</u> | <u>2050</u> |
|------------------|-------------|-------------|-------------|-------------|
| 20-24            | 72          | 77          | 77          | 77          |
| 25-29            | 68          | 82          | 82          | 82          |
| 30-34            | 61          | 80          | 81          | 81          |
| 40-44            | 45          | 78          | 80          | 80          |
| 50-54            | 45          | 73          | 78          | 78          |
| 60-64            | 36          | 63          | 75          | 75          |

- (d) The probabilities as adjusted in (c), summed over all ages of the parent, produced the probability that a child age 'n' in a particular year would be entitled to an orphan's benefit. Interpolation between those pivotal values yielded probabilities that children aged 0-4, 5-9, 10-14, or 15-17 in that year would be entitled to orphans' benefits in respect of a parent of a given sex. Such probabilities, when applied to the projected children's population, yielded orphan beneficiaries. In the case of the existing plan, the orphan beneficiaries in respect of female contributors were reduced by five percent to allow for the fact that a child cannot simultaneously receive benefits in respect of both of his parents. Since the calculations had been carried out for quinquennial years only, Lagrange interpolation was used to obtain beneficiaries for other years. Benefits were determined by multiplying beneficiaries by the flat-rate amount of benefit adjusted in accordance with the Pension Index.
- (e) Benefits projected for the early years following the valuation date by the above procedures turned out to be unreasonably high in comparison with benefits that have been paid in recent years and were reduced to allow for recent experience. However, it is likely that the long-run estimates will also turn out to have a considerable margin of conservatism.

11. Death Benefit

Estimated deaths, derived consistent with population projections described in 3 above, were multiplied by earnings-related benefit factors developed by a procedure similar to that used for retirement benefit factors described in 6 above, but representing the value of half a year's instead of a full year's pension payment. The resultant death benefit estimates were reduced to allow for the fact that the death benefit cannot exceed 10% of the YMPE for the year of death.

12. Split of Pensionable Earnings on Divorce or Annulment of Marriage, and Child Raising Drop-out

The assumptions described above were used for making preliminary estimates without taking into account the plan provisions for (a) an equal split between spouses of unadjusted pensionable earnings credits during their marriage upon application by either spouse after termination of the marriage by divorce or annulment and (b) the option to drop out years of earnings during which a contributor had care of a child under age 7 in determining benefit amounts if to the advantage of the contributor.

Sets of adjustment factors were developed and applied to benefits as determined above to take into account both of these provisions.

- (a) For the first of these provisions, a second set of estimates was made assuming that total unadjusted pensionable earnings of both spouses earned during their marriage would be split equally between them on a year-to-year basis in all cases.

Adjustment factors were then based on the assumption that final estimates should reflect 9/10 (14/15 for spouses' benefits) of the figures generated by the first set of estimates, plus 1/10 (1/15 for spouses' benefits) of the figures generated by the second set of estimates.

The split of unadjusted pensionable earnings on marriage termination has an effect on benefits varying according to their categories, particularly subdivisions by sex of contributor, but it has very little effect on the aggregate level of benefits, and for such purposes might well have been ignored.

- (b) For the second of these provisions, earnings-related benefits payable in respect of female contributors were increased by adjustment factors to allow for the child raising drop-out provision. These adjustment factors were calculated as follows:

- (i) It was assumed that the average female contributor would have two children, separated two years in age, so that she would be potentially eligible for nine additional years of drop-out, representing approximately 20% of her contributory period.
- (ii) It was estimated that in the long run retirement benefits for female contributor would be increased 17% if the regular drop-out provision were increased from 15% to 35%. It was felt that this would overstate the effect of the child raising drop-out provision in that a modification in the regular drop-out provision from 15% to 35% would permit dropping out an additional 20% years of lowest earnings while the child raising drop-out provision only permits dropping out the actual years of care of children which may not be those of lowest earnings. It was decided to assume that the child raising drop-out provision would have only half the effect of a modification in the regular drop-out provision from 15% to 35%, i.e., would increase female retirement benefits in the long run by 8.5%.
- (iii) In the short run, the effect on retirement benefits would be much less, e.g., it would be very small for a female aged 40 at the inception of the Plan since she would be unlikely to have years of child raising in her contributory period. Consequently, the 8.5% increase in female retirement benefits, assumed applicable from 2025 onwards, was graded down to much lower percentages for earlier years.
- (iv) While the effect on other earnings-related benefits varies according to age at emergence and is therefore not identical with that on retirement benefits, nevertheless for simplicity and because of their relative unimportance, the factors developed for female retirement benefits were also applied to other earnings-related benefits in respect of female contributors.

The Child Raising Drop-out provision, which was assumed to apply only in respect of benefits attributable to female contributors, has a much more significant effect on the aggregate level of benefits than the splitting of pensionable earnings and, of course, operates so as to increase that level.

### 13. Fund Projections

- (a) The Fund, for the purpose of this report, is assumed to correspond to the amount to the credit of the Canada Pension Plan Account.
- (b) Annual investments in provincial bonds prior to 1986 are known, but for various reasons\* are less in total than the amount to the credit of the Canada Pension Plan Account at December 31, 1985. They were adjusted proportionately so as to match the said credit.
- (c) The annual amounts of interest earned on the investments made each year prior to 1986 are also known and were adjusted in proportion to the adjustment in the investments.
- (d) Amounts invested in each future year were taken as equal to contributions for the year minus benefits for the year, plus one year's interest on outstanding investments, plus prior investments maturing during the year.
- (e) The investments in any future year are assumed to earn interest until maturity at the annual rate of interest on new investments postulated in the economic assumptions for the year of investment.
- (f) Normally, investments are assumed to mature after 20 years. However, the program provides that if the amount to be invested in any year, calculated by the formula in (d), and assuming 20-year maturities, should turn out to be negative, additional maturities are assumed in that year, sufficient to provide a positive investment, (and sufficient cash released in that year to meet all expected payments). Such additional maturities are assumed to be on a last-in, first-out basis.
- (g) The Fund at the end of any year was taken as the sum of the outstanding investments.

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\* Primarily due to the statutory requirement for the retention of an amount deemed necessary to pay three months' expenditures.



14. Entry-Age Normal Actuarial Cost and related Unfunded Actuarial Liability\*

(a) Entry-Age Normal Actuarial Cost (current service contribution rate)

This was determined by estimating contributory earnings and benefits and expenses in respect of the quinary age-group cohort centered around age 18 on December 31, 1985 and determining (by an iteration process as well as our usual fund accumulation methods) the contribution rate that would be exactly sufficient to accumulate a nil fund in respect of that cohort at the expiration of all contributions and expenditures in respect of that cohort. The entry-age normal actuarial cost was taken to be the contribution rate so determined.

(b) Unfunded Actuarial Liability

An amount "A", hypothetically invested in mid-1986, was determined by an iteration process such that together with (i) the fund at December 31, 1985, (ii) future (post-1985) contributions at the entry-age normal actuarial cost rate collected in respect of the population aged 18 and over on December 31, 1985 and (iii) investment earnings, it would be just sufficient to pay all future benefits and administrative expenses in respect of those aged 18 and over on December 31, 1985. The unfunded actuarial liability at December 31, 1985 was taken as the amount "A" discounted for one-half year's interest.

(c) Economic Assumptions

For reasons explained in Appendix C, only the ultimate economic assumptions are used for purposes of (a) and (b) above.

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\* see Appendix C

Appendix C

ESTIMATES OF CONTRIBUTION RATES BASED ON "ACTUARIAL FUNDING" AND  
DEVELOPMENT OF RELATED "UNFUNDED ACTUARIAL LIABILITY"\*

In the field of private pensions, normal actuarial funding serves three main purposes

1. It recognizes and aims to meet the estimated real cost of pension obligations at the time the benefits are deemed to be earned and thus prevents inappropriate deferment of costs.
2. The plan sponsor transfers the accrued pension obligations to trustees or an insurance company, and thus the security of the pensions is not tied to the fortunes of the sponsor (normally the employer).
3. Costs tend to be stable and are conducive to the orderly conduct of the sponsor's business.

In social insurance, while it is possible to calculate a "normal actuarial cost" (current service contribution rate), there appear to be great difficulties not only in applying the technique of "actuarial funding" but in applying the objectives or even some of the basic concepts.

On a national basis, it is not clear to what extent pensions can be prefunded and thus a "deferment of costs" avoided. Moreover, if actuarially calculated contributions are collected, it is often feared that the colossal investment funds that are generated would lead either to unwarranted government projects or to indirect government control over the private sector through the investment of social insurance funds. In any case, it is not easy to demonstrate how the payment of pensions in the distant future would be facilitated or savings increased, although the direct link between concurrent contributions and benefit payments would be eliminated and future productivity might well be enhanced by prudent investments.

Achieving security through funding does not seem possible in social insurance, because a country cannot divest itself of its pension obligations, unless it were to export the required savings and this did not itself constitute a reduction in security.

Finally, stability of costs as reflected in contribution rates can usually be effected in social insurance without recourse to actuarial funding.

\* For additional details on methodology and assumptions see preceding page.

Because of the above reasons and imponderables, the application of the principles of "actuarial funding" is usually considered inappropriate in the field of social insurance. Nevertheless, it is interesting and informative to calculate the level of the contribution rate that might be considered appropriate, if the benefits provided by the Canada Pension Plan were to be funded by means of a normal pension trust. Moreover, the Auditor General of Canada suggested in 1977 that information based on principles of "actuarial funding" be made public and, accordingly, such information was included for the first time with Statutory Actuarial Report No.6.

The rates of contribution quoted in this appendix were developed by the entry-age normal actuarial cost method, which aims at a level percentage of contributory earnings to be contributed during the active lifetime of a normal cohort of entrants sufficient to support all benefits payable to them and their beneficiaries.

It must be noted that, as indicated in the chart below, certain assumptions do not affect contribution rates according to the entry-age normal actuarial cost method in the same way as they affect the pay-as-you-go contribution rates presented in this report (e.g. Table 10).

| <u>Parameter changed</u>              | <u>Effect on CPP Contribution Rate</u> |  |
|---------------------------------------|--|--|
|                                       | <u>Pay-as-you-go</u>                   | <u>Entry-age normal</u>  |
| (i) Real rate of increase in earnings | varies inversely                       | may vary directly or inversely depending on net effect of change in real interest rate, change in effective deferred period discount (interest rate less rate of earnings increases), and level of inflation |
| (ii) Interest rate                    | independent                            | varies inversely, other things being equal (see (i) above)   |
| (iii) Fertility                       | varies inversely                       | negligible (affects only volume of children's benefits)  |
| (iv) Immigration                      | varies inversely                       | varies directly  |

The concept of an entry-age normal actuarial cost (contribution rate) engenders the concept of an unfunded actuarial liability arising out of the lack of contributions prior to the inception of the plan, the collection of contributions since the inception of the plan at a rate below the entry-age normal rate and several other less significant sources.

As described on page 72 the unfunded actuarial liability is calculated as the amount which would theoretically be required to be invested in the year following the valuation date and is therefore extremely sensitive to the rate of interest assumed applicable for that year. For example, if there is

a drop in interest rates, all other things being equal, the unfunded liability would appear to have increased very substantially in the following year, merely because the amount of the unfunded liability was not invested during a year of high interest rates. In order to avoid such somewhat artificial fluctuations, the calculations for purposes of this Appendix (as in the case of Report No.8) were based on the ultimate economic assumptions only.

The unfunded actuarial liability may be expected to grow (i) by the amount of interest not earned thereon at the assumed rate and (ii) by the difference between contributions at the hypothetical entry-age normal actuarial cost rate and contributions actually collected and by interest not earned on this difference. These increases in the unfunded actuarial liability are offset to some extent by the difference between interest at the actual and assumed rates (and there may be other sources of gains and losses). Thus, for example, the estimated unfunded actuarial liability of \$280 billion shown below on basis A as at December 31, 1985 may be expected to increase to about \$305 billion by December 31, 1986.

The results of our calculations are as follows:

| Basis | Economic Assumptions** |                          |                           | Entry Age Normal Actuarial Cost (%)* | 1985 Unfunded Actuarial Liability (\$billions) |
|-------|------------------------|--------------------------|---------------------------|--------------------------------------|--|
|       | Increase in CPI (%)    | Increase in Earnings (%) | Interest on New Bonds (%) |                                      |  |
| A     | 3.5                    | 5.0                      | 6.0                       | 9.45                                 | 280  |
| B     | 3.5                    | 5.0                      | 6.5                       | 8.08                                 | 254  |
| C     | 6.0                    | 8.0                      | 8.5                       | 10.14                                | 295  |

It might be added that the liquidation of the unfunded actuarial liability is unlikely to be advocated because such a course would enhance neither the security of benefit payments nor intergenerational equity.

\* Percent of contributory earnings.

\*\* The assumptions shown for A are the new ultimate assumptions adopted for purposes of this report. The assumptions shown for B are the ultimate assumptions used for purposes of Report No.8 and clearly differ from those for A only in respect of the rate of interest which is 0.5% greater than for A. Basis B is thought to be more appropriate for purposes of comparison with pension costs for private pension plans. The assumptions for C are those adopted by the Business Committee on Pension Policy in its 1983 Cost Study; they imply the same real interest rate (interest rate less increase in CPI) as for A, but increases in real earnings (increase in earnings less increase in CPI) that are 0.5% higher than for A and B. All other relevant assumptions are the new assumptions used for purposes of the Proposed Plan as described in Appendix B.