

**The Equalization Program and
the Property Tax Base**

**Feasibility Study
Conducted by
Statistics Canada**

Feasibility Report to Finance Canada

February 28, 2005

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1. Executive summary

In the fall of 2003, Finance Canada opened discussions with Statistics Canada (STC), prompted by the 2004 Equalization Program renewal, and asked STC to assess the feasibility of developing and maintaining new statistics related to the property tax base. The property tax base is the second largest of the 33 bases in the Equalization Program and determines approximately \$2.5 billion of the total entitlements of \$9.7 billion.¹

In January 2004, STC submitted a feasibility study proposal to Finance Canada (FC). The objectives of the study were (1) to determine FC's specific data requirements regarding the property tax base in the context of the Equalization Program; (2) to enable STC to assess the feasibility of producing such statistics; and (3) if feasibility is proven, to enable STC to propose to FC a work plan for implementation (with estimated cost for the development and ongoing production phases). The feasibility study officially started on May 17, 2004 and was completed on February 28, 2005.

FC asked STC to determine its capacity to produce, at the national, provincial and municipal level,² the following annual data:

- residential and non-residential property values at market prices
- residential and non-residential property and property-related tax revenues
- population estimates.³

The results of our investigation and testing of STC's capacity to provide data to FC as described above, in accordance with FC's variable specifications,⁴ are in most cases positive. The evidence gathered supports the view that the data can be produced—with a few exceptions that concern the non-residential property value and tax revenue data, and the property-related tax data.

To arrive at these conclusions, STC

- conducted a number of statistical evaluations, including a field test and focus groups
- hired and consulted with experts in the field of property appraisal
- consulted with representatives from provincial and municipal property assessment authorities as well as provincial ministries of municipal affairs
- examined related international practices.

This report contains the study findings for each data requirement and provides FC with a work plan for implementation along with estimated costs for the development and ongoing production phases. The work plan contains a number of options from which FC can choose.

Survey of residential property values at market prices

The field test and focus groups conducted during the study have provided invaluable lessons on how a survey of residential property values at market prices can be developed and on its associated operational logistics. The field test certainly suggests that sufficiently effective respondent relations materials can be developed to secure acceptable response rates. The field test has also enabled STC to examine and to test some collection logistics and to identify areas requiring further development. Finally, the field test (and the feasibility study more generally) has allowed STC to

1. These numbers are for fiscal year 2004/05 (as per the March 2004 Federal Budget).

2. There are approximately 3,700 municipalities in Canada.

3. Population estimates at the provincial level are already provided to FC.

4. It should, however, be noted that for a number of cases, a final decision is required on the specifics of a few of the data requirements.

develop a fruitful relationship with a number of key players in the field of residential property appraisal in Canada. All the information gathered and analysed during the study leads to the conclusion that the development and the operation of an annual survey of residential property values at market prices is feasible. In our opinion, such a survey is the only means to ensure that interprovincial comparability of residential property values at market prices is demonstrably achieved.

The work plan for the proposed survey contains three options. Each reflects a different level of precision for the resulting estimates and for the associated sample sizes required to reach these levels. Given these differences, the costs of each option also differ. Each option shares the following basic survey elements and work activities: the list (frame) of properties from which the sample will be drawn, sample design, data collection, edit and imputation, weighting and estimation, data validation and quality control, and data dissemination. The table below summarizes these options and provides some key planning elements.

Table 1			
Survey of residential property values at market prices:			
Options according to level of precision			
Survey covering the 10 provinces	Option 1	Option 2	Option 3
Level of precision: coefficient of variation of the total property value by province ¹ (%)	1.0	1.5	2.0
Effective sample size required (number of properties)	16,100	10,400	7,700
Reference period (property value as of July 1)	2006		
Costs, ² (of which fees paid for certified appraisers)	\$ millions		
2005/06	5.4 (0.0)	5.4 (0.0)	5.4 (0.0)
2006/07	14.3 (8.3)	11.3 (5.7)	9.5 (4.1)
2007/08	14.4 (8.3)	11.4 (5.7)	9.6 (4.1)
Availability of preliminary results for 2006 survey, assuming project starts by April 1, 2005	December 2007		
Data accountability:	Provincial estimates Municipal estimates	Statistics Canada Finance Canada	
Survey covering the 3 territories³			
Level of precision: coefficient of variation of the total property value by territory (%)	2.0	3.0	4.0
Effective sample size required (number of properties)	825	625	525
Costs, ² (of which fees paid for certified appraisers)	\$ millions		
2005/06	0.3 (0.0)	0.3 (0.0)	0.3 (0.0)
2006/07	1.4 (0.9)	1.1 (0.7)	1.0 (0.6)
2007/08	1.4 (0.9)	1.1 (0.7)	1.0 (0.6)

1. The coefficient of variation (CV) of the total property value would be equal for all provinces except Ontario, where the CV would be higher: 2%, 2.75% and 3% for options 1, 2 and 3, respectively.
2. Internal co-ordination and external liaison costs for all project components (property values, property tax revenues and population estimates) would need to be added to these amounts. The combined cost is about \$0.4 million.
3. The reference period, the availability date of the preliminary results and the data accountability for the territories are the same as those in the survey covering the 10 provinces.

Implementation of the program described in this report could start as early as April 1, 2005 (provided that the funding has been allocated). The earliest year for which data could be produced under this scenario is for a valuation as of July 1, 2006 for the volume of properties taxable in 2006. These data (preliminary version) would be made available in December 2007. Depending on the desired level of precision, the survey costs vary from \$9.5 million to \$14.3 million (fiscal year 2006/07) for the 10 provinces. For the territories, the survey costs vary from \$1.0 million to \$1.4 million (fiscal year 2006/07). It is worth mentioning that appraisal services will be required in 2006/07 and the years thereafter and will represent approximately 60% of the total survey costs.⁵

However, it may be necessary for FC to obtain estimates for earlier reference years. The table below presents the additional cost that would be incurred in the first year of collection if two sets of appraisals were done on the sample for 2006. Appraisers would value the properties as of both July 1, 2005 and July 1, 2006.⁶ This option is only presented in order to provide FC with data for the earliest possible reference year. This approach would be a one-time addition and is not envisioned for the subsequent survey years.

Table 2 Survey of residential property values at market prices			
Survey covering the 10 provinces	Option 1	Option 2	Option 3
One reference year (property value as of July 1, as per Table 1)	2006 only		
Costs for reference year 2006, (of which fees paid for certified appraisers) as per Table 1	\$ millions		
2006/07	14.3 (8.3)	11.3 (5.7)	9.5 (4.1)
Two reference years (property value as of July 1)	2005 and 2006		
Costs based on 2006/07, (of which fees paid for certified appraisers)	\$ millions		
	21.1 (14.9)	16.0 (10.3)	12.9 (7.4)
Survey covering the 3 territories			
One reference year (property value as of July 1, as per Table 1)	2006 only		
Costs for reference year 2006, (of which fees paid for certified appraisers) as per Table 1	\$ millions		
2006/07	1.4 (0.9)	1.1 (0.7)	1.0 (0.6)
Two reference year (property value as of July 1, as per Table 1)	2005 and 2006		
Costs based on 2006/07, (of which fees paid for certified appraisers)	\$ millions		
	2.1 (1.5)	1.7 (1.3)	1.5 (1.1)

5. An exceptionally high proportion of the costs of the proposed survey (80% in the case of option 1) are non-salary costs. This is primarily due to appraisers' fees, data acquisition payments to provincial assessment agencies, and payments to Public Works and Government Services Canada for providing quality control services and an interface with the appraisal industry. These costs are beyond the control of STC. While departmental budgets are escalated to reflect growth in salary costs, no routine mechanism exists to do the same for non-salary expenditures. At some point in the future, if STC productivity gains do not keep pace with escalating non-salary costs, STC may have no choice but to reduce data quality (e.g., by reducing the sample size) in order to maintain the balance between the survey's budget and its costs. FC will be consulted before any action of this sort is implemented. If such reductions in data quality would result in data that would no longer meet FC's requirements, it will be necessary to seek FC's support in pursuing supplementary funding from the Treasury Board.

6. While the quality of the appraised value is diminished for retrospective appraisals, the level of quality is still acceptable and would not interfere with the overall quality of the results.

In making its choice of options, it may be of use to FC to know that a coefficient of variation of 1.5% (option 2) would make the precision of this survey similar to that of many major economic estimates published by STC (e.g., estimates relating to major industries). This is the level of reliability that STC views as making the data fit for most users. However, from FC's perspective, there is only one use in question and that is the calculation of Equalization entitlements. FC may, therefore, wish to select a higher level of precision (option 1) since this level may be deemed by FC as making the data more fit for Equalization, or a lower level (option 3) if costs are viewed as a critical constraint.

STC will be accountable for the statistical quality of the provincial / territorial survey results and, in signing the certificate, the Chief Statistician will be attesting that the statistics accurately represent what they purport to represent. FC will be accountable for the municipal property values estimates, and, the Chief Statistician will be attesting that the data have been generated according to the methodological specifications laid down by FC.

Residential and non-residential property values based on the municipal assessment rolls

FC has additionally requested that STC explore the production of aggregate residential and non-residential property value data (at market prices) at the provincial and municipal level based on municipal assessment rolls (MARs).

Two options for implementation are presented. The first one, the simplest (and costing about \$0.7 million per year), uses adjustment techniques at an aggregated level to make the MARs more comparable across provinces. These adjustments could be performed for both residential and non-residential properties. Adjustments are required in terms of coverage, property classification and reference dates. The other option (costing in excess of \$2.6 million per year) still uses algorithms to make the MAR data more comparable across provinces, but it does so at a much finer level of details (i.e., microdata, or individual records for each property). These adjustments could be performed for residential properties only. For the non-residential properties, STC is not proposing any adjustments based on sales transaction microdata⁷.

The difference in costs for the two options is mainly due to the need to acquire microdata (MARs) and to higher salary costs resulting from the increase in complexity and scope to develop and maintain adjustment algorithms.

Assuming the project starts by April 1, 2005 (provided that funding has been made available), using option 1 ('macro-level' adjustment), STC would be able to provide to FC in December 2006 MARs-based provincial and municipal (preliminary) estimates of residential and non-residential property values for reference year 2004 as per the methodology described in this report. Estimates using micro-level adjustments would be available in August 2007.

Data produced by adjusting the MARs, while potentially having improved interprovincial comparability, have unknown statistical properties. If FC elects to choose one of the MARs options described in this report, STC will certify only that the data have been generated according to the FC methodology. STC will not be accountable for these data.

7. For the non-residential properties, the prospects of being able to make micro-level adjustments are not good. The number of sales of non-residential properties each year appears to be low when compared with residential properties. When this is combined with the extreme heterogeneity of business properties (even among businesses in the same industry), there is little prospect of being able to create adjustment strata containing enough properties to yield meaningful results. If one persisted in spite of these limitations, excessive year-to-year changes in the results are likely to occur.

Property tax revenues

FC requested that STC provide property tax revenue, by province and for each municipality, with the following dimensions:

- residential
- non-residential
 - farm
 - commercial/industrial
 - other

FC also asked for property-related taxes such as land transfer taxes, by province, but reported separately.

In terms of the data for residential and non-residential tax revenues, it is essential for FC's purposes that the types of properties giving rise to residential and to non-residential tax revenues (i) be comparable across the provinces and (ii) reflect the taxation practices of the majority of provinces

STC has concluded that conventional property tax revenues can be provided according to FC's specifications and that they can be produced with sufficient precision that STC is conditionally prepared to be accountable for these data at the provincial level but not at the municipal level.

Data on property-related taxes are another matter. Property-related taxes collected by the municipalities, such as lot levies, are available by municipality but cannot be disaggregated into residential and non-residential portions. Property-related taxes collected by the provinces (primarily, land transfer taxes) cannot readily be disaggregated by municipality or by residential/non-residential designation.

The methodology proposed is to a significant extent an extension of an important element of the methodology currently used in STC's local government finance program. Specifically, all of the provinces collect tax revenue data from each of the municipalities in their province. STC has historically asked for and received only total property tax revenue since that was all that had been required for its own purposes and for providing data for Equalization. Contact during this study with the provincial governments revealed that they could additionally provide a residential/non-residential breakdown, and within the non-residential category, subcategories as noted above.

However, the types of properties labeled residential and the types labeled non-residential are not uniform across provinces, and as noted, consistency across provinces is essential for FC.

Since detailed breakdowns of the broad residential and non-residential tax categories are not available from most provinces, the movement of revenues between residential and non-residential to achieve interprovincial comparability is not possible on the basis of tax revenue data alone.

However, it is possible to take advantage of the fact that the types of properties within the broad residential and non-residential categories are designated by the provincial assessment authorities and applicable to all municipalities within a given province. These property types are believed to be recorded in municipal assessment roll (MAR) microdata that were investigated in other parts of this study.

The plan is to use municipal-level data on aggregate assessed value by property type, combined with municipal mill-rate information, to yield the detailed revenue-by-type data that are not available from the revenue data collected by the provinces. This same technique also has the potential to create interprovincially comparable data on the subcategories of non-residential property data requested by FC.

Assuming the project starts by April 1, 2005, STC will be able to submit to FC in August 2007 property tax revenues data (as described in this report) for reference year 2004. This is not an ideal level of timeliness but it reflects the current delivery dates for the input data for some provinces. The annual costs of producing these data would be \$1.9 million (covering the provinces only) and about one hundred thousand dollars for the territories. STC will work with the provinces in question to shorten the time required between the finalization of municipal accounts and the delivery of municipal-level data for the entire province.

Population estimates at the census subdivision (municipality) level

A number of estimation techniques for producing municipal data—at the level of the census subdivision (CSD)—were evaluated on the basis of their performance in the period 1996 to 2001. These are the main findings:

- a) The *cohort-component method*, which is used to produce the existing official subprovincial population estimates (at the census metropolitan area and census division levels) cannot, at this point in time, be reproduced at the municipality (CSD) level.
- b) CSD-level population estimates produced with the three STC census-based methods are of lower quality than STC's official provincial/territorial and subprovincial estimates.
- c) Among the three STC methods, the *current CD growth rate* method is the best, giving slightly better results than the *previous intercensal growth rate* method, which is the current method used by STC to produce unpublished CSD estimates.
- d) For all methods, the quality of the estimates improves as the CSD population gets larger.
- e) CSD-level population estimates produced by three provincial/territorial statistical agencies (Quebec, British Columbia, Northwest Territories) were all found to be of better quality when compared with those based on any of the three STC methods.

Five methodological options can be considered for implementation. These options include the three methods presented by STC, plus two of the STC methods combined with those by the provincial/territorial statistical agencies that produce CSD-level population estimates. The estimates produced by Quebec, British Columbia and the Northwest Territories are based on data sources that cannot be replicated throughout the country. Therefore, the options suggesting the use of estimates produced by the provincial/territorial agencies, while giving better results for these jurisdictions, do not strictly provide the same level of interprovincial comparability as provided by the three STC methods. This is, however, a tightly constrained source of non-comparability.

Assuming the project starts on April 1, 2005, preliminary data for reference year 2004 (as of July 1) would be available in June 2005. The annual costs to produce the requested statistics range from about \$170,000 to \$210,000, depending on the selected option.

If FC considers that one (or more) of the proposed options meets its specific requirements, STC will certify that the data have been generated according to the FC methodology but will not be accountable for the statistical quality of these data.

2. Context and objectives

The federal government transfers funds to the provincial and territorial governments on an annual basis to assist them in the provision of programs and services. The vast majority of these transfers are done through five major transfer programs: the Canada Health Transfer, the Canada Social Transfer, the Health Reform Fund, Equalization and Territorial Formula Financing.

The Equalization Program, in effect since 1957, permits Canadians from all provinces to receive comparable levels of public services at comparable levels of taxation. Finance Canada (FC) is the organization responsible for the determination of the Equalization formula and the associated payments to the provinces. For fiscal year 2004/05, these payments are estimated at \$9.7 billion.⁸ Statistics Canada (STC) is the key provider of the data used in the formula for calculating these payments.

The Equalization Program is reviewed and renewed every five years to ensure the integrity of the formula. In the fall of 2003, FC opened discussions with STC about the 2004 Equalization renewal and asked STC to assess the feasibility of developing and maintaining a new database related to the property tax base, covering elements such as residential property values and residential property taxes as well as population estimates by municipality. The property tax base is the second largest in the Equalization Program, accounting for just under \$40 billion in provincial/local revenues. The property tax base alone determines approximately \$2.5 billion of the total entitlements of \$9.7 billion.

On January 16, 2004, STC submitted a feasibility study proposal to FC.⁹ As described in the proposal, the objectives of the study were threefold: (i) to determine FC's specific data requirements regarding the property tax base in the context of the Equalization Program; (ii) to enable STC to assess the feasibility of producing such statistics; and (iii) if this is proven to be feasible, to enable STC to propose to FC a work plan for implementation along with estimated costs for the development and ongoing production phases.

The feasibility study officially started on May 17, 2004 and was completed on February 28, 2005.

It is worth noting that, during the feasibility study, three detailed status reports were sent to FC at regular intervals.¹⁰ The status reports described in detail, for the overall study and each main data requirement, the following: objectives; progress and achievements to date; problems and issues under consideration; upcoming activities, challenges and deliverables. Some of the findings contained in this feasibility report have previously been presented in the status reports.

For each of the three broad FC data requirements, this feasibility report contains a description of the work undertaken by STC to assess its capacity to produce the required statistics as well as the feasibility conclusions. A work plan for implementation is also presented for the cases where STC concluded that it is feasible to produce the data requested by FC. The work plan also includes a

8. These numbers are for fiscal year 2004/05 (as per the March 2004 Federal Budget).

9. The January 16, 2004 study proposal did not address the requirement for data on non-residential properties (values and tax revenues) as it was not, at that time, known to be a FC data requirement. This requirement was officially stated on June 11, 2004.

10. They were sent to FC on July 16, September 17 and November 19, 2004. Following the receipt of FC's comments, STC distributed each status report to the provincial and territorial statistical focal points.

description of the general methodological approaches as well as a timetable and estimated cost for the development and ongoing production phases.

3. Finance Canada's data requirements

FC asked for a report on STC's capacity to produce, at the national, provincial and municipal level,¹¹ the following annual data:

- residential and non-residential property values at market prices
- residential and non-residential property and property-related tax revenues
- population estimates.¹²

In the interest of the national statistical system, STC has also extended the coverage to include the three territories.

A comprehensive and precise definition of FC's data requirements was crucial in assessing our capacity to respond to these requirements. Exchanges of documents between the two organizations have occurred throughout the study to reach this objective. In these documents, STC sought clarification/confirmation from FC on several issues, including classification/coverage, property valuation, reference date and timeliness. Classification/coverage issues include the following: definition of a residential property; treatment of farms, property with a dual usage, the inclusion/exclusion of residential vacant land or institutional and communal properties; and treatment of properties on Indian Reserves. In a few of its responses, FC indicated that no final decisions had been made as things were in flux. The specifics of each data requirement are discussed in the respective sections later in the report.

4. Overall feasibility conclusions

The results of our investigation and testing of the capacity of Statistics Canada (STC) to provide data to Finance Canada (FC) as described above, and in accordance with FC's variable specifications, are in most cases positive. The evidence gathered supports the view that the data can be produced with a few exceptions. These exceptions concern the non-residential property value and tax revenue data, and the property-related tax data.

In addition to describing the conclusions reached for each data requirement, the next sections also provide a description of the methodological options considered and the general approach taken to test feasibility. A work plan for implementation (including a number of options) for each data requirement is also presented. FC can select the option(s) that best suits its needs.

11. There are approximately 3,700 municipalities in Canada.

12. Population estimates at the provincial level are already provided to FC.

Feasibility conclusions by data requirement

5. Residential property values at market prices: The survey approach

Although all provinces assert that they aim at market value assessment in the municipal assessment rolls (MARs), differences in policies and practices (including the choice of reference dates) render the data of indeterminate comparability. This common objective does not in itself provide evidence that the assessments are comparable enough for STC to certify their comparability for use by FC for Equalization. In the absence of demonstrably comparable benchmarks, it is not possible to know how interprovincially comparable the MARs in fact are. For this feasibility study, STC hired experts to provide an assessment of the interprovincial comparability of the MARs. Their assessment is discussed later in this report (in the MARs-based options in section 6).

It has been suggested on a number of occasions, both prior to and during the feasibility study, that sales (transaction) data, which provide incontestably valid market prices for individual properties, could be used to adjust the MARs to render them comparable.

This proposition has a certain intuitive appeal. However, it must be recognized that sales transactions are not randomly distributed across all properties. In other words, the subpopulation of the properties that have been sold in a given period is not a random sample of all properties in that period. Real estate markets are changing continuously with different segments selling at rates that change through time. Sales rates in the suburbs may be high relative to those in established neighbourhoods only to have the relationship reversed a short time later. The rate at which serviced land comes onto the market can change through time influencing the price of new housing compared to older dwellings. In some large urban areas, recent years have seen rapid growth in high-rise condominiums as a proportion of new construction.

It has been proposed that this problem could be overcome by creating highly specific strata for both sales and properties in general and then performing adjustments within those strata. Again, this has intuitive appeal but on closer examination it can be shown not to solve the problem. Even within a very specific stratum, there is no way of knowing, for example, whether all of the sales are at the high end (or the low end) of prices in the stratum. And, of course, the more detailed (i.e., more numerous) the strata, the smaller the subpopulation of sold properties becomes, including the possibility that there are no sales in a given stratum in a given period. (Based on available data, it is thought that about 5% of residential properties change hands each year. This varies considerably from province to province and over time.)

Finally, since it is not possible to treat the subpopulation of properties that have been sold as a random sample, there is no way to describe the quality of the resulting adjusted MAR data. In other words, one cannot estimate the sampling variance of the adjusted MAR data and so one has no idea of their quality.

Consequently, in order to achieve strict comparability in property evaluations, STC has studied the feasibility of conducting a sample survey of residential properties using independent professional appraisers applying uniform appraisal techniques. It was also indicated that survey data could extend only to the provincial level because of the costs and undue respondent burden that a probability sample survey in each municipality in Canada would involve. Municipal-level data could be model-based or synthetically derived. However, FC would be accountable for the resulting data.

Approaches for producing residential property values at market prices by municipality are discussed later (in section 5.4.2).

At FC's request, STC has also explored the production of aggregate residential and non-residential value data based on the MARs.¹³ This approach is discussed later in the report (section 6).

In order to help determine the feasibility of conducting a survey of residential property values at market prices, various survey elements needed to be researched and evaluated. These included the respondents' expected willingness to participate in such a survey, the capacity of the appraisal industry to supply the necessary services, the sample design, including the property frame (i.e., the list of properties from which the sample would be drawn), and the extent to which other countries make use of surveys to measure residential property values. The following section provides a description of this testing and evaluation work and the associated findings.

5.1 Testing and evaluation (focus groups and field test)

Focus groups were conducted to help develop respondent relations materials needed to promote participation in the survey, and a small field test was conducted to test both the respondent relations approach (including willingness to participate) and the collection logistics.

Focus groups

Over 60 individuals (both property owners and tenants) from 4 provinces (Ontario, Quebec, Alberta and Nova Scotia) participated in focus groups during the month of September 2004. The objectives of the focus groups were to find out participants' opinions and reactions to a survey on residential property values, to test an introductory letter, and to determine best practices for contacting and informing respondents (both owners and landlords/tenants).

Most participants had never heard of the Equalization Program prior to reading the introduction letter that was given to them. They requested that Equalization be explained in detail. They also required more information on why existing data (municipal assessments and recent sales transactions) are not appropriate measures. Finally, participants needed to be reassured that the information collected during the survey would not be shared with municipal authorities and could not be used to increase their property taxes. In the end, approximately 50% of participants answered that they would participate in a survey of this nature.

Based on participants' feedback, STC revised the introduction letter and designed a questions-and-answers pamphlet to address participants' most frequently asked questions.

When asked about the best way to make contact with respondents, most participants agreed that sending an introductory letter, followed by a telephone call where respondents could ask interviewers questions and obtain more information regarding the survey, would be the best way to get agreement to participate.

13. However, for the MARs option, FC would accept accountability for the results at all levels (national, provincial and municipal).

Field test: objectives

STC conducted a small field test in the National Capital Region (Ottawa and Gatineau) from mid-October to mid-December 2004. As indicated before, the objectives of the field test were to test various operational logistics and to help determine respondents' willingness to participate in a survey of residential property values.

A description of the methodology used for conducting the field test is presented in Appendix A. (Briefly stated, STC used two lists of properties to draw the sample: the Multiple Listing Services (MLS) databases and STC's Labor Force Survey (LFS). Various types of residential properties were selected. STC interviewers made the initial contact with the selected sample of property owners. Once agreement to participate was obtained, cases were assigned to certified appraisers to set up the appointments and to do the appraisal.)

Field test: findings

a) Willingness to participate (with STC interviewers)

As indicated by the results in Table 3, 64% of all respondents who were contacted by STC interviewers agreed to participate in the field test.¹⁴ This is 14% higher than we had expected, based on our focus group feedback. What is also encouraging is that these rates were achieved with very limited efforts devoted to refusal conversion. The willingness to participate was higher for Ottawa residents (65%) than for Gatineau residents (59%).

	Yes	No	Total	Yes	No	Total
Municipalities	number			%		
Ottawa	129	69	198	65	35	100
Ottawa – LFS ¹	45	26	71	63	37	100
Ottawa – MLS ²	84	43	127	66	34	100
Gatineau – LFS^{1,3}	37	26	63	59	41	100
Ottawa and Gatineau	166	95	261	64	36	100

1. LFS: STC's Labour Force Survey.

2. MLS: Multiple Listing Services databases.

3. There was no Gatineau sample selected from the MLS.

Although the response rate above is very positive, one should not infer that it is indicative of the willingness of Canadians elsewhere to participate, given the high geographic concentration of this

14. It should be kept in mind that we did not have a representative sample and, therefore, that one cannot infer much from the details. Using a sample of households that had previously been in the LFS sample for six months complicates the interpretation of the response rate for this segment of the sample, although it can be seen that the response rates of the LFS sample (61%) and the MLS sample (66%) are similar. The LFS sample is not considered as 'fresh': after having responded to the LFS for six months, respondents may have been exhausted and unwilling to participate further. On the other hand, respondents to the LFS are informed about STC and about the importance of participating in surveys.

sample. STC draws from its experience in conducting other surveys in other jurisdictions for the determination of key survey elements, such as the anticipated response rate of an ongoing survey. For cases where the respondents declined to participate in the field test, we recorded the reasons for such decision. A brief refusal analysis is presented here. The majority of respondents (47%) from the LFS sample who refused to participate did so because they had just finished participating in the LFS for six months;¹⁵ An additional 10% said they were too busy and another 10% said they were too old or ill to have someone come over to their home.

Reason for refusal	LFS ¹ sample		MLS ² sample	
	number	%	number	%
Just participated in LFS / other survey	24	47	1	2
Not interested	3	6	15	34
Too busy	5	10	7	16
Wants information package	n/a	0	6	14
Old/illness	5	10	0	0
Already appraised	2	4	1	2
Other (various reasons)	12	24	14	31
Total	51	100	44	100

1. LFS: STC's Labour Force Survey.
2. MLS: Multiple Listing Services databases.

The majority of respondents (34%) from the MLS sample who refused to participate did so because they were simply not interested. It is interesting to note that about 14% of the MLS sample refused because they had not received an information package from STC prior to the interviewer's phone call.¹⁶

When comparing the LFS reasons for refusal with the MLS reasons, certain interesting observations can be made. The obvious one is the impact of having just participated in another STC survey (24 times more people from the LFS than from the MLS refused because they had just participated in another survey). The second one is that LFS respondents were almost 5 times less likely to say they were not interested, perhaps because they had received the information package prior to the contact over the phone.

b) Willingness to participate (with certified appraisers)

The second stage of collection involved viewing of the properties by accredited appraisers. About 10% of assigned cases were not completed as appraisers were not able to deal with 'soft' refusals from people who realized that participating involved scheduling appointments, use of their time, etc.). Again, caution should be used when analysing these results and reaching overall conclusions as more limited efforts were used for refusal conversion than would be the case in a full-scale ongoing survey.

15. We anticipated that drawing a sample from the LFS frame could yield a higher-than-normal refusal rate. This proved to be the case. In the ongoing survey, the likelihood of respondents having completed other Statistics Canada surveys is minimal (as we will be drawing the sample of properties from the MARs).

16. For the LFS sample, an information package was sent to all respondents prior to making initial contact. This was not the case for the MLS sample.

c) Field test logistics

The second objective of the field test was to test a number of operational logistics. Below are the main findings:

- Interviewers noticed a difference between dealing with respondents who had received the information package prior to their call and dealing with those who had not. Respondents were more receptive if they had the information on hand at the time of the interviewer's call.
- Interviewers also thought that the questions and answers provided to them were sufficient, as they were not asked any questions that they could not answer. However, during the interviewers' debriefing session following the field test, most interviewers felt that the training they received was helpful but thought that more should have been provided. Appraisers indicated that training was sufficient.
- When contacting landlords, many interviewers had to address privacy and confidentiality issues.
- A recent change in property ownership created challenges for tracing respondents. What made tracing respondents for this test more difficult than usual was trying to find the owners/landlords of large condominiums and incorporated businesses (those with a number as identification instead of a name).
- Appraisers made useful comments about possible ways to improve the collection tools (software and hardware)
- Finally, telling respondents that they could receive a copy of the appraisal report enhanced respondent relations.

d) Field test conclusions

The field test has provided invaluable lessons on how a survey of residential property values and its associated operational logistics can be developed. The field test certainly suggests that sufficiently effective respondent relations materials can be (and will be) developed to ensure that a survey of this nature is able to yield acceptable response rates. The field test has also enabled STC to identify areas requiring development in terms of the collection logistics. Finally, the field test (and the feasibility study in general) has allowed STC to develop a fruitful relationship with a number of key players in the field of residential property appraisal in Canada.

5.2 The sample design, including the property frame

The second main survey element that was researched and evaluated during the feasibility study was the sample design (and the associated choice of the list of properties from which the random sample would be drawn). This section provides a description of our evaluation.

5.2.1 The target population

The target population for the survey of residential property values at market prices is composed of all residential properties on which property taxes were levied during the year of interest. Residential properties include various types of physical buildings, such as apartment buildings and houses, as well as the land on which they are built. Land that is zoned 'residential' and is vacant is also included in the target population. The following list describes the various types of properties included in the target population:

- Single-family properties: single detached, semidetached, condominium row housing or high-rises that are considered as single properties for tax purposes.
- Multifamily properties: duplex, triplex, apartment buildings, row housing (rental)
- Cottages
- Mobile homes
- Communal properties (e.g., retirement homes, convents, rooming houses)
- Residential part of dual-use properties
- Residential portion of farms
- Vacant land (zoned 'residential')

Currently, there are some known exclusions from the target population, such as Indian reserves and provincial government properties. The finalization of the coverage will be achieved through further study, during the implementation phase, of provincial assessment practices. FC requires that the target population reflect the practice in the majority of provinces; once these practices have been established, they will be applied to all provinces to the extent that the property-type data on the MARs will allow. FC will be consulted during this process.

5.2.2 Options for the frame and sample design

We have investigated four design options. Each of the options is based on a different sampling frame and each leads to a different sample design since each frame has its particular pieces of information and population coverage. However, all the options have a two-stage sampling design, with the first stage being essentially the same for all options. The municipalities are the primary sampling units and the properties are the secondary units. Below is a description of our evaluation and our preferred frame and sampling design option.

First stage of sampling

The first stage of the design will essentially be a stratified sample of municipalities within each province, where the strata would be formed by grouping municipalities with similar characteristics from a property taxation point of view. Auxiliary variables that could be used include total assessed values per capita, total property taxes per capita and total population. For this study, municipalities that contribute the most to the provincial property value total will be identified and grouped in a take-all stratum, where they will be sampled with certainty. The rest of the municipalities will be divided into a number of strata (most likely based on their contribution to the provincial total) and will be selected randomly. A benefit of this first stage of sampling is that it will concentrate the subsample of properties in some municipalities and thus help to minimize data collection costs, such as the hiring, training and travelling of interviewers and appraisers. If this reduction is not sufficient, another stage of sampling could be introduced. This would consist of selecting some submunicipal areas.

Second stage of sampling

The second stage of sampling essentially consists of selecting residential properties within selected municipalities (or submunicipal areas). In order to select properties within municipalities, four frame options have been investigated:

- electronic files of MARs
- on-site MARs
- the one-in-five sample of census 2B forms
- an area frame.

Frame options for the second-stage design

Option 1: Electronic files of MARs

Since the unit of interest is the residential property, STC's best option is to use a list of properties as the sampling frame for the second stage. Most provincial governments have a central list of properties in their province, along with a number of key elements of information about properties. The lists are in electronic format and include all the MARs for the province. Such a list would be the best frame for the survey as it would generally provide excellent coverage of Canadian properties as well as many data elements useful for designing a second-stage sample and for data collection. For example, the data elements on such a frame would include municipality, property type, assessed value, property address, owner name and address¹⁷ and other physical characteristics for each property.

The strategy for the second stage of sampling will be similar to that of the first. In all selected municipalities, properties that contribute the most to the municipal total will be identified and grouped into a take-all stratum, where they will be sampled with certainty. The rest of the properties will be divided into a number of 'take-some' strata (based on their assessed value and/or type) and will be selected randomly.

Within each take-some selected municipality, the plan is to select the same number of properties, corresponding to one appraiser assignment. This will help control the costs and monitor more effectively the work of the appraisers. Within take-all municipalities, the number of properties selected will vary and the workload will be shared among two or more appraisers.

Option 2: On-site MARs

If electronic MAR files cannot be acquired for a province (or a part of a province), another solution would be to use the on-site MAR files available in the property tax office of each municipality selected in the first stage. These files are either physical or virtual (i.e., accessible via a video terminal) and often organized by submunicipal area (e.g., by ward). They would contain the same data elements as for option 1 above. However given the nature of the frame, we would be limited in the amount of stratification that could be done prior to the selection of the second-stage sample.

With the on-site MAR files, the second-stage sample would be designed within each province as follows: Within each selected municipality, the properties would be stratified only if this were deemed possible. For instance, in the case of virtual files, it might be possible to sort properties by submunicipal area or type of property. In the case of physical files, it should be possible to stratify by submunicipal area. This area stratification might bring some efficiency if the average assessed value varied significantly between areas.¹⁸ Then, properties would be selected with equal probability within each second-stage stratum via systematic sampling.

Option 3: One-in-five sample of census 2B forms

The first two options refer to using property frames. Another option is to use a dwelling frame¹⁹ derived from census 2B forms. These forms are used to collect information on private occupied

17. The owner's name and address are not variables that are required for establishing the survey frame and drawing the sample. However, they would be useful for data collection activities (e.g., tracing of respondents). The associated privacy issues will need to be addressed.

18. This assumes that, with physical files, statistics such as average assessed value for submunicipal areas have been calculated by the municipality.

19. A 'dwelling' is a separate physical entity where people live, whereas a 'property' is any piece of land used for residential purposes including vacant land zoned for residential use. There could be from zero to many dwellings on a given property.

dwellings for one-fifth of Canadian households found in all areas of the country. The following variables could be useful for a residential property value survey: type of residential construction; selected physical characteristics; monthly rent if the dwelling is rented; owner-estimated value of the dwelling if it is occupied by the owner. These variables are not collected for private dwellings unoccupied on Census Day. In addition to the list of private dwellings, there exist a list for seasonal dwellings and another for collective dwellings.

With the census 2B dwelling data, the second-stage sample would be designed within each province, similar to option 1, as follows: Within each selected municipality, the properties would first be stratified by type and, when counts are sufficient, within type, by size of the assessed value. (For owner-occupied dwellings, an assessed value could be provided by the owner; for renter-occupied dwellings, it is assumed that it could be predicted with a model.) Then, properties would be selected with equal probability within each second-stage stratum.

Problems associated with the use of census data include the timeliness of the data (i.e., it becomes available many months after Census Day), the necessity to supplement them with a frame of new constructions, the possible lack of accuracy of the owner's estimated property value, and the fact that census data do not cover unoccupied dwellings and vacant land. In order to improve this coverage, possibilities include the use of MAR books, an area frame or the Business Register. In the case of the Business Register, a sample of enterprises that own or lease residential real estate could be drawn.

Option 4: Area frame

The fourth and last option to design the second-stage sample is the use of an area frame.²⁰ The starting point would be the frame of the redesigned Labour Force Survey (LFS) in order to reduce survey design costs. The redesigned LFS makes use of a list frame of addresses in a subset of the areas covered by STC's Address Register, and an area frame for the rest of the country. For the list frame portion, either clusters would have to be formed or the census collection units could be taken in order to build an area frame. For the rest of the country, some areas are excluded and we would need to study whether it would affect significantly the survey estimates. If so, we may then need to create an area frame in these areas as well. The census data discussed in option 3 would be matched with the resulting area frame and used to get cluster-level data.

With the area frame, the second-stage sample would be designed within each province and would be a multistage sample as follows: Within each selected municipality, the clusters would first be stratified by size of the assessed value (derived from the census data described in option 3). These clusters would be selected with probability proportional to size (size being total assessed values) within each second-stage stratum. Finally, properties would be selected with equal probability within each selected cluster.

20. An 'area frame' can be contrasted with a 'list frame.' In a list frame, there is a record representing every entity to be surveyed, that is, a list of the members of the population of interest. Samples are drawn from this list. The MAR microdata provide a list frame. In an area frame, there is no list of the entities to be surveyed. One starts by selecting large geographic areas, then smaller geographic areas within the larger ones, and so on. In the case of the Labour Force Survey (LFS), the penultimate selection is the 'cluster,' which in urban areas corresponds to a city block or a large apartment building. Dwellings to be interviewed are randomly selected from within the cluster. All persons in the selected dwellings are included in the survey. Area samples can be said to be indirect. The object of the LFS is to have a sample of the human population. In the LFS area frame, a sample of the population is obtained indirectly by taking a sample of the dwellings in which the people in the population live.

An advantage of using an area frame is that its in-sample clusters are maintained up-to-date and would cover all types of properties all over Canada (including the territories) except for undeveloped (vacant) residential land. However, the complexity of this design in addition to the inefficiency of cluster sampling does not make this option worthwhile. (In this particular situation, properties often tend to be of similar value in the same neighbourhood, leading to higher sampling rates for a given precision.)

Preferred frame and sampling design option

The option retained is the use of MAR electronic files. It is built from a list of properties (which are our unit of interest) and contains auxiliary information highly correlated with the variable of interest; the undercoverage of such a frame appears to be minimal.²¹ Additionally, it has the information in terms of owner name²² and address, which makes tracing a lot easier. A sample drawn (according to the description above) from this frame will be our preferred option in order to yield estimates of residential property values at market prices. Section 5.4.2 (“Work plan for implementation”) discusses the different options for the level of precision and the sample size required to reach these levels.

5.3 Use of surveys of residential property values in other countries

As part of the feasibility study, STC examined the extent to which other countries have developed and used surveys to measure the aggregate value of residential properties, with the objective of benefiting from their experience.

Statistical agencies or the relevant official organizations of the following countries were consulted: England, Australia, France, Japan, New Zealand, Northern Ireland, Sweden, Switzerland and the United States. (Of particular interest was also the New York State Market Value Survey; see Appendix B for a detailed description.) Based on this review, it appears that the use of a survey to measure the aggregate value of residential properties according to the concept of market value is quite limited.

Of the countries surveyed, only England has a survey similar to the proposed STC survey of residential property value. Called the Market Value Survey (MVS), it is a subsurvey conducted as part of the English House Condition Survey (EHCS). The purpose of the MVS is to evaluate local market conditions. In 2001, 200 specially trained surveyors conducted a detailed physical inspection of a sample of properties. A firm of national appraisers used the information gathered by the surveyors and established a market value for each property surveyed. However the results are not used for national accounting purpose. In Northern Ireland and Scotland, surveys on the condition of housing take place. In these surveys, a physical inspection of the buildings included in the sample is done but no market value is assigned to the buildings.

In several countries, the market value of the housing stock is derived by using surveys such as the population census or surveys of the assets of the population. In this type of survey, dwelling owners are asked to estimate the market value of their property. Some other countries use property registers or real estate transaction records to estimate average prices. All this information is used to derive a market value for the housing stock, but only by applying a sizable number of assumptions that ultimately may strongly bias the results.

21. Based on the information provided by the various provincial and territorial assessment authorities, Newfoundland and Labrador is the only province where it appears that a significant undercoverage problem exists.

22. Obtaining the name of the property owners from the various jurisdictions that will supply the MARs may raise privacy concerns, which will need to be addressed.

5.4 Options and work plan for implementation of the survey

In light of the demonstrated feasibility of designing a survey of residential property values at market prices, in this section we propose a work plan for its implementation (with estimated cost for the development and ongoing production phases). The work plan contains three options. Each option differs from the others in terms of the expected level of precision of the resulting survey estimates and the associated sample sizes required to reach these levels. Each option shares the following basic survey elements and work activities: sample frame, sample allocation, data collection, edit and imputation, weighting and estimation, data validation and quality control, and data dissemination.

The work plan for implementation can be divided into the following six main tasks:

Task 1: To develop and maintain the sampling frame

Task 2: To develop concepts and definitions including a national standard of appraisal

Task 3: To develop the sampling design: three options for the level of precision and sample sizes

Task 4: To develop the data collection approach

Task 5: To conduct other survey-related activities

Task 6: Other activities

In addition to providing a description of the survey objectives for each of these six main tasks, this section contains information on the following elements: costs, timetable, frequency of the survey, a choice of survey options, and the data accountability.

5.4.1 Survey objectives

The statistics that will be provided will have to be of demonstrable quality and of a level suitable for the intended application. All users will want to be reassured of the fitness for use of the data. Since the survey is designed to yield comparable totals of residential property market values at the provincial level, the design is based on the quality of these aggregates. However, we are advised that in the case of Equalization, it is provincial shares of the national total that are the primary determinants of provincial entitlements.

The necessity of producing comparable estimates from one province to another requires the use of the same concepts, definition and techniques for appraising properties across Canada.

Another objective is the measurement of the variability (i.e., sampling variance) of estimates of year-to-year change, and the development of methodologies to minimize this variability. This responds to FC's desire to reduce avoidable sources of instability in the Equalization entitlements. Minimization methodologies are likely to call for panel designs, that is, samples where properties selected in one year continue to be in the sample in the next (and possibly in subsequent years). However, the development of panel designs requires information that will be available only when the full first cycle of the ongoing survey has been completed. (See "Data quality control" in section 5.4.2.)

5.4.2 Work plan for implementation

Preparatory activities²³

Prior to the initiation of any data development *per se*, STC will have to secure funding. A request for funds for the implementation of the options selected by FC will need to be composed and submitted to the Treasury Board for its consideration. Success will depend in large measure on FC's active support.

Once the funding is secured, a number of other project initiation activities will follow. These include creating internal governance and project-management structures, hiring employees and providing them with training, and acquiring informatics infrastructure. Furthermore, a privacy impact assessment (as required by the Treasury Board) will need to be conducted to address a number of privacy issues. For example, STC needs to develop the mechanisms to ensure that the data flow among STC interviewers, appraisers and respondents are acceptable to the federal Privacy Commissioner in terms of confidentiality, privacy and security. Such assessment is also necessary to address the privacy concerns of provincial privacy commissioners related to the acquisition of individual records contained in the MARs. Approval within STC will also be required in order to perform data record linkages. (Record linkage is a sensitive issue for STC, so much so that all record linkages that are approved are published on the STC website.)

Task 1: Developing and maintaining the sampling frame

As stated previously, the MAR microdata are considered to be the best frame from which the sample could be drawn. The following activities are envisioned under this task:

a) Acquisition of the MAR microdata

While the study established that electronic microdata files are held by all of the assessment agencies in the provinces, actually obtaining these files poses some challenges for STC. In a number of cases, STC will likely have to enter into formal agreements under Section 13 of the *Statistics Act*. Some assessment agencies have indicated that they will require the payment of substantial fees for the files. In other jurisdictions, STC's concerns with provincial privacy legislation will have to be addressed. This concern is heightened by our wish to have the property owners' names included in the file. STC has successfully addressed such legitimate privacy concerns in analogous situations in the past, and we are confident the issue can be resolved. As well, these are large files and once there is agreement on obtaining them, delivery will have to be arranged.

Based on the information at our disposal today, we expect that the data acquisition process will take up to 12 months to complete. If we cannot acquire the MAR electronic file for a province (or part of a province), the contingency plan is to identify an alternate frame source that allows for the most efficient design.²⁴

23. Some of these preparatory activities would also be required for (and combined with) the other two project components—property tax revenues and population estimates.

24. The use of an alternate frame source may have an impact on the survey costs, given that larger sample sizes could be required to obtain the same level of precision achievable with MAR microdata. Having electronic MAR microdata at our disposal has many advantages, one of which is to allow a reduced sample size, given that some characteristics of the targeted population (such as the distribution and variability of property values across municipalities) are known.

b) Data processing

As we start receiving the MAR microdata,²⁵ efforts will be directed toward the data processing stage and the requirement of converting the various provincial and municipal files to a more standard database. This includes the following:

- reception of the data through a secure channel
- loading the data
- standardization of the data for definition and classification (residential versus non-residential properties) in concert with the one that will be developed for the tax revenues component or for the MAR-based options (see Appendix C for a discussion on aligning the parts for the residential and non-residential properties)
- ability to generate aggregated data.

c) Data quality control

With the objective of producing an excellent sampling frame for the survey, we must ensure that a certain number of checks and balances are applied to the MAR data file that we receive. More specifically, the verification will include:

- geographical coverage corroboration
- data validation
- comparison between two years of data (when we have received two years of data). For example, comparison between the flow of the two years and the STC building permit data; comparison with census data to ensure that the stock of dwellings is within some reasonable range of other sources and, if not, to identify and possibly correct the difference. STC's Address Register may also be of value here.
- specific validation processes such as verifying duplicate and blank records.

d) Use of complementary information

Since not all provincial MAR files will have the same exact reference date for the list of properties that they contain, we will use other sources of data to complement the MAR data in order to bring all files to a unique reference point. These other sources will include data from the STC Building Permits survey, possibly Canada Mortgage and Housing Corporation data, as well as the following year's MARs.

Task 2: Developing concepts and definitions, including a national standard of appraisal

Ensuring that estimates of market value from the survey are comparable and consistent across provinces will require the development of a national appraisal standard. Accredited appraisers in Canada follow the Uniform Standards of Professional Appraisal Practice. While standards are always applied, appraisals differ in scope and cost depending on the purpose of the appraisal, the type of report being completed and the appraisal methods used. For the proposed survey, a set of procedures will be developed in order that appraisals conducted across the country are completed using the same approach.

During the development of the survey, STC with the Appraisal Directorate of Public Works and Government Services Canada (PWGSC) will create an expert advisory group. The Appraisal Institute of Canada and the *Ordre des évaluateurs agréés du Québec* will be invited to participate in developing:

- common concepts and definitions
- common appraisal procedures to follow
- a standard appraisal report.

25. Prior to this, STC will set up the computer infrastructure required to handle this massive entry of data.

These will constitute the basis for the appraiser training and procedures manual that will be developed for the survey. The use of single appraisal software (for data collection) will also help.

PWGSC will perform a review of a sample of returned appraisal reports. This quality control function will be structured so as to ensure that standards are adhered to. The sample of reports that will be earmarked for quality control will be selected based on edits on key fields within the reports. Furthermore, each appraiser will have at least one report reviewed and the sample in each selected municipality will see a sample of reports reviewed for each stratum.

Additionally, in order to help achieve consistency and comparability across the country during data collection activities, formal training will be developed and provided to interviewers and appraisers.

Task 3: Developing the sampling approach: Three options for the level of precision and sample sizes

As we indicated previously, the MAR electronic microdata files constitute the preferred approach for the creation of the survey frame from which the sample would be drawn. The proposed two-stage sampling design was also discussed earlier. The methodological text here discusses this approach specifically and presents three options for the level of precision of the estimates and the sample sizes (i.e., number of properties) required to reach these levels.

The precision of an estimate is typically represented by the coefficient of variation (CV), which is the ratio of the standard error to the estimate itself. This is an indication of the relative sampling error and it permits the comparison of the precision of estimates that may vary greatly in size. The estimates of the aggregate residential property value at market prices will have to be of highest quality and be comparable and consistent across provinces. The level of precision required depends on the intended use. In the case of the Equalization, we are told that the choice of the most appropriate quality target must be taken in light of the accuracy of the estimates in terms of the share of each province in the national total residential property value.

The table below shows the three options for quality targets—1%, 1.5% and 2% CV on the total property value by province. Different quality targets (namely 2%, 3% and 4%) have been calculated for the territories. Quality targets for the territories identical to those of the provinces would have resulted in prohibitive survey costs. What is also important for Equalization is that the CV of the provincial share (of the national total) be of approximately equal precision. The importance of Ontario in the Canada total means that fixing equal CVs on the share would result in much higher CVs for Ontario on its total value. As a means of achieving a compromise between the CV on the share and the CV on the total value, the CV on the total value for Ontario is set at a slightly higher level in order to provide relatively equal CVs on the shares for all provinces.

The provincial distribution of the sample sizes is a reflection of the provincial differences in terms of number of municipalities, variability of the total property value between municipalities, total number of residential properties, and variability of property values within municipalities.

Province/ territory	Option 1			Option 2			Option 3		
	CV total value	CV share	Sample size	CV total value	CV share	Sample size	CV total value	CV share	Sample size
	%		number	%		number	%		number
Nfld.Lab.	1.0	1.4	1,500	1.5	2.0	1,000	2.0	2.5	700
P.E.I.	1.0	1.4	1,100	1.5	2.0	700	2.0	2.5	500
N.S.	1.0	1.4	1,400	1.5	2.0	800	2.0	2.5	600
N.B.	1.0	1.4	1,700	1.5	2.0	1,200	2.0	2.5	900
Que.	1.0	1.3	2,500	1.5	1.8	1,600	2.0	2.2	1,200
Ont.	2.0	1.1	1,000	2.7	1.5	800	3.0	1.7	700
Man.	1.0	1.4	2,100	1.5	2.0	1,400	2.0	2.5	900
Sask.	1.0	1.4	1,500	1.5	2.0	900	2.0	2.5	700
Alta.	1.0	1.3	1,600	1.5	1.9	900	2.0	2.4	700
B.C.	1.0	1.3	1,700	1.5	1.8	1,100	2.0	2.2	800
Subtotal: provinces	1.0	...	16,100	1.4	...	10,400	1.5	...	7,700
Yukon	2.0	...	225	3.0	...	175	4.0	...	150
N.W.T	2.0	...	375	3.0	...	275	4.0	...	225
Nunavut	2.0	...	225	3.0	...	175	4.0	...	150
Subtotal: Territories (as a whole)	1.1	...	825	1.6	...	625	2.1	...	525
Total	16,925	11,025	8,225

... not applicable.

1. These sample sizes will have to be adjusted to account for the expected non-response.

It should be noted that the sample sizes provided in Table 5 are approximate, and for this reason they have been rounded up to the nearest hundred (in the case of the provinces). When conducting this study, the MARs were available for only one province. Therefore, as a way of determining the required sample size, census data had to be used in order to create pseudo-MARs for all the other provinces and territories. It is not known for sure what the impact of doing this was on the sample sizes shown in Table 5. It is, however, important to remember, as mentioned previously, that the MARs would be used as the sampling frame for the ongoing survey. Appendix D discusses the use of MARs in the context of this survey in terms of its impact on the required sample size.

When the sample sizes were determined, a number of parameters were set. One of them is the minimum number of appraisals that should be conducted in a selected municipality. The current scenarios were built using a minimum of 15 appraisals.²⁶ Increasing this minimum of appraisals from 15 to 25 has an effect on the overall sample size. Because the variability is higher between municipalities than within them, the direct effect of increasing the minimum number of appraisals

26. Fifteen appraisals were selected as this number represents a reasonable work load for one appraiser.

from 15 to 25 is a decrease in the number of selected municipalities but an increase in the overall number of properties to be assessed.²⁷

For each quality option, 95% confidence intervals were calculated on the provincial shares. These intervals show the ranges of values across which the estimated shares will lie 95% of the time with the proposed sample sizes, assuming that the true provincial shares are those in the table. It should be noted that the property values shown in this table (and their corresponding provincial shares) were obtained from FC.²⁸

			Option 1	Option 2	Option 3
Province	Total residential value 2001/02	Provincial share	Confidence intervals of share		
	\$ millions		%		
Newfoundland and Labrador	10,133	0.71	0.69–0.73	0.68–0.73	0.67–0.74
Prince Edward Island	3,331	0.23	0.23–0.24	0.22–0.24	0.22–0.24
Nova Scotia	30,588	2.13	2.08–2.19	2.05–2.22	2.03–2.24
New Brunswick	18,486	1.29	1.25–1.32	1.24–1.34	1.23–1.35
Quebec	228,424	15.93	15.53–16.33	15.36–16.51	15.23–16.63
Ontario	677,374	47.24	46.23–48.25	45.85–48.64	45.69–48.79
Manitoba	29,876	2.08	2.03–2.14	2.00–2.17	1.98–2.18
Saskatchewan	26,838	1.87	1.82–1.92	1.80–1.95	1.78–1.96
Alberta	133,510	9.31	9.07–9.55	8.96–9.66	8.88–9.74
British Columbia	275,291	19.20	18.73–19.67	18.52–19.88	18.38–20.02
Total	1,433,851	100.00			

Task 4: Developing the data collection approach

a) Collection logistics

Collection for this survey is not standard for STC because of the need to use outside experts to collect information and estimate the value of the sampled residential properties. The appraisal of properties across Canada must be done using standard concepts and definitions in order that estimates are comparable from one province to another.

Collection can be described as a two-stage process. The first stage of collection will involve STC interviewers. Following the determination of a representative sample of residential properties in each province, STC interviewers will be responsible for tracing and making contact with respondents, informing them of the objectives and purpose of the survey, addressing any concerns they may have, and obtaining their consent to participate.

27. For example, for New Brunswick, in option 2 (CV = 1.5%), when the minimum number of appraisals is set to 15, 68 municipalities are selected for a total of 1,200 properties. When the minimum number of appraisals is set to 25, 62 municipalities are selected for a total of 1,700 properties.

28. From "Equalizing Residential Property Taxes: The Stratified Market Value Base Approach", Federal-Provincial Relations Division, November 2003, p. 12.

The second stage of the collection process is to conduct a residential property appraisal. Accredited appraisers will be contracted as 'deemed employees' under the *Statistics Act*. These appraisers are professionals whose accreditation is regulated by the Appraisal Institute of Canada (AIC) and the *Ordre des évaluateurs agréés du Québec* (OEAQ). Accredited appraisers are objective and conform to the Uniform Standards of Professional Appraisal Practice (see Appendix E for a brief description of the property appraisal industry in Canada and its appraisal approach). Once agreement has been obtained and an appointment has been set up, an appraiser will visit the respondent's property to collect data on the necessary characteristics, analyse all the information and complete the appraisal report.

Following the appraisal exercise, the data (a subset) will be verified by the PWGSC Appraisal Directorate, whose accredited appraisers will perform the quality control function as 'deemed employees' under the *Statistics Act* (and on STC premises). Note that PWGSC also has developed memoranda of understanding with both the AIC and the OEAQ on the development of uniform standards, and these organizations have the expertise to ensure that appraisals are completed correctly.

Since the process is not typical of most STC household or dwelling surveys, a number of mechanisms to ensure data quality will be put in place. Standardization and training are tools that we will implement. Since the data need to be comparable across provinces, standardization of concepts and definitions is essential. As mentioned earlier, STC, in conjunction with PWGSC, plans to work with the AIC and OEAQ to develop a national standard of residential property appraisal.

As was stated previously in this report, the field test provided invaluable lessons on the development of a survey of residential property values and its associated operational logistics. From these lessons, below are examples of specific data collection measures that would be implemented for the full-scale, ongoing survey:

- Additional training would be given to STC interviewers and certified appraisers, especially when an electronic case management application and report system are developed.
- In terms of respondents' tracing and contact procedures, two different teams (a tracing research team and a respondent contact team) would be set up as a means to increase efficiency and proficiency.
- In terms of respondent relations, although interviewers said the respondent relations material was sufficient, more work is required to develop an overall communication strategy as well as to address refusals for participation.
- An electronic case management system that is efficient in assigning cases to certified appraisers would be created, as well as a follow-up system for the tracing research team to verify the timely completion of each case.

b) Collection infrastructure

When property owners agree to participate in the survey, cases will be transferred to appraisers in the field. The survey does not require the design of a questionnaire per se, but there will be an electronic appraisal report in which appraisers will capture their field notes (i.e., property characteristics and contextual information) and prepare an appraisal report. The first stage of collection involving STC interviewers will exploit STC's current collection infrastructure and standard software. However, STC needs to further investigate the available appraisal software options in terms of their functionality and ease of integration into STC's collection infrastructure. The cost estimates provided in this report are presently based on the acquisition of pre-existing software (with some development work within STC).

There are a few options being considered for the case management system that will be needed for transferring cases between STC interviewers and appraisers. STC can either use its current infrastructure or investigate an alternative platform such as a Web-based system that would eliminate current limitations and provide more functionality. The required functionality includes a contract management function to assign cases and monitor their progress.

In order to preserve confidentiality, STC may be obliged to provide the appraisers with its own dedicated laptop computers versus having the appraisers use their own machines. This will be the case until further investigations, improvement and advancements are made vis-a-vis encryption software and security protocols. The cost estimates provided in this report are presently based on the acquisition by STC of dedicated laptops.

Needless to say, regardless of the option chosen, STC will make maximum use, whenever possible, of its existing collection infrastructure (both in its regional offices and its headquarters), thereby limiting the cost of the survey.

c) Contract management activities

This survey is not standard because of the use of outside experts to collect information and estimate the value of the sampled residential properties. Significant efforts will be required to secure the services of the appraisal industry in conducting the survey.²⁹ A number of options have been considered. Further work remains before making a final determination of the most efficient one (technically and cost-effectively). Of prime importance in the selection of the approach is its compliance with confidentiality regulations applicable to conducting a survey under the *Statistics Act*. An approach similar to the one used during the field test (involving the Appraisal Directorate of PWGSC) appears to be the most promising one.

Task 5: Conducting other survey-related activities

In addition to activities described earlier (sampling frame, sampling design, data collection), the following survey-related tasks are necessary to produce the required survey data: edit and imputation, weighting and estimation, data validation and quality control. They are discussed briefly.³⁰

a) Edit and imputation

- Data editing is the application of checks to detect missing, invalid or inconsistent entries or to point to data records that are potentially in error. Some of these checks involve logical relationships that follow directly from the concepts and definitions. Others are more empirical in nature or are obtained as a result of the application of statistical tests or procedures (e.g., outlier analysis techniques).
- Imputation is the process used to determine and assign replacement values for missing, invalid or inconsistent data that have failed edits. This is done by changing some of the responses or assigning values when they are missing on the record being edited to ensure that estimates are of high quality and that a plausible, internally consistent record is created. Many of these problems would have been solved earlier through follow-up with the respondent or through review and manual correction of the questionnaire. However, it is generally impossible to resolve all problems at these early stages because of concerns of response burden, cost and timeliness. Since it is usually desirable to produce a complete

29. As indicated in the section on the survey frame (section 5.2.2), STC will also need to enter into contractual agreements for the purpose of data acquisition, such as those from the MARs.

30. Some of the information provided in this section was extracted from STC's Quality Guidelines (STC Catalogue no. 12-539) as it applies to the proposed survey.

and consistent microdata file containing imputed data, imputation is used to handle the remaining edit failures.

- The quality of adjustments for non-response
While the non-response rates for the field test reported previously (section 5.1, “Testing and evaluation”) may seem high,³¹ the characteristics of the proposed sampling frame (i.e., MARs) are such that a given level of non-response has much less impact on data quality than is the case in the typical household survey.

The frame from which the sample for the residential property value survey will be drawn is the complete MAR microdata file. Each record on that file contains a significant amount of information about the property represented by the record. In other words, even before the appraisals are done on the properties selected for the sample, we will know a great deal about all properties, both those chosen for the sample and those not chosen.

This is in contrast with several social surveys of persons based on samples of dwellings. Here, nothing is known about the persons in the selected dwellings until those persons have been interviewed. If no interview is obtained, nothing is known about the persons in the selected but non-responding dwelling. In these surveys, because nothing is known about the characteristics of persons in non-responding households, all one can do to adjust for non-response is impute the average value of persons in responding households. In other words, in household surveys, one is obliged to make the unproven assumption that the characteristics of non-respondents are distributed like the characteristics of all respondents.

However, in the case of the property value survey, because we will have the MAR-based characteristics of both the responding and the non-responding households, the non-responding properties can be grouped with the participating properties with similar characteristics. Adjustments for non-response can, therefore, be made with much higher levels of precision since the adjustment will be based on the responses given in similar responding properties, not in all responding properties, whether similar or not.

b) Estimation

- An essential step in every sample survey is estimation. Estimation is the process that converts the information collected from a sample of a population into information about the entire population. For example, the appraised values of the sample of properties chosen for the survey in a given province will be converted into estimates of the appraised value of all properties in that province.
- Estimation for the provincial survey totals
There exists a variety of possible estimators for a survey such as the one under examination here. Each of these estimators has its own merits. A widely used estimator is the Horvitz-Thompson (H-T) estimator, which consists of simply weighting every response by the inverse of its probability of selection (sampling rate).³² (For example, if the probability of

31. One has to remember that virtually no refusal conversion strategy was developed for the field test. These strategies have materially improved the quality of the data in other surveys and there is no reason to believe that these proven techniques will not be just as effective here.

32. If we let y_i denote the appraised value for property i , and w_i be the inverse of its probability of selection (adjusted for non-response), then the H-T estimator of the province total is given by $\hat{Y} = \sum_i w_i y_i$, where the sum is taken over all sampled properties that have been appraised in that province.

selection is 1 in 250, each record is given a weight of 250 since it represents itself and 249 other properties in the population of properties.)

Another class of estimators that can be used for this survey is called regression estimators. Instead of trying to describe the general form of these estimators, we will give the example of a specific type of regression estimator, namely the combined ratio estimator. In short, a ratio is calculated between the estimate obtained from the observed values in the sample (survey appraised values), and an estimate obtained from the same sample, but using the values on the frame (municipal assessed values) instead of the observed values. This ratio is then applied to the known total value for the entire frame.³³ Such an estimate can have a much lower variance than the H-T estimate, depending on the correlation between the values on the frame and the values obtained from the survey. The higher the correlation is, the lower the variance will be. Future empirical studies will determine the proper form of the regression estimator that could be used in practice for the survey. These studies will also produce data on the reductions in sampling variance obtained by the use of regression estimators. (Appendix F draws a parallel between the proposed survey and ratio studies).

It should be noted that for the purpose of this feasibility study, sample sizes have been estimated assuming the use of the simple H-T estimator described above. This was done since there are no data available at this time to estimate any potential gains (e.g., the correlation between the survey's appraised values and MARs' assessed values). As stated above, the use of a regression estimator in the future could lead to greater precision (i.e., lower variance and CVs) for a sample of a given size or, alternatively, to smaller sample sizes to achieve the same precision. However, it is important to realize that in the context of the proposed survey the greatest gains in variance reduction from using the auxiliary information on the frame will be achieved through stratification and allocation of the sample. This was discussed earlier in the context of the option of on-site MARs.

- Estimation for municipal totals
FC also wants residential market value estimates at the municipal level. Because we will not be able to survey properties in all municipalities (because of the cost constraint and response burden), some sort of model has to be developed for those municipalities that are not in the sample. However, even for municipalities that are in the sample, the sample size may not be sufficient to yield estimates with an acceptable precision.

A proposed option is to use a composite estimator.³⁴ This would be a linear combination of two distinct estimators: a direct estimator for the municipality (for example, the H-T estimator described above), and an estimator for the municipality based on a model (for example, a regression model where the parameters are estimated using data collected from similar municipalities). For municipalities not in the sample, the resulting estimator would rely entirely on the second estimator, since there would be no direct estimator available. For municipalities in the sample, a weight would be applied to each of the direct estimator and the model-based estimator in such a way as to minimize the resulting sampling error.

33. If \hat{Y} is as above, and if $\hat{X} = \sum_i w_i x_i$ is the corresponding H-T estimator calculated with the property values on the

frame, denoted by x_i , then the combined ratio estimator at the provincial level is given by $\hat{Y}_R = \hat{R} X$, where $\hat{R} = \frac{\hat{Y}}{\hat{X}}$ is

estimated with the sample and X is the provincial total obtained by summing all property values on the frame.

34. Rao, J.N.K., 2002, *Small Area Estimation*. John Wiley and Sons, p. 57.

The larger the sample in a municipality is, the larger the weight on the direct estimator would be, i.e., the resulting estimate would have a larger reliance on the direct estimator.³⁵

c) Data quality control

- Data quality evaluation is a process used to determine whether final products meet the original objectives of the statistical activity, particularly in terms of the data's accuracy and reliability. It enables STC to improve the quality of its surveys. When the results of data quality evaluation are disseminated they allow users to better interpret survey results. Over the years, STC has established a range of quality control mechanisms, and this survey will benefit from these.
- As stated previously, PWGSC will also provide quality control services on a sample of appraisals performed by the certified appraisers.
- Complementing the data quality analysis mentioned above, data analysis and data confrontation (described in task 6 below) are further means to help ensure that the data are fit for use.
- As part of its proposed work plan, STC is looking at conducting a number of quality-related methodological studies. These studies would provide qualitative and quantitative information on the specific factors influencing the quality of the survey data. These include a study on measuring the appraisers' variability and another on sampling in time.
 - **Measuring appraiser variability**

Although appraisers will, in principle, adhere to standard guidelines in doing their work, an estimate of a property's market value is ultimately a product of judgment and, as such, some degree of variability among appraisers is inevitable. Ideally, this variability needs to be measured in order to incorporate it into the calculation of survey errors.³⁶ This is what is done in the English House Condition Survey (EHCS), which has some similarities with our proposed survey. To appraiser variance, we propose an approach similar to that of the EHCS, which involves a random allocation of properties to appraisers within areas. Future studies will dictate what these areas could be. For example, the largest (take-all) municipalities could be divided into a number of 'neighbourhoods,' with two appraisers assigned to each of these neighbourhoods. In the smaller municipalities, we are faced with two options: do as we do in the larger municipalities (but the availability of two appraisers may be a problem, and the sample size is already small), or not do it at all. In the latter option, we would need to find a way to extend the results for the larger municipalities to the entire sample.
 - **Sampling in time**

A desirable characteristic of the survey would be to minimize that portion of the year-to-year variability in the estimates attributable to sampling. This can be achieved by overlapping a given proportion of the samples between two consecutive years.³⁷

35. Mathematically, the composite estimator has the form $\hat{Y}_C = \phi \hat{Y}_1 + (1 - \phi) \hat{Y}_2$, where \hat{Y}_1 is the direct estimator for the municipality, \hat{Y}_2 is the model-based estimator for the municipality, and ϕ is a number between 0 and 1.

36. This was also expressed by some members of the STC's Advisory Committee on Statistical Methods, when the proposed sample design was presented to them on November 1, 2004.

37. STC's Labour Force Survey uses a similar approach. Five sixths of the households are common to any two adjacent months. This overlap, and the use of a technique called composite estimation that depends on this overlap, serve to substantially reduce the sampling variance of month-to-month variation.

This overlap could be at the municipal level, or even at the property level. The proposed design discussed previously achieves this goal to some extent, since the take-all properties of the take-all municipalities will be in the sample every year. But is this overlap enough? By assessing the contribution of these properties to the overall estimated total, we will be in a position to answer the question. There also has to be a balance between overlap and respondent burden. For this reason, the best option could be to control the overlap at the municipal level rather than at the property level. An advantage of this option would be to stabilize the work related to hiring appraisers, since a proportion of them could be retained in the sample between consecutive years, even if they do not work in the larger municipalities. Once again, it is planned that future studies will shed more light on the issue.

Task 6: Other activities

The proposed work plan contains a number of other activities:

a) Data consistency for property values, taxes and population estimates

The other two elements of FC data requirements consisted of the property tax revenues and population estimates. As noted elsewhere in this report, efforts will need to be devoted toward achieving and maintaining data consistency between the property values and the property tax revenues (in terms of coverage, classification and the list of municipalities) and population estimates (in terms of the list of municipalities).

b) Macroeconomic analysis and data confrontation

Any related data source will be exploited in assessing the reasonableness of the levels or trends found in the survey's outputs. These include the MARs themselves, data generated by the real estate industry, data available from CMHC, series on housing starts and completions, building permit aggregates, both stock and flow data from the system of national accounts, and so forth. These analyses will compliment the quality control mechanisms embedded in the survey's processes. Together they will ensure that the data are fit for use for Equalization, and that accepting accountability for them will not threaten STC's credibility. This analysis will be especially important in the first few years where it will provide important intelligence to fine-tuning that is a part of every new survey.

c) Data dissemination

The work plan takes into consideration all the activities related to the dissemination of the survey results.

5.4.3 Deliverables

- *Survey outputs*

Annual estimates of residential property values at market prices at the provincial level will be submitted to FC according to the timetable described in section 5.4.5. Presuming that the official STC-to-FC transmittal mechanisms will be the same as in the past, the survey's estimates at the provincial level will be included in the certificate signed by the Chief Statistician. In addition to the provincial results themselves, a document containing a detailed description of the survey's objectives, concepts, definitions, methodology and quality evaluation will be produced.

- *Municipal estimates*
Annual municipal estimates of residential property values (derived from the provincial survey results as per the methodology described earlier) will also be transmitted in the same certificate as referred to above.
- *Status reports during the implementation phase*
At regular intervals (twice a year) leading up to the first provision of the survey results, STC will provide to FC a status report on the implementation phase. Similar to the ones provided during the feasibility study, such status reports will include a description of the following: objectives, progress and achievements to date, problems encountered and actions taken to solve them, upcoming steps/challenges/deliverables and responsibilities. These reports are in addition to the information provided through the interdepartmental working group that STC is proposing.
- *Confidentiality and other relevant STC policies*
All STC surveys are conducted under the authority of the *Statistics Act*. Under this Act, STC is, among other things, obliged to ensure that no data are released that identified any individual, business or organization. This policy will obviously apply to the proposed survey and to other parts of the property tax base project.
- *Revisions to existing data or introduction of new methodology*
The survey results will be subject to revisions. The following factors may cause such revisions: integration of new data sources; incorporation of data not available prior to the cut-off date for official release; revisions to the existing information (from commercial sources, from information collection within STC or elsewhere); new statistical methods related to the editing and imputation as well as to the estimation process; and correction of errors. Changes to the underlying concepts (if proposed by FC or as a reflection of changes of this nature vis-à-vis existing property assessment concepts, definitions or practices) may also lead to revisions. Methodological or conceptual changes will be discussed with FC and the provinces prior to implementation.

5.4.4 Costs

As presented earlier in the report, three options were considered in terms of the level of precision and the sample size required to reach these levels. Cost estimates for options 1, 2 and 3 are presented accordingly. Separate cost estimates were prepared for a survey covering the 10 provinces only and for one covering the 10 provinces and 3 territories. Depending on the desired level of precision, the survey costs vary from \$9.5 million to \$14.3 million (fiscal year 2006/07) for the 10 provinces.³⁸ For the territories, the survey costs vary from \$1.0 million to \$1.4 million (fiscal year 2006-07)

These costs are based on the project starting by April 1, 2005. Fiscal year 2005/06 is a development year (see section 5.4.5, "Timetable," for a list of key activities by fiscal year); no survey collection activities are planned in that year. Appraisal services will be required in 2006/07 and the years thereafter; they alone represent approximately 60% of the total survey costs.³⁹ STC will also

38. Internal co-ordination and external liaison costs for all project components (property values, property tax revenues, and population estimates) would need to be added to these amounts. The combined cost is about \$0.4 million.

39. As indicated in section 5.2.1, "The target population," the survey will cover a wide range of residential properties, from single detached houses to large apartment buildings. The sample that will be drawn will therefore reflect this heterogeneous population. As one can imagine, the appraisal fees for a single detached house (a few hundred dollars) are substantially different from those for a large apartment building (a few thousand dollars).

need to acquire data (such as MAR microdata) from external sources. The services that will be provided by PWGSC constitute the third element that comes from an external source.

Combined, these three elements represent about 70% of the total survey costs for 2006/07 and 2007/08.⁴⁰ STC's salary costs (including interviewers) represent 20% of the total; the remaining 10% can be accounted for by other non-salary expenditures.

	2005/06	2006/07	2007/08
	\$ millions		
Survey¹ covering the 10 provinces			
Salary (including interviewers) ²	2.3	3.0	3.1
Appraisals services	0.0	8.3	8.3
Services provided by PWGSC	0.1	0.4	0.4
Data acquisition	1.0	1.0	1.0
Other non-salary expenditures (informatics, travel, translation, printing, etc.)	2.0	1.6	1.6
Total: 10 provinces	5.4	14.3	14.4
Survey³ covering the 3 territories			
Salary (including interviewers) ²	0.2	0.3	0.3
Appraisals services	0.0	0.9	0.9
Services provided by PWGSC, data acquisition, other non-salary expenditures (informatics, travel, translation, printing, etc.)	0.1	0.2	0.2
Total: 3 territories	0.3	1.4	1.4

1. Level of precision: CV of 1% on the total property value in all provinces, except in Ontario (2%). Effective sample size of 16,100 properties.

2. The salary costs include the overhead costs: the employee benefit plans (pension, dental, insurance, etc.) and office space rent (accommodation as per Public Works and Government Services Canada).

3. Level of precision: CV of 2% on the total property value by territory. Effective sample size of 825 properties.

40. The percentages have been calculated using option 1.

Table 8 Survey of residential property values at market prices Costs for option 2			
	2005/06	2006/07	2007/08
	\$ millions		
Survey¹ covering the 10 provinces			
Salary (including interviewers) ²	2.3	2.8	2.9
Appraisals services	0.0	5.7	5.7
Services provided by PWGSC	0.1	0.3	0.3
Data acquisition	1.0	1.0	1.0
Other non-salary expenditures (informatics, travel, translation, printing, etc.)	2.0	1.5	1.5
Total: 10 provinces	5.4	11.3	11.4
Survey³ covering the 3 territories			
Salary (including interviewers) ²	0.2	0.2	0.2
Appraisals services	0.0	0.7	0.7
Services provided by PWGSC, data acquisition, other non-salary expenditures (informatics, travel, translation, printing, etc.)	0.1	0.2	0.2
Total: 3 territories	0.3	1.1	1.1

1. Level of precision: CV of 1.5% on the total property value in all provinces, except in Ontario (2.75%). Effective sample size of 10,400 properties.

2. The salary costs include the overhead costs: the employee benefit plans (pension, dental, insurance, etc.) and office space rent (accommodation as per Public Works and Government Services Canada).

3. Level of precision: CV of 3% on the total property value by territory. Effective sample size of 625 properties.

Table 9 Survey of residential property values at market prices Costs for option 3			
	2005/06	2006/07	2007/08
	\$ millions		
Survey¹ covering the 10 provinces			
Salary (including interviewers) ²	2.3	2.7	2.8
Appraisals services	0.0	4.1	4.1
Services provided by PWGSC	0.1	0.3	0.3
Data acquisition	1.0	1.0	1.0
Other non-salary expenditures (informatics, travel, translation, printing, etc.)	2.0	1.4	1.4
Total: 10 provinces	5.4	9.5	9.6
Survey³ covering the 3 territories			
Salary (including interviewers) ²	0.2	0.2	0.2
Appraisals services	0.0	0.6	0.6
Services provided by PWGSC, data acquisition, other non-salary expenditures (informatics, travel, translation, printing, etc.)	0.1	0.2	0.2
Total: 3 territories	0.3	1.0	1.0

1. Level of precision: CV of 2% on the total property value in all provinces, except in Ontario (3%). Effective sample size of 7,700 properties.

2. The salary costs include the overhead costs: the employee benefit plans (pension, dental, insurance, etc.) and office space rent (accommodation as per Public Works and Government Services Canada).

3. Level of precision: CV of 4% on the total property value by territory. Effective sample size of 525 properties.

The costs above associated with the three quality options are based on the proposed survey approach described in this report. The earliest year for which data could be produced in this scenario is for a valuation (price) as of July 1, 2006 for the volume of properties taxable in 2006.⁴¹ That being said, it may be necessary for FC to obtain estimates for earlier taxation years. The table below presents the additional cost that would be incurred in the first year of collection if two appraisals were done on the sample for 2006. Appraisers would value the properties as of both July 1, 2005 and July 1, 2006. Estimation based on the final property counts for 2005 and 2006 taxation years would be used for weighting. While the quality of the appraised value is diminished for retrospective appraisals, the level of quality is still acceptable and would not interfere with the overall quality of the results. This option is presented only in order to provide FC with data for the earliest possible taxation year. This approach would be a one-time addition and is not envisioned for subsequent survey years.

	Option 1	Option 2	Option 3
Fiscal year 2006/07	\$ millions		
Original cost: provincial total (from tables 7, 8, 9)	14.3	11.3	9.5
Additional costs if two valuations:			
Fees for appraisal services	6.6	4.6	3.3
Quality control provided by PWGSC, processing, estimation	0.2	0.1	0.1
Total : 10 provinces	21.1	16.0	12.9
Original cost: territorial total (from tables 7, 8, 9)	1.4	1.1	1.0
Additional costs if two valuations:			
Fees for appraisal services, quality control provided by PWGSC, processing, estimation	0.7	0.6	0.5
Total : 3 territories	2.1	1.7	1.5

Responding to future cost increase

One of the distinguishing features of this survey is the exceptionally high proportion of the total costs that are non-salary. In many STC surveys, non-salary costs are less than 20% of the total, with salary costs accounting for the remaining 80%. In the case of the residential property value survey, the opposite is true. In this survey, non-salary costs are 80% of total costs (based on option 1).

Just three components of the non-salary costs largely explain why non-salary costs account for so much of the total:

- fees paid to accredited real estate appraisers
- payments to provincial assessment agencies for the data in their possession
- payments to PWGSC for serving as the interface with the appraisal industry and for providing quality control services.

Each of these costs is beyond the control of STC. We will, of course, negotiate for the lowest appraiser fees possible. However, as the 'going rate' for appraisers increases, so will the total amount paid in these fees. Provincial assessment agencies are, in many cases, special entities

41. Using July 1 as a reference date is FC's requirement.

operating outside of the mainstream of provincial ministries, and they are mandated to operate on a cost-recovery basis. They are also in possession of data with significant market value, particularly to financial institutions. The fees that they charge will grow with the market for their products. Finally, PWGSC will do the work on a cost-recovery basis, and although STC will pay only the marginal cost of this work, as PWGSC's costs increase, so will the charges to STC.

In seeking funds through a submission to the Treasury Board, the distinction between salary and non-salary dollars is particularly important when looking into the future. We can presume that in the case of salary dollars, departmental budgets will continue to be increased to reflect the additional costs associated with new collective agreements. There are, however, no routine mechanisms in place to adjust departmental budgets in the face of inescapable growth in non-salary dollar costs.

At some point in the future—and when is difficult to predict—STC will find itself in the position where the cost of conducting the survey of residential properties will exceed the budget that STC has been given to carry it out. At that point, STC will first look to any efficiency gains that might have been realized in other parts of the property tax base program. Once that source has been exhausted (presuming that it occurs), STC will need to identify how survey data quality standards can be relaxed in order to restore balance between the budget and the survey's costs. Reducing sample size is one of the ways of achieving this. FC will be consulted before any action of this sort is implemented.

If such reductions in data quality resulted in data that would no longer meet FC's requirements, it would be necessary to seek FC's support in pursuing supplementary funding from the Treasury Board.

5.4.5 Timetable

Assuming the project starts by April 1, 2005 (provided that funding has been made available), STC would be able to provide to FC in December 2007 provincial and municipal (preliminary) estimates of residential property values at market prices for reference year 2006 (price as of July 1, 2006 and volume of properties for 2006)⁴² as per the methodology described earlier in this report. Revised estimates will be available in December 2008. Please note that the associated data accountability for the provincial and municipal estimates is described in the next section. If FC elects to request data for reference year 2005 as well, it is worth noting that the first completion date (December 2007) would remain. Below is a summary of the key activities by fiscal year.⁴³

42. We have been advised that FC requires that estimates of the market value of residential properties have a valuation date that coincides with the volume of properties in a given year. FC may elect to request a different valuation and volume configuration such as a valuation in year t-1 for volume in year t. Such a scenario would have a significant impact on the availability of the estimates because of the added delay in obtaining the MARs for year t.

43. Overlapping of activities between fiscal years will obviously occur as a survey is a continuous process.

Table 11
Timetable of key survey activities (first survey cycle)

Fiscal year 2005/06

1. Obtain/secure funding (Treasury Board submission)
2. Start project by April 1, 2005
3. Initialize project (internal governance and working group structure, hiring, etc.)
4. Establish working group between STC and FC (covering all the project components)
5. Partner and consult with PWGSC (for the appraisal standard, contract management process)
6. Consult with the appraisal industry and create an advisory group
7. Address privacy issues
8. Create sampling frame (agreements for data acquisition, database development, data processing and validation, etc.)
9. Develop concepts and definitions, including a national standard of appraisal
10. Develop survey methodology (sampling design)
11. Develop respondent relations, communication plan
12. Develop/acquire and test collection infrastructure (software and hardware for field collection)
13. Develop database and processing system
14. Produce two status reports for FC

Fiscal year 2006/07

1. Early fiscal year: continue some development activities initiated in 2005/06, such as sampling design and frame
2. Develop training material for interviewers and appraisers
3. Proceed with contracting process for obtaining appraisal services
4. Provide training sessions to interviewers and appraisers
5. Create sample
6. Conduct tracing activities (find missing names / addresses / phone numbers)
7. August to December 2006: collect data (contact owners and appraise property)
8. Perform quality control (PWGSC)
9. Produce two status reports for FC

Fiscal year 2007/08

1. Process data following collection (including edit and imputation)
2. Do estimation
3. Produce one status report to FC
4. Analyse and confront data
5. Do methodological assessment and overall review of survey process
6. Do documentation (including translation)
7. December 2007: disseminate data

At the same time as the production activities of the first survey cycle, a number of activities for the second survey cycle (such as collection and data processing) will also take place in 2007/08.

5.4.6 Planning assumptions

The proposed timetable, costs and survey design are contingent upon several assumptions, and modifications to them could result in amendments to these key elements. Below are the main assumptions for all the survey-based options:

- The project starts by April 1, 2005 (implies that the funding for the project has been made available).
- Each option reflects information at the time this report was written and no significant changes in the information provided by external organizations will occur (such as price quotations provided by the vendors).
- Privacy issues (such as for the data acquisition of the MAR data) are fully resolved.
- The most recent MAR microdata can be obtained for all provinces/territories and the first version of a sampling frame can be developed within the first year following the start of the project.
- The expected levels of precision (based on the expected required sample sizes) are met. The estimated response rate was set at about 70%.
- A national appraisal standard can be set up (within the pre-established time frame).
- Appraisal software can be obtained and integrated into STC's collection infrastructure.
- The development of a Web-based application is feasible and within the pre-established budget.
- The appraisal industry (especially in small provinces) can respond in a timely fashion to the level (and quality) of services required by STC.

5.4.7 Choice of survey options

In making its choice of options, FC may find it useful to know that a coefficient of variation of 1.5% (option 2) would make the precision of this survey similar to that of many major economic estimates published by STC (e.g., estimates relating to major industries).⁴⁴ This is the level of reliability that STC views as making the data fit for use by most data users.

However, from FC's perspective, there is only one use in question and that is the calculation of Equalization entitlements. FC may, therefore, wish to select a higher level of precision (option 1) since this level may be deemed by FC as making the data more fit for Equalization. Alternatively, FC may wish to select a lower level of precision (option 3) if costs are viewed as a critical constraint.

5.4.8 Data accountability

Each data series to be produced as a result of this feasibility study will fall into one of two groups: data for which STC will be accountable, and data for which FC will be accountable.

In those cases where STC will be accountable, the Chief Statistician, in signing the certificate, will be attesting that the statistics accurately represent what they purport to represent. In those cases where FC is accountable, the Chief Statistician will be attesting that the data have been generated according to the methodological specifications laid down by FC.

44. Here are a number of examples: the provincial CVs for the Wholesale Trade and Retail Trade surveys (for the 'revenues' component) are between 1% and 1.5%. For the Survey of Employment, Payrolls and Hours (SEPH), the provincial CVs (for the number of hours of paid employees) are between 1.5% and 2.8%. For some of the surveys covering the service industry (such as the Food Services and Drinking Places Survey), the provincial CVs are around 3%.

An example of this exists in the certificate prepared for Equalization for the 1999 to 2003 period. In that certificate, a series on 'taxable paid-up capital' served as the base for capital tax calculations in Equalization. Data on business capital were (and are) published by STC only at the Canada level. However, provincial breakdowns are required for Equalization. Therefore, FC specified the formula by which STC distributed the Canada total across the provinces. STC was accountable for the Canada total estimate of 'taxable paid-up capital' while FC was accountable for the provincial distribution.

In the ongoing program that follows from this feasibility study, those data for which STC will be accountable will be published by STC as part of our contribution to the national statistical system. In those cases where FC will be accountable, STC will not publish these data, although we have no choice but to provide them should we be requested to do so.⁴⁵

The issue of accountability was raised in the fall of 2003 before the feasibility study had started: STC recognized then that the provision of data for approximately 3,700 municipalities, many of which have very small populations, would be problematic in terms of STC's standards of what is publishable.⁴⁶ The issue was also relevant to data to be derived directly from the MARs (i.e., in the absence of a survey) since STC cannot accept accountability for data produced beyond our control and for which adjustments acceptable to STC in the context of Equalization are not possible.

For the proposed survey, as indicated before, STC will be accountable for the statistical quality of the provincial survey results and, in signing the certificate, the Chief Statistician will be attesting that the statistics accurately represent what they purport to represent. FC will be accountable for the municipal property value estimates, and the Chief Statistician will be attesting that the data have been generated according to the methodological specifications laid down by FC.

5.4.9 Internal co-ordination and external liaison with Finance Canada and other users

An internal governance structure, similar to the one in place during the feasibility study, will be created to ensure a co-ordinated approach within STC to ensure that the stated objectives are met, particularly with respect to cross-cutting definitions such as those for residential and non-residential properties. During the process of developing the survey and the estimates of property tax revenues and population estimates, frequent communication with FC will be required to ensure, among other things, that the detailed data requirements, as well as the data or methodological limitations, are communicated and fully understood by both parties. STC proposes the creation of a working group between the two organizations to reach this objective. Consultation with the provinces will also be required and in light of the division of accountabilities, this will be organized in a co-ordinated fashion with FC.

45. This obligation to provide on demand whatever we produce (within the limits of confidentiality) also applies to all of STC's other programs. We frequently provide data on demand where we would not publish the data requested.

46. Publishable data are those data which we perceive are of sufficiently high quality that they are fit for use in most applications. STC accepts accountability for all data that it chooses to publish. Making the distinction between the entire range of data that STC's data-generating mechanisms are capable of producing and the subset of those data that STC regards as publishable is a continuous activity.

6. Residential and non-residential property values at market prices: The municipal assessment roll approach

FC has requested that STC explore the production of aggregate residential and non-residential property value data (at market prices) at the provincial and municipal level, based on municipal assessment rolls (MARs).⁴⁷ For the non-residential properties, FC has requested that STC study the feasibility of obtaining aggregate values by type of property. The types were farms, commercial/industrial properties, and other.

In order to assess our capacity to respond to these requirements, we:

- examined the statistical characteristics of the MAR data
- examined the interprovincial comparability of the MARs
- investigated ways of adjusting the MAR data to render them more comparable across provinces.

To this end, as we reported in the three status reports, STC consulted with the assessment authorities in all provinces and territories, hired experts in the field of property assessment, and conducted its own research.

The next sections provide a description of these findings. Also included is a work plan for implementation along with estimated costs for the development and ongoing production phases. The work plan contains two options from which FC can choose.

6.1 Study findings

Some statistical properties of the MARs

An assessment of the MARs was conducted for two reasons:

- to establish its viability as a sampling frame for the survey of residential property values at market prices
- to assess its capacity to provide aggregate property values at current market prices.

This first dimension was discussed earlier in this report.

The statistical properties that were evaluated included availability of macrodata and microdata,⁴⁸ coverage/classification/definition of properties, the reference point (“base date” and “state date”)⁴⁹, timeliness, the level of details, privacy issues as perceived by the assessment authorities, and acquisition costs. The interprovincial comparability of the MARs, including appraisal techniques, was also assessed through a contract with qualified experts.⁵⁰ Depending on the province/territory, property assessments are conducted by a single provincial authority, by individual municipalities (Quebec, Alberta), or by both (Newfoundland and Labrador, Manitoba, Saskatchewan). It is worth noting that in the case of Quebec and Alberta, the data holding (a subset of all variables) is

47. No survey work was envisioned for the non-residential property values at market prices.

48. Macrodata refers to an aggregate total value for a given jurisdiction (municipality or province); microdata refers to individual records (i.e., by property) in a given jurisdiction.

49. A base date is the effective date for the valuation of all properties on the assessment roll; the state date is the date that reflects the physical state of the property immediately prior to the setting of a new roll.

50. STC provided FC with a copy of the consultants’ report Analysis of Comparability of Municipal Assessment Rolls on December 7.

provincially centralized. As one can imagine, the large number of property assessment authorities creates by itself additional challenges for STC in acquiring the MAR data.

The data requirement is the MAR database, for each province/territory at the municipal level. The key data variables required from the MAR database include year of assessment roll (state date and base date), municipality identification, geospatial identification, unique lot identification, physical address of the property, type of property identification, and the assessed value of the property.⁵¹

Based on the information provided to us, it appears that most of the key data variables are present in each jurisdiction's database holdings (see Appendix G for a summary table). However, some adjustments would be required (in terms of coverage, tax exclusions, property classification, base and state dates) to increase the level of interprovincial comparability.

- *Coverage*

With the exception of Newfoundland and Labrador, all assessment jurisdictions have indicated that their coverage is as close to complete as one could hope for. No structures of substance are, in principle, omitted from the provincial MARs. It appears that the underlying methodology across the country is to assess all properties—tax exempt and taxable—and include them on the base (though there is much complexity, particularly in non-residential properties around certain inclusions/exclusions from taxation). Newfoundland and Labrador is the only jurisdiction that has a data gap: a significant number of jurisdictions there do not levy property taxes and thus tax rolls do not exist. (It is estimated that about 50,000 properties are not taxed. This number, derived from the census, is provided only as an approximate indication of the size of the data gap).

- *Tax exclusions*

Certain properties are taxable in some provinces whereas they are exempt in others. Although not specifically stated in all of the assessment acts, common exclusions from assessment (not present on the rolls) include Indian reserves, public roads, growing crops, municipal water utilities, government sewage drainage systems, etc. Since authorities vary in terms of what is excluded it is desirable to bring all assessment databases to a common level by excluding machinery and equipment, power lines, gas and oil pipelines, furniture, fixtures and equipment, crops, timber and other public and private infrastructure in those jurisdictions that do include it. (For more information on exclusions, see the report entitled "Analysis of Comparability of Municipal Assessment Rolls (MARS)" prepared by the Altus Group). As noted in section 7 (property tax revenues), this common level will be established according to the practices of a majority of the provinces.

- *Property classification*⁵²

In light of the need for FC to have a clear distinction between the residential and non-residential components of the property tax base, properties must be consistently classified accordingly. As noted in Appendix C, applying the relationship between property type and the residential/non-residential designation will be a two stage process. In the first stage, for each property type, we will establish the residential/non-residential designation used in the majority of the provinces, according to their assessment acts and regulations. For the majority of both residential and non-residential properties (although not for a majority of property types) all provinces have the same designation. Properties containing owner-occupied dwellings are universally designated residential, and properties used for conventional business activities (e.g., retail trade) are

51. For ease of collection for the survey, the name of the owners would also be required.

52. Further discussion on this topic is also included in the property tax revenues component of this feasibility report.

universally designated non-residential. However, there is a long list of types of properties where the designation varies from province to province (see section 7).

This leads to the second stage, where we will determine the designation in the majority of the provinces. For each of these property types subject to mixed treatment across the provinces, in the minority provinces the designation will have to be changed to that of the majority.

While a request was made by FC for a breakdown between land values and building values, it has been determined that this information is not always available across jurisdictions. Ontario, for example, does not have this split. While a number of jurisdictions publish figures for land and improvements separately, there have been comments that these are in fact inconsistent with the market value methodology—buildings are almost always sold with the land on which they are built. There is virtually no market for residential buildings divorced from the land on which they sit. It was indicated that this split was in fact more compatible with the former method of property value calculation, depreciated replacement cost. This latter method is still being employed in the territories. If a requirement exists for separate land and building valuations, we would work with FC to develop a methodology and the additional costs associated with the request.

Other problems with the classification concern farm properties. Farms with residences on them are a particular case of dual-usage properties. All jurisdictions recognize farm residences for their residential nature, but they vary considerably in how the farm residence and its associated land are to be split from the rest of the land and the farm buildings on it. Again, the practice of the majority of provinces will be determined and that practice applied to all provinces.

- *Base date, state date and assessment frequency*

One of the consultants found that each jurisdiction has a similar methodology utilizing both a base date and state date for the roll.⁵³ A base date is the effective date for the valuation of all properties on the assessment roll, whereas the state date is the date that reflects the physical state of the property immediately prior to the setting of a new roll.

Impediments to comparability include items such as base dates varying among jurisdictions, and the state date varying mostly October 31 of the previous year to January 1 of the assessment year, although in most instances the degree of variance is minor. Also, the frequency between reassessments differs among jurisdictions. In fact, 7 of the 13 jurisdictions reassess annually while the remainder, with the exception of Nunavut, have a frequency of two to four years.

As indicated earlier, the interprovincial comparability of the MARs was assessed by external experts. The consultants identified a certain number of non-comparability issues, some of which have been discussed above. The consultants also suggested ways for resolution. According to the consultants, the suggestions aim to make the interprovincial comparison feasible. The consultants, however, specified that the resulting statistics (following the implementation of the proposed adjustments) will not represent the total residential and non-residential assessments in all jurisdictions but, rather, a standardized dataset, which may be compared across jurisdictions. STC recognizes that for Equalization purposes, complete coverage is required.

53. Other findings can be found in the consultants' report under the section entitled "Survey results: Base date, state date and assessment frequency."

6.2 Options and work plan for implementation

In our opinion, if implemented, the suggestions put forward by the consultants would appear, on the surface, to make the MARs more comparable across provinces. However, that being said, for reasons articulated elsewhere in this report, STC believes that the proposed survey (with its associated characteristics as described earlier in this report) is the best tool to ensure that interprovincial comparability of residential property values at market prices is achieved.⁵⁴

The work plan contained here provides a general description of the methodological approach to produce aggregate residential and non-residential property values based on MAR data. Two options for implementation will be described. The first and simplest one uses adjustment techniques at an aggregated level to make the MARs more comparable. The other one still used algorithms to make the MAR data more comparable across provinces, but it does so at a much finer level of detail (i.e., individual property records).

The work plan for implementation can be divided into five main tasks (see below). All these tasks need to be performed for both options, the main difference residing in the complexity and the level of detail at which the adjustments are performed (task 4). The MAR data input—whether macrodata or microdata—is also different according to the option. The description here pertains to the option where microdata and detailed adjustments (option 2) would be used, except in task 4, where both options are discussed.

In addition to providing a description of each of these five main tasks,⁵⁵ this section contains information on costs, timetable, and data accountability.

Task 1: Acquisition of the MAR microdata

Task 2: Data processing

Task 3: Data quality control

Task 4: Development of adjustments/algorithms to make the MAR data more comparable across provinces

Task 5: Other activities

Task 1: Acquisition of the MAR microdata

While the study established that electronic microdata files are held by all of assessment agencies in the provinces, actually obtaining these files poses some challenges for STC. In a number of cases, STC will likely have to enter into formal agreements under Section 13 of the *Statistics Act*. Some assessment agencies have indicated that they will require the payment of substantial fees for the files. In other jurisdictions, the agencies' concerns with provincial privacy legislation will have to be addressed. STC has successfully addressed such legitimate privacy concerns in analogous situations in the past, and we are confident the issue can be resolved. As well, these are large files and once agreement on obtaining them has been reached, delivery will have to be arranged.

Based on the information at our disposal today, we expect that the data acquisition process will take up to 12 months to complete.

54. As well, contrary to the survey results, it will be impossible to measure the level of precision of the resulting MARs.

55. The first three tasks described here are almost identical to the ones presented in the section covering the frame for the survey.

Task 2: Data processing

As we start receiving the MAR microdata,⁵⁶ efforts will be directed toward the data processing stage and the requirement of converting the various provincial and municipal files to a more standard database. This includes:

- receiving the data through a secure channel
- loading the data
- standardizing the data for definition and classification (residential versus non-residential properties) in concert with the standardization that will be developed for the tax revenues component or for the survey (see Appendix C for a discussion on aligning the parts for the residential and non-residential properties)
- generating aggregated data.

Task 3: Data quality control

We must ensure that a certain number of checks and balances are applied to the MAR data file that we receive. More specifically, the verification will include:

- geographical coverage corroboration
- data validation
- comparison between two years of data (when we have received two years of data). For example, comparison between the flow of the two years and the STC building permit data; comparison with census data to ensure that the stock of dwellings is within some reasonable range of other sources and, if not, to identify and possibly correct the difference. STC's Address Register may also be of value here.
- Specific validation processes such as verifying duplicate and blank records.

Task 4: Development of algorithms to make the MAR data more comparable across provinces

As its name indicates, this task is devoted to developing (and maintaining) a number of algorithms that would bring adjustments to the MAR data, with the objective of making them more comparable across provinces. Adjustments would be performed to account for missing entities, various state dates and various base dates.

a) Adjustments for missing entities

Resulting from our quality control, we may have to make estimates for missing entities (municipality, township, summer village, etc.), in terms of both number of dwellings and values. Such adjustments would only be undertaken when the relevant assessment agency is unable to resolve cases of missing entities. The source for these missing entities is likely to be the census dwelling counts associated with the building permit data or completed dwellings data from CMHC through the years to estimate a housing stock. Again, the Address Register will be assessed to determine its usefulness in this context.

b) Adjustments for various state dates

Since the various MAR files received will give a physical stock of properties for various reference dates, we have to use other sources of data to complement the data file in order to bring all files to the same reference period.

These other sources could include data from STC's Building Permits Survey and the Canada Mortgage and Housing Corporation data. The pricing of these new units added to the existing MARs can be done using information from the Building Permit Survey, in conjunction with the information on the land portion of STC's New Housing Price Index.

56. Prior to this, STC will set up the computer infrastructure required to handle this massive entry of data.

Two approaches are considered to adjust the various state dates:

- Macro adjustment without verification (option 1)

The first approach makes the assumption that the state date specified by the assessment authorities reflects reality, and then makes the appropriate adjustment. We call this 'macro adjustment without verification' because no verification will be done to ensure that the state date really reflects the reality. The macro adjustment aims to bring all the provinces up to the same state date. An example is the Quebec MARs, where the legislated date for the state date is September 15 for all municipalities. If we decide to choose December 31 as the state date, we will do an adjustment to reflect the gap between September 15 and December 31. The adjustments will use the building permit data and incorporate all new construction after September 15 in Quebec.

- Micro adjustment (option 2)

Depending on the level of precision required by FC, additional efforts to improve the adjustments can be made.

One of the verifications we can do is to validate that new construction is included and the state date is really the one that is reflected in the file. If this is not the case, we can gather the necessary information or use external sources.

An example is the Quebec MARs. Despite the fact that the legislated date for the state date is September 15, no guarantee or special efforts are made by *le Ministère des affaires municipales et des sports et des loisirs* to ensure that the state date is respected by each of the municipalities. The Quebec officials have already indicated to us that for the major cities, the update is done twice a year and sometimes the second update is not present on the electronic data file. In that case, we will try to obtain the information to correct the situation.

The process to validate the data implies that :

- we have access to two years of data,
- we can calculate the flow from the MARs and compare it with other sources to validate the data, and
- we can make the appropriate adjustment for each of the entities on the MARs.

c) Adjustments for various base dates

As noted, since the various files received will give a value of the stock of properties for various reference dates, adjustment would be required to bring them to the same date of evaluation. After data analysis and discussions with FC, a rebasing could be done.

- *Macro adjustment at the provincial level (option 1)*

For the **residential properties**, the adjustment can include the use of one or more of the following adjustments:

- General-level ratio adjustment: Efforts would be devoted to obtain this adjustment from the various assessment authorities. Some authorities already produce measures to take into account various base dates in the present roll. After analysis of the results, we may apply these ratios to correct the various base dates.
- Adjustment using the New Housing Price Index (NHPI): STC's NHPI is a monthly series that measures changes over time in the contractors' selling prices of new residential houses, where detailed specifications pertaining to each house remain the same between two consecutive periods. The survey also collects contractors'

estimates of the current value (evaluated at market price) of the land. For the NHPI, the universe consists of builders in 21 metropolitan areas who build mainly single unit houses in such volume, or in such a fashion, that they can report selling prices for comparable transactions.

- Adjustment using the housing component of the Consumer Price Index. STC's Consumer Price Index (CPI) is an indicator of changes in consumer prices experienced by Canadians. It is obtained by comparing through time, the cost of a fixed basket of commodities purchased by consumers. Since the basket contains commodities of unchanging or equivalent quantity and quality, the index reflects only pure price movements. We propose to use the housing component of the CPI in order to reflect the price movement for the various base dates.
- Adjustment using the Apartment Building Construction Price Index (ABCPI): The ABCPI measures changes in contractors' selling prices of a representative apartment building. The indexes relate to both general and trade contractors' work and exclude the cost of land, design and real estate fees.
- Adjustment using the average increase of the resale price using resale transactions from the Canadian Real Estate Board (Multiple Listing Service) or others sources: Use of the information on resale price transactions—at provincial and census metropolitan area levels—to align the various base dates is worth nothing, as that measure is not a true price index movement.

For the **non-residential properties**, the adjustment can include the use of the following:

- Non-residential Building Construction Price Index (NRBCPI): The NRBCPI is a quarterly series measuring the changes in contractors' selling prices of non-residential building construction (i.e., commercial, industrial and institutional). The indexes relate to both general and trade contractors' work and exclude the cost of assembly, design and development of land, and real estate fees.

For the territories, with the exception of the adjustment based on the shelter component of the CPI, none of the above adjustments could be performed, given the unavailability of the input data. To meet the requirements of FC, a so-called proxy approach could be developed, i.e. data for one province (or several) could serve as the basis to adjust the evaluation date of the MARs for the territories.

- *Micro adjustment: data adjustments at the municipal level (option 2)*

For the **residential properties**, the adjustment can include the use of the following:

- Level ratio adjustment using individual resale transactions: This option assumes that we will be able to obtain or buy information at a transaction level (i.e., individual record) to adjust the existing MARs. Although this approach does not meet all the requirements described in Part 3 (Standard on Ratio Studies) of the report prepared by the Altus Group, FC may find it very appropriate in the absence of a full survey, which, in our opinion, is the best tool to help ensure interprovincial comparability of residential property values at market prices.

For the **non-residential properties**, the prospects of being able to make micro-level adjustments are not good.

- The number of sales of non-residential properties each year appears to be low when compared with residential properties. When this is combined with the extreme heterogeneity of business properties (even among businesses in the same industry) there is little prospect of being able to create adjustment strata containing enough properties to yield meaningful results. If one persisted in spite of these limitations, excessive year-to-year changes in the results are likely to occur.

Therefore, STC is not proposing any adjustments based on sales transaction microdata.

For the same reason, STC is not proposing any adjustments based on sales transaction micro data for the territories (for both residential and non-residential properties).

Task 5: Other activities

A number of related data production activities are also included in the proposed work plan. These include the analysis of the data inputs (such as proposed price indexes) and outputs, the creation of standard tabulations (and possibly custom tabulations following ad hoc requests⁵⁷ by FC), and data dissemination (i.e., to those who request the data, which will not be published by STC).

6.3 Deliverables

Outputs

Annual estimates of residential and non-residential property values based on MARs (at the provincial and municipal level) will be submitted to FC according to the timetable below. They would be provided to FC using the same transmittal mechanism as described in the survey portion of this report.

In addition to the MAR results themselves, a document containing a detailed description of the definitions/concepts, methodology, data sources, data limitations and quality control will be produced.

Status reports during the implementation phase

Please see section 5.4.3 of this report.

Confidentiality and other relevant STC policies

Please see section 5.4.3 of this report.

Revisions to existing data or introduction of new methodology

Please see section 5.4.3 of this report.

6.4 Costs

As presented earlier in the report, two options are considered in terms of ways of how to make the MAR data more comparable across provinces. Cost estimates are presented for both options. Using fiscal year 2005/06 as an example, the costs to produce the data for the ten provinces are \$0.7 million for option 1 (using “macro-level” adjustment) and in excess of \$2.7 million for the more complex, detailed (“micro-level”) option. Including the territories in the activities described under the “macro-level” approach would add about \$25,000 to these costs. At this time, the \$2.7 million cost

57. Provided that the licence agreement necessary to obtain MAR microdata allows us to do so and that these requests are within reasonable complexity and frequency.

of the micro-level adjustment does not include the cost of acquiring a complete set of microdata on all real estate sales transactions from the appropriate provincial authorities (generally land registry offices⁵⁸). STC has postponed its investigation of the acquisition of data from these agencies until FC has made its selection from the range of options contained in this report. As well, it is our understanding that the Canada Mortgage and Housing Corporation is considering initiating a feasibility study where, among other things, the creation of a national repository of residential sales transactions⁵⁹ would be investigated.

These costs are based on a project start by April 1, 2005. Fiscal year 2005/06 is a development year (see section 6.5, "Timetable," for a list of key activities by fiscal year) and data acquisition should take place. The costs of acquiring MAR microdata (records for individual properties) by municipality are significantly larger than those of simply obtaining a few data points by municipality. The difference in salary expenditures between the two options is a reflection of the complexity and scope of the work.

	Option 1 'Macro-level' adjustments			Option 2 'Micro-level' adjustments		
	\$ millions					
	2005/06	2006/07	2007/08	2005/06	2006/07	2007/08
For the 10 provinces						
Salary ¹	0.4	0.4	0.4	1.3	1.2	1.3
Data acquisition	0.2	0.2	0.2	1.0	1.0	1.0
Other non-salary expenditures (informatics, travel, translation, etc.)	0.1	0.1	0.1	0.4	0.3	0.3
Total	0.7	0.7	0.7	2.7	2.5	2.6

1. The salary costs include the overhead costs, i.e., the employee benefit plans (pension, dental, insurance, etc.) and office space rent (accommodation as per PWGSC).

It is important to note that option 2 (using the more detailed micro-level adjustment), by virtue of its construction, will also produce aggregate property value. The costs for producing option 2 also include the production of option 1.

6.5 Timetable

Assuming the project starts by April 1, 2005 (provided that funding has been allocated), using option 1 ('macro-level' adjustment), STC would be able to provide to FC, in December 2006, MAR-based provincial and municipal (preliminary) estimates of residential and non-residential property values for reference year 2004 as per the methodology described earlier in this report. Estimates using micro-level adjustments would be available in August 2007. Please note that the associated data

58. Contacts were made with the Canadian Real Estate Association to enquire about the possibility of obtaining individual records of sales (i.e., sale price) through their Multiple Listing Service (MLS). However, we have been advised that such detailed information is not centrally held but instead is dispersed across the country in several real estate boards.

59. For transactions covered by the Canadian Real Estate Association's MLS.

accountability for the provincial and municipal estimates is described in the next section. Table 13 gives a summary of the key activities by fiscal year.

Table 13 Timetable of key activities for MAR options	
Fiscal year 2005/06	<ol style="list-style-type: none"> 1. Obtain/secure funding (Treasury Board submission) 2. Start project by April 1, 2005 3. Initialize project (internal governance and working group structure, hiring, etc.) 4. Establish working group between STC and FC (covering all the project components) 5. Address privacy issues 6. Acquire data, develop database, process and validate data, etc. 7. Produce two status reports to FC
Fiscal years 2006/07 and 2007/08	<ol style="list-style-type: none"> 1. Early fiscal year: continue some development activities initiated in 2005/06 2. Develop algorithms to make MAR data more comparable 3. Analyse data 4. Make tabulations 5. December 2006: disseminate data (MAR data based on macro-level adjustments) 6. Do documentation (including translation) 7. August 2007: disseminate data (MAR data based on micro-level adjustments) 8. Produce two status reports to FC 9. Do methodological assessment and overall review

6.6 Planning assumptions

As was the case for the proposed survey of residential property values at market prices, the proposed timetable, costs and design of for the MAR options described earlier in this section are contingent upon several assumptions, and modifications to them could result in amendments to these key elements. These are the main assumptions:

- The project starts by April 1, 2005 (implies that the funding for the project would be secured).
- Each option reflects information at the time this report was written and no significant changes in the information provided by external organizations will occur (such as price quotations provided by the vendors, or willingness to share the data).
- Privacy issues (such as for the acquisition of the MAR microdata) are fully resolved.
- The most recent MAR microdata can be obtained for all provinces/territories and, for a number of quality control functions, two consecutive years of data.
- Individual records of resale transactions can be obtained.

6.7 Considerations

STC believes that the proposed survey (with its associated characteristics as described earlier in this report) is the best tool to help ensure the highest level of interprovincial comparability of residential property values at market prices.

In the absence of a survey, the adjustment of the existing residential MARs (using a macro-level or micro-level approach) will yield results that may only partly correct the lack of interprovincial comparability.

Furthermore, at the present time, it is impossible to know whether the micro-level adjustment will yield results significantly different from those resulting from a macro-level adjustment. FC may want to consider that, for a minimum number of years, in the absence of a survey, both micro- and macro-level adjustments be performed to enable STC to analyse the results and provide to FC an evaluation after that period.

The residential component will represent a lesser challenge in terms of adjustments, as more related series in terms of housing are available than for the non-residential properties.

6.8 Data accountability

In order to accept accountability for the provincial estimates of residential property value estimates, STC found it is necessary to recommend a survey based on a probability sample. Data produced by adjusting the MARs, while potentially improving their interprovincial comparability, have unknown statistical properties. If FC elects to choose one of the MAR options described in this report, STC will certify only that the data have been generated according to the FC methodology. STC will not be accountable for these data.

7. Residential and non-residential property and property-related tax revenues

7.1 Methodological options

Background

As noted, inter-provincial comparability of the data on property tax revenue data is essential to meet FC's needs. Because property taxation is a provincial as well as a municipal responsibility, and because property taxation practices are at the discretion of these two levels of government, the policies and procedures that give rise to property tax revenues differ according to choices made by individual provinces, territories and municipalities. The resulting administrative data are not, therefore, inherently and directly comparable.

However, to meet the data requirements of FC, only two of the dimensions of the property tax revenue data need to be made interprovincially comparable. These are:

- the types of properties yielding what will be labelled as residential and non-residential property tax revenue, and
- the coverage of related tax revenues such as land transfer taxes.

Division of assessment and taxation responsibilities

In all provinces, property types are established by provincial assessment authorities within the context of property types specified in provincial assessment acts and the pursuant regulations. While municipalities have various degrees of discretion when it comes to setting mill rates, they must conform to the property classifications established by the provincial assessment agencies. This ensures that within each province, the coverage and labelling of the residential and non-residential taxes are consistent.

It facilitates the harmonization of the tax revenue data with the survey data on residential property values. Specifically, only those properties whose tax revenues will be labelled as residential taxes will be included in the MAR-based list of properties from which the survey sample will be drawn.

Similarly, when deriving aggregate property values directly from the MARs, (i.e., not via a survey) only those properties labelled as residential will be included in the aggregates, and these are the same properties whose taxes will be included in the tax revenue data. The same applies to non-residential properties. (Here 'residential' and 'non-residential' refer to the labelling done by Statistics Canada as described in Appendix C.)

Residential versus non-residential property tax revenues

In the data previously supplied to FC for use in Equalization, the distinction between residential and non-residential property tax revenues was not made. FC now requires that the distinction be made and that it be done in such a way that the sum of residential and non-residential property tax revenues are close to being equal to the undifferentiated property tax revenue previously provided in the certificate.

Data by municipality

FC requires property tax revenue, divided into residential and non-residential property tax revenue, for each of approximately 3,700 municipalities in Canada.

FC has requested that related taxes such as the land transfer tax be reported separately at the provincial level.

As noted in Appendix H, one of the ongoing tasks will be to keep the list of municipalities and their boundaries current and co-ordinated with aggregate property values and population, the other two elements of the program.

Collection of property taxes

Property taxes are collected primarily by municipal governments, although they are collected by the provincial government in New Brunswick. In most provinces, there is some property tax collection by the provincial government, particularly in the sparsely populated portions, known as 'unorganized areas,' where municipal governments have not been created. In the case of Quebec, property taxes are paid directly to school boards by property owners.

In many cases, while the municipal government collects the property tax, some of the collection is done on behalf of other public-sector agencies, such as school boards. To meet FC's data needs, the collection of property taxes by one provincial or local government entity on behalf of another is immaterial. What is important is that STC measure the total revenue raised by the taxation of real property and do so without double counting.

7.2 Methodological choices

From a methodology point of view, three broad options could be considered. At the one extreme, one could collect the required data from each and every one of the approximately 3,700 municipalities in Canada. At the other extreme, one could, in theory, collect data on individual municipalities via provincial government ministries that have previously collected it from the municipalities in the province.

Between these two extremes lies the possibility of using a methodology analogous to that used for many years by STC to produce its local government finance data. These data are produced only as provincial aggregates; there are no data for areas within provinces. A sample survey is conducted of local governments and applied to provincial totals to obtain provincial-level distributions of revenues and expenditures.

Under the sample survey option, to meet FC's needs we would obtain from provincial governments individual total property tax revenue data for each and every municipality within the province—in other words, the data that STC is already collecting. Then, using a sample survey of municipalities, we could obtain data on the split between residential and non-residential property tax revenue for each municipality in the province.⁶⁰ The residential/non-residential split would have to be provided by the municipalities according to definitions supplied by STC because the municipalities' own designations of residential and non-residential are not comparable interprovincially. Since the proportions of taxes from the two sources are likely to vary by type of municipality (e.g., rural versus urban, large versus small) all of the municipalities in a given province would be divided into strata (municipalities of similar type) and independent samples would be drawn from each stratum. The residential/non-residential split obtained from the survey would then be applied, within each stratum, to the total property tax revenue obtained from the provincial government.

A census of approximately 3,700 municipalities would be very expensive and time-consuming, and a sample survey would yield data subject to sampling variability and other data quality limitations. In addition, for both methodologies, it would have to be determined that municipalities were capable of reporting residential and non-residential tax revenues according to STC's definitions. Accordingly, it was decided to first examine what could be obtained from provincial governments since it was already known from the existing local government finances program that all provinces collect total property tax revenue data from their constituent municipalities.

7.3 Findings

Through contacts with all of the provincial governments, it was determined that all provincial governments have data showing the breakdown of property taxes into their residential and non-residential components, according to individual provincial definitions. In other words, the least expensive methodology, yielding the highest-quality data, has proven to be feasible, provided that STC is able to perform the adjustments described later in this section.

However:

- Some types of property are classified as residential in some provinces and non-residential in others. These mixed-treatment properties do not appear to be a large component of either the residential or the non-residential aggregate property tax revenues, but that remains to be confirmed once quantitative information becomes available.
- A few of the subcategories of residential and non-residential properties are not uniform across provinces.
- The residential/non-residential distinction is not available for individual unorganized areas where property taxes are collected by the provinces.
- In the case of dual-use properties (e.g., residence and business, residence and farm, etc.), the classification to residential/non-residential is not consistent across all provinces.
- The breakdown of non-residential properties into farms (non-residential portion), commercial/industrial properties, and other is available for all provinces, but the types of properties included in these three are not uniform.

60. This would not be the same sample as used currently. The objectives here would be quite different and so a suitable sample design would have to be developed.

- Certain property-related taxes, such as lot levies, cannot be segregated into their residential and non-residential components. They are, however, available by municipality.
- Property-related taxes, such as land transfer taxes, cannot be divided into residential and non-residential components. In addition, they are not available by municipality.
- In the case of some provinces, the required data are not currently available until approximately 24 months after the end of the reference period. (The fiscal year for municipal governments is the calendar year, with the exception of New Brunswick and a number of municipalities in Nova Scotia.)

National definitions of 'residential' and 'non-residential'

FC wants the definitions of residential and non-residential property tax revenue to be consistent across all provinces. Furthermore, FC wants the consistent definition of what a residential (or non-residential) property is to be based on the practice in the majority of provinces. (We are advised that this reflects the principles of the representative tax system, which is one of the conceptual foundations of Equalization.) In the face of the variety of practices across provinces in what is treated as residential or non-residential, the first task is to determine what types of properties are not uniformly classified, and then to determine what is the practice of the majority. The practices of the majority will then yield what might be called the national definitions of residential and non-residential.

STC has studied property-type labelling practices of all provinces by examining the provincial assessments acts and regulations. This study has identified 27 types of properties that are not classified in the same way in all provinces. Some of these represent cases where properties used for human habitation have some commercial dimension resulting in classifications of residential or non-residential, depending on the province. Bed and breakfast establishments are an example. In some relatively rare cases, some provinces use the classification 'residential' for properties that are unrelated to human habitation such as privately owned unmanaged forests.

In some cases, the issue is not one of residential versus non-residential, but rather whether the property is taxed, exempt or subject to grants in lieu of taxes. This situation arises in cases of properties in public-sector ownership (e.g., nursing homes). In these cases, we are in effect dealing with the distinction between taxable and not taxable, within the broad categories of residential and non-residential. Nevertheless, the principle of determining the practice in the majority of provinces still applies.

As noted, because provinces set property-type designations that are used by municipalities when they apply their mill rates to calculate tax bills, municipal residential tax revenues come from provincially designated residential properties, and municipal non-residential taxes come from provincially designated non-residential properties. Similar reasoning applies to the subcategories of residential and non-residential properties. The relationship between MAR property types and taxes by property type will be beneficial when it comes to making adjustments to the tax revenue data as described below.

In most cases, where there is non-uniform treatment across provinces, adjustments will have to be made to the tax revenues from the minority provinces.

Adjusting revenue data to achieve a standard definition

In those cases where the mixture is between residential and non-residential only, in the minority provinces the adjustment takes the form of moving estimates of revenues from residential to non-residential (or vice versa) as applicable in order to conform to the national (majority) definition.

However, while the municipality-specific property tax revenue data held by provincial ministries is divided into residential and non-residential, very few provinces have any further detail by property type within the two broad categories.

As a result, it is not possible to identify the revenues from particular types of properties and to move those revenues between residential and non-residential to achieve uniform coverage of the two types of property tax revenue.

It will, therefore, be necessary to find some method to indirectly estimate the revenue amounts that have to be moved and the proposed approach is to use the MARs with their provincially-designated property types.

For example, for each municipality one could use the proportion of the total assessment accounted for by the properties in question and, assuming a constant mill rate across all types of residential (or non-residential) properties, apply that proportion to the total residential (or non-residential) property tax revenue. The resulting revenue would be moved to the non-residential revenue category, or to the residential category, as the case may be.

The level of precision of these calculations is a function of the mill rates used. Mill rates are determined largely at the local level.⁶¹ However, within a given municipality the mill rate may vary by type of property within the broad categories of residential and non-residential. In theory at least, we could relax the uniform mill rate assumption and obtain all of the relevant mill rates from each municipality. The assessed values times the specific mill rate would then yield the exact revenue concerned.

However, collecting mill rates by type of property from 3,700 municipalities would be extremely expensive when one considers the small fraction of total property tax revenues that are likely to be in question (see next paragraph).

Knowledge of assessed-value distributions

The amount of precision-enhancing effort that goes into calculating these adjustments should, in the interests of statistical efficiency, be proportional to the size of the tax revenues involved. Since, as noted, we cannot obtain data on tax revenues by detailed type of property from the provinces, we do not know the magnitude of the revenues at issue, and we are unlikely to have these data directly in the foreseeable future.

Once the ongoing program is launched, however, STC will obtain MAR microdata from all provinces. Our research to date suggests that the MARs contain detailed (sometimes very detailed) information on type of property, and hence we can obtain aggregate property value data distributed by type of property for each municipality.

61. This is not entirely true in some provinces. In Ontario, for example, the province sets the same mill rate for all municipalities for purposes of calculating the amount of property tax revenue that will be transferred to the local school boards. There are also provincially imposed constraints on the relationship between the mill rate for residential properties and those for non-residential properties.

With this information in hand, we will be able to determine the level of detail on mill rates that needs to be collected and applied to the calculations to ensure that the cost is proportional to the impact on aggregate residential and non-residential revenue data in the municipalities.

Dealing with limitations of property-related taxes

Property-related taxes collected by municipalities, such as lot levies, special assessments and the like, cannot be broken into their residential and non-residential components. The data collected by the provincial ministries do not make this distinction, and because these taxes are not a function of the type of property, simulating the split via the MARs is not possible.

In the case of property related taxes collected by the provinces, primarily land transfer taxes, or deed transfer taxes, neither the residential/non-residential distinction nor the breakdown by municipality, are available.

If STC were to have access to the land registry office microdata, it would be possible, at considerable expense, to disaggregate these data by municipality since the microdata files contain very specific information on geographic location. However, even land registry office microdata would not yield the residential versus non-residential distinction since the type of usage of the land is not relevant to the land registration process.

Disaggregations of non-residential property tax revenue

FC has requested that non-residential tax revenues be disaggregated into farms, commercial/industrial properties and other.

Data from the provincial governments separately identify farm, commercial/industrial and other tax revenues. However, like the designation of residential tax revenue, the types of properties included in each of the non-residential subcategories are not uniform. It is conceivable that the same techniques using the MAR detail described above to perform exchanges between residential and non-residential can be used to increase the trans-provincial uniformity of the non-residential subcategories. FC will have to decide whether it wants STC to pursue this further.

Derivation of provincial and municipal data

In the case of the survey-based property value data, the proposal is to estimate provincial aggregates and then distribute those provincial totals to arrive at estimates for each municipality.

In the case of tax revenue data, the relationship is just the reverse. In all provinces, tax revenues disaggregated into their residential and non-residential components will be calculated for each municipality, and then these municipal revenues will be summed to arrive at a provincial total.

Future developments

As noted, the timeliness of the data available from the provincial governments varies greatly from province to province. STC will work with the provincial governments concerned to decrease the delay in the availability of the data.

The adjustments to municipal revenue data based on the corresponding MAR data may not always be necessary. There was a time when provincial ministries did not have municipality-specific data on property tax revenues, and even more recently, not all provinces could break that into the residential and non-residential components. If the trend to provinces collecting more detailed data on municipalities continues, we may find ourselves in a position for some provinces where there is sufficient property-type detail in the revenue data to achieve consistency with national definitions by moving revenues directly rather than doing it indirectly via data from the MARs.

7.4 Work plan for implementation (including costs and timetable)

Assuming the project starts by April 1, 2005, STC will be able to submit to FC in August 2007 property tax revenues data (as described in this report) for reference year 2004. This is not an ideal level of timeliness but it reflects the current delivery dates for the input data for some provinces. STC will work with the provinces in question to shorten the time required between the finalization of municipal accounts and the delivery of municipal-level data for the entire province. The annual costs of producing these data would be \$1.9 million (covering the provinces only). For the territories, the annual cost is about one hundred thousand dollars. Fiscal year 2005/06 is considered as a development year.

Table 14 Property tax revenues Costs			
	2005/06	2006/07	2007/08
	\$ millions		
For the 10 provinces			
Salary ¹	0.8	1.4	1.5
Other non-salary expenditures (informatics, travel, translation, data acquisition, etc.)	0.3	0.5	0.4
Total: 10 provinces	1.1	1.9	1.9
For the 3 territories			
Total: 3 territories	0.1	0.1	0.1

1. The salary costs include the overhead costs, i.e., the employee benefit plans (pension, dental, insurance, etc.) and office space rent (accommodation as per PWGSC).

Table 15 shows the key activities and the associated timetable.

Table 15 Timetable of key activities for property tax revenue	
Fiscal year 2005/06	
<ol style="list-style-type: none"> 1. Obtain/secure funding (Treasury Board submission) 2. Start project by April 1, 2005 3. Initialize project (internal governance and working group structure, hiring, etc.) 4. Establish working group between STC and FC (covering all the project components) 5. Establish a uniform definition of residential and non-residential properties 6. Develop database 7. Develop methodologies for adjusting revenue data to obtain uniform definition 8. Produce two status reports (covering all the project components) 	
Fiscal years 2006/07 and 2007/08	
<ol style="list-style-type: none"> 1. Collect data 2. Capture and process data 3. Derive provincial and municipal data as per developed methodologies 4. Analyse data and perform quality control 5. Do tabulations 6. Do documentation (including translation) 7. August 2007: disseminate data 8. Produce two status reports to FC (covering all the project components) 9. Do methodological assessment and overall review 	

Deliverables

Outputs

Annual estimates of property and property-related tax revenues (at the provincial and municipal level) will be submitted to FC according to the timetable described above. They would be provided to FC using the same transmittal mechanism as described in the survey portion of this report.

In addition to the tax revenue results themselves, a document containing a detailed description of the definitions/concepts, methodology, data sources, data limitations and quality control will be produced.

Status reports during the implementation phase

Please see section 5.4.3 of this report.

Confidentiality and other relevant STC policies

Please see section 5.4.3 of this report.

Revisions to existing data or introduction of new methodology

Please see section 5.4.3 of this report.

7.5 Data accountability

As stated earlier, in order to accept accountability for the provincial estimates of residential property values, STC found it necessary to recommend a survey based on a probability sample rather than making use of the MARs, subject to some form of adjustment through modelling. This was based on the fact that producing data by adjusting the MARs would have resulted in data with unknown statistical properties which, if known, could have rendered the data unfit for use as the base for calculating each province's entitlement for the property tax component under Equalization.

Property tax revenue by province and municipality

In the case of the property tax revenue data, as noted above, data from one source (MARs) will be used to adjust data from another (municipal property tax revenue data). Such adjustments are a simple form of modeling. The question, therefore, is whether STC can accept accountability for the residential and non-residential property tax data in light of the use of adjustments (simple models) to achieve consistency in the types of properties covered by residential and non-residential property taxes.

Provincial level:

In the case of property tax revenue data, STC expects to be able to accept accountability for the provincial-level data. We cannot say with certainty for three reasons:

- We have not yet taken receipt of the municipal-level data that the provinces have said that they could provide. Nevertheless, years of experience using provincial government finance data leads us to expect that they will be of good quality.
- We do not yet know the level of detail on property types contained in the MAR microdata. If there is little information on property types (and this seems unlikely), the adjustments described earlier in this section of the report cannot be executed with sufficient precision.
- As noted, we do not know the size of the property tax revenues relative to the total that will be involved in the adjustments. The larger the relative size, the more the adjustments compromise fitness for use.

Within these constraints, STC can accept accountability for the provincial-level data in spite of the presence of adjustments for the following reasons:

- The properties of the adjustments are known. If we were to use for each municipality the precise mill rate for the type of property whose taxes are subject to adjustment, the adjustment would be of the same quality as the unadjusted tax data and the impact of the adjustment would be known with equal precision. (The tax data are from audited municipal financial statements and are, therefore, extremely reliable; the MAR data used in the adjustment are the very same data used by each municipality.) Even when, in the interest of efficiency, we use one mill rate for all types of residential properties, and one mill rate for all types of non-residential properties, to perform the adjustment, the impact of using approximations can be measured. All that we would need to do is to take a sample of municipalities and do the adjustment using property-type-specific mill rates and then compare the provincial-level numbers under the two methods.
- We have been advised that the tax revenue data for any one province have a much smaller impact on that province's entitlements than the corresponding aggregate property value data. This makes the consequences of possible bias or variance much smaller and so less exacting standards are required to achieve fitness for use.

As for the disaggregation of non-residential tax revenue into farms, commercial/industrial properties and other, the issue is lack of interprovincial comparability in the definitions of types of non-residential properties used by the provinces. STC would accept accountability only if the same kinds of adjustments were performed on the non-residential property type categories as are proposed to harmonize the overall residential and non-residential tax revenues. The adequacy of these adjustments depends on the same conditions as noted for residential property tax data. That is, the revenue data from the provinces would have to be of high quality and sufficiently detailed, and the same would apply to the non-residential MARs. The cost of implementing such adjustments has not been included in the cost estimates.

Municipal level:

In the case of municipal-level data, STC expects that it will not be able to accept accountability for estimates at this level. This is based on a concern about the accuracy and materiality of the adjustments for the many very small municipalities among the 3,700 in total. In a rural town or village, the presence of a large, residential care home can have a material impact on that town's property tax revenues.

When summed over all of the municipalities in a province, however, these situations are not sufficiently consequential for STC to decline accountability.

Property-related tax revenue by province and municipality

For purposes of allocating accountabilities, a distinction needs to be made between property-related taxes collected by the provinces and those collected by the municipalities.

STC would accept accountability for estimates of provincially collected tax revenues at the provincial level but these would not differentiate between those applicable to residential and those applicable to non-residential properties. STC would not be accountable for municipality-specific data on provincially collected property-related taxes.

STC would accept accountability for provincial-level data on property-related tax revenue collected by municipalities, but these data would be undifferentiated between residential and non-residential. As for municipality-specific data, it is unlikely that STC would accept accountability. However, a final determination would have to wait until STC had an opportunity to assess the quality of these data as received from the provincial ministries of municipal affairs.

8. Population estimates

FC requested annual population estimates by municipality / census subdivision (CSD).⁶² STC already produces official annual national and provincial/territorial population estimates. These provincial/territorial estimates are currently provided to FC for use in the Equalization program and other transfer programs. STC also produces official subprovincial population estimates for census metropolitan areas (CMAs) and for census divisions (CDs). (See Appendix H for a discussion on municipal geography and the standard geographic classification.) The quality of these estimates has been demonstrated through numerous studies and is recognized by all Canadian users.

STC also produces estimates of population at the CSD level, but these estimates are not part of the official estimates program and are available only on a cost-recovery basis. Because of quality concerns regarding the available input information at the CSD level, STC uses a different estimation approach from the one used to derive the official estimates at the CMA and CD levels. In the latter cases, STC uses a so-called *Cohort*-component method with direct data (on population flows such as births, deaths, migration, etc.). For the CSD statistics, STC uses a mathematical model called the previous intercensal growth rate method.

During the feasibility study, STC evaluated three simple and readily available census-based methods. An assessment and a comparison of these three methods are presented in section 8.1.⁶³ In addition, an assessment of the municipal estimates produced by the statistical agencies of British Columbia, Northwest Territories and Quebec⁶⁴ was also performed and is included in this report.

8.1 The three census-based methodological options

Description

Below is a brief description of the three readily available census-based methods to produce the municipal population estimates requested by FC. All those methods meet FC's timeliness and coverage requirements in addition to allowing the highest possible levels of interprovincial comparability. A detailed description of each method, including main assumptions, coverage and timeliness, is presented in Appendix I. As we indicated on a number of occasions, the choice of the option that best meets its requirements resides with FC, and FC will need to accept accountability for the data.

62. Population estimates would be produced for CSDs for which property value data and tax revenue data are available for the reference year. It is expected that the list of municipalities contained in the Public Sector Universe of STC's Financial Management System (FMS) will be used. In 2001, the FMS contained 3,737 municipalities. The difference between the number of CSDs in the 2001 Census (5,600) and the number of municipalities in the FMS list (3,737) is due to two main factors: the Indian reserves (approximately 1,150 of them,; FC has asked that they be excluded) and the unorganized territories (areas within a province that are not covered by municipal governments). Data for the unorganized territories would be provided as a total.

63. Such assessment was also available in the third status report, submitted on November 19, 2004.

64. They are the only provincial/territorial jurisdictions producing these data.

The three census-based methods examined were the following:

- The last adjusted census method (method 1) is the simplest. It consists of using the last census available (here, 2001), adjusting for net undercoverage and keeping the population numbers constant until the next census information is available. (The 2006 Census adjusted numbers should be published in 2008.) One of the implications of using this method is that in all post-censal years, the CSD estimates produced by it will not add up to the corresponding CDs and CMAs
- The current CD growth rate method (method 2) applies the CD population growth, which is calculated annually, to its CSDs' population estimates of the previous year. Algebraically, this method yields CSD estimates that sum to the appropriate CD and CMA totals. However, rounding errors in the course of calculations requires a very small additional adjustment as a final step to achieve numeric consistency.
- The previous intercensal growth rate method (method 3) is the one currently used by STC. More complex than the two other approaches, it applies to each CSD its growth rate of the previous intercensal period (here, 1996 to 2001) and makes the totals consistent with the current CD population estimates through a raking process.

Concepts of evaluation

The method used to evaluate alternative algorithms for estimating CSD populations in the years following each census involves measuring each method's performance between the two most recent censuses. More specifically, we start with the CSD populations as of 1996, as measured by the census and adjusted for net undercoverage. We then apply each of the methodologies being studied to these base CSD populations to generate post-censal time series. We then measure how close the post-censal estimates are to the benchmark provided by the 2001 Census (also adjusted for net undercoverage). The difference between the post-censal estimate and the 2001 benchmark is referred to as the error of closure. The assumption is that the relative performance of each method will be replicated in the years after 2001.

The error of closure comes from two sources:

- differences in the level of net undercoverage in successive censuses, and
- errors induced by the estimating method.

For the period 1996 to 2001, the error of closure (EC) is calculated as follows:

$$EC = PD_{2001} - C_{2001adj}$$

Where: PD_{2001} is the final post-censal estimates (based on adjusted 1996 Census counts) as of July 1, 2001, and
 $C_{2001adj}$ is the census count adjusted for net undercoverage and adjusted to July 1, 2001.

The error of closure is often represented as a percentage, which is obtained by calculating $(EC / C_{2001adj}) * 100$.

We have used the mean absolute percent error (MAPE) of closure, one of the most common measure in the field of population estimate assessment, in order to evaluate estimates and measure differences between them. MAPE is the sum of the estimated percent error (regardless of the sign) measured for each area divided by the number of areas.

Evaluation of the three census-based methods (1996 to 2001)

Of the 3,737 CSDs that were included in the 2001 list of municipalities used for this study, 518 were excluded, mostly because of boundary changes between 1996 and 2001. The analysis was thus done on 3,219 CSDs. To be included, CSDs had to meet these three criteria:

- They were on the 2001 list of municipalities used for this study.
- There were no boundary changes from January 1, 1996 to January 1, 2001.
- The population > 0 for the estimates of both July 1, 1996 and July 1, 2001.

By comparing the MAPE of closure, we see from Table 16 that while the three methods show similar precision, the current CD growth rate method (method 2) gives the best results by a small margin (i.e., the lowest MAPE of closure). While the similarity in precision between the three methods was also found in studies looking at the period 1991 to 1996, the previous intercensal growth rate approach (method 3) then gave better results (Bender and Bédard, 1996 Federal–Provincial–Territorial Conference on Demography).

Estimating method	MAPE of closure	Weighted MAPE of closure
	MAPE (%)	
Method 1: Last adjusted census	8.8	6.5
Method 2: Current CD growth rate	7.3	4.0
Method 3: Previous intercensal growth rate	8.0	4.7

Notes:

Best results are indicated using bold numbers.

1. The results were obtained using 3,219 CSDs.

Regardless of the estimating method, the MAPE of closure of CSD estimates is considerable higher than what was measured at the CD level (1.3%) over the period 1996 to 2001.⁶⁵

MAPE of closure according to CSD characteristics

For all three methods, CSD size is the factor explaining most of the MAPE of closure variability. As shown in Table 17, while the average error is very high for small CSDs, it goes down as the CSD's population gets larger. These findings are consistent with what was found for the period 1991 to 1996 (Bender and Bédard, 1996 Federal–Provincial–Territorial Conference on Demography).

65. See 2003 Annual Demographic Statistics, Statistics Canada Catalogue no. 91-213-XPB for more details on error of closure at the provincial/territorial, CD and CMA levels.

CSD size in 1996, by population	Number of CSDs	Method 1 Last adjusted census	Method 2 Current CD growth rate	Method 3 Previous intercensal growth rate
number		MAPE (%)		
<250	486	17.8	16.1	18.4
250–999	1,324	8.4	6.8	7.5
1,000–2,499	683	6.3	5.3	5.7
2,500–4,999	279	5.3	4.5	4.4
5,000–9,999	172	6.3	4.4	4.4
10,000–99,999	246	5.7	3.4	3.5
100,000–499,999	23	9.4	2.4	2.1
500,000+	6	7.4	1.8	2.4
All CSDs	3,219	8.8	7.3	8.0

Note:

Best results are indicated using bold numbers.

Another way to see the effect of population size on the error level is to weight that error by the population of each CSD. In this study, the weight is defined by the proportion of the population of each CSD within its province. The effect of the weighting is clear: the MAPE of closure goes down for each method (Table 16). We can also note that the Current CD growth rate method (method 2) gives the best results for a majority of the CSD size categories (Table 17).

MAPE of closure also varies according to the province/territory (Table 18a below). Method 2 gives the best results for the majority of provinces/territories. One can also note that the average CSD-level error is often high when the provincial CD-level error is also high (Alberta, Saskatchewan, Newfoundland and Labrador, and the Yukon are the exceptions). Exclusion of CSDs because of boundary changes might also explain some of the regional differences. In other words, in one province the excluded CSDs might have been subject to high error of closure while those in another province might have been subject to low error. Finally, weighting of the error diminishes the interregional differences (Table 18b).

Table 18a MAPE of closure, by estimating method and province 1996 to 2001				
Province/ territory	Number of CSDs	Method 1 Last adjusted census	Method 2 Current CD growth rate	Method 3 Previous intercensal growth rate
	number	MAPE (%)		
Nfld.Lab.	284	14.0	7.7	7.0
P.E.I.	41	4.8	5.0	8.4
N.S.	44	3.8	2.9	3.6
N.B.	96	5.0	4.3	4.9
Que.	1,090	5.3	4.5	5.6
Ont.	224	7.8	5.7	5.4
Man.	185	6.6	5.5	5.6
Sask.	765	12.7	11.1	12.1
Alta.	303	10.7	10.7	11.8
B.C.	133	8.3	6.7	6.2
Y.T.	10	37.3	35.3	33.4
N.W.T.	19	7.6	6.7	8.6
Nvt.	25	8.9	4.5	7.0
All CSDs	3,219	8.8	7.3	8.0

Note:
Best results are indicated using bold numbers.

Table 18b MAPE of closure, by estimating method and province 1996 to 2001				
Province/ territory	Number of CSDs	MAPE of closure CD level	Method 2 Current CD growth rate	Weighted method 2 Current CD growth rate
	number	MAPE (%)		
Nfld.Lab.	284	2.6	7.7	3.9
P.E.I.	41	1.2	5.0	3.2
N.S.	44	1.6	2.9	2.3
N.B.	96	0.9	4.3	2.3
Que.	1,090	0.9	4.5	2.5
Ont.	224	1.1	5.7	4.1
Man.	185	1.7	5.5	2.2
Sask.	765	2.3	11.1	5.5
Alta.	303	1.9	10.7	2.5
B.C.	133	1.0	6.7	2.8
Y.T.	10	---	35.3	10.5
N.W.T.	19	1.6	6.7	3.4
Nvt.	25	0.8	4.5	6.0
All CSDs	3,219	1.3	7.3	4.0

Note:
The Yukon consists of one CD.

8.2 Estimates produced by provincial/territorial agencies

On September 23, 2004, preliminary findings for this component of the feasibility study were presented at the meeting of STC's Federal–Provincial–Territorial Committee on Demography.⁶⁶ Some participants questioned the quality of the CSD-level estimates when compared with the official subprovincial estimates (CMA and CD levels).

Moreover, the three jurisdictions that are producing CSD-level estimates (British Columbia, Quebec and the Northwest Territories) asked that their results, based on sources of information specific to their jurisdiction and on more complex methodologies, be considered. This is in direct line with the mandate of STC's Demographic Estimates Program, which is to use the best estimates available. This is already done for the official subprovincial (CD and CMA) preliminary post-censal estimates in which the data from BC Stats and l'*Institut de la statistique du Québec* (ISQ) are used because they have historically been shown to be of better quality. Updated and final post-censal estimates are all produced by STC's Demography Division.

Description of the methodology and sources used by the statistical agencies of British Columbia, Quebec and the Northwest Territories

- British Columbia: BC Stats produces its CSD-level population estimates using regression methods with specific symptomatic indicators (number of residential electrical connections and Old Age Security (OAS) recipients). For more details on the methodology, see *Generalized Estimation System (GES), Small Area Population Estimation Methodology* published by BC Stats in 1998 and available on their website.⁶⁷
- Northwest Territories: The Northwest Territories Community Population Estimates Program of the NWT Bureau of Statistics⁶⁸ produces its CSD-level population estimates using census numbers and the cohort-component approach with administrative files specific to the territory (Health Care Registration file and Health Care Address files).
- Quebec: L'*Institut de la statistique du Québec* (ISQ) produces its municipal population estimates with the cohort-component approach, using census counts as controls and population base. It gets its component of growth from the *Fichier d'inscription des personnes assurées* (FIPA) of the *Régie de l'assurance maladie du Québec* (RAMQ). A methodological document is available on the ISQ website.⁶⁹

Evaluation of the CSD-level population estimates produced by provincial/territorial agencies

In order to assess the precision of the CSD-level estimates produced by the provincial/territorial agencies, we compared the MAPE of closure of those estimates with the ones produced from the Current CD growth rate method (method 2), which gave the best results.

66. The provincial/territorial members of this committee are the provincial–territorial statistical focal points.

67. <http://www.bcstats.gov.bc.ca/data/pop/popstart.htm>

68. <http://www.stats.gov.nt.ca/>

69. <http://www.stat.gouv.qc.ca/donstat/societe/demographie/>

Table 19a MAPE of closure, by estimating method: British Columbia, Northwest Territories and Quebec 1996 to 2001			
Province/ territory	Number of selected CSDs	Provincial/territorial agency's method	STC's current CD growth rate (method 2)
	number	MAPE (%)	
British Columbia ¹	124	4.1	6.9
Northwest Territories	19	6.3	6.7
Quebec	1,090	2.1	4.5

Note:

Best results are indicated using bold numbers.

1. For British Columbia, nine CSDs were excluded because of boundary problems.

Measured by the MAPE of closure, the estimates produced by the provincial/territorial agencies showed better results (Table 19a). This superiority still exists when CSD size is taken into account (Table 20). Finally and as it was seen above, the weighting lowers the average error level; this shows that a large proportion of the error is found in smaller areas (Table 19b). It is also interesting to note that the STC approach is more affected than the other methods by the weighting.

Table 19b Weighted MAPE of closure according to the estimating method, British Columbia, Northwest Territories and Quebec 1996 to 2001			
Province/ territory	Number of selected CSDs	Provincial/territorial agency's method	STC's current CD growth rate (method 2)
	number	MAPE (%)	
British Columbia ¹	124	2.3	3.0
Northwest Territories	19	3.5	3.4
Quebec	1,090	1.2	2.5

Note:

Best results are indicated using bold numbers.

1. For British Columbia, nine CSDs were excluded because of boundary problems.

Table 20
**MAPE of closure, by estimating method and CSD size,
 British Columbia, Northwest Territories and Quebec
 1996 to 2001**

Province/ territory	CSD size by population	Number of selected CSDs	Provincial/territorial agency's method	STC's current CD growth rate (method 2)
	number		MAPE (%)	
B.C. ¹	< 2,500	47	5.9	9.8
B.C. ¹	≥ 2,500	77	3.0	5.0
N.W.T.	< 2,500	15	6.9	7.5
N.W.T.	≥ 2,500	4	3.8	3.9
Que.	< 2,500	809	2.4	4.9
Que.	≥ 2,500	281	1.2	3.4

Note:

Best results are indicated using bold numbers.

1. For British Columbia, nine CSDs were excluded because of boundary problems.

If provincially/territorially supplied population estimates at the CSD level were to be used in place of those that will be produced by STC, it would raise questions about the interprovincial comparability of the municipal population estimates. While FC has requested that interprovincial comparability be given the highest priority, the impact on comparability of using of provincially/territorially-generated municipal population estimates needs to be assessed in context. In two of the three methods mentioned above, the CSD estimates produced by the provinces/territories will be strictly consistent with the CD and CMA estimates produced by STC, and these in turn are strictly comparable interprovincially. When one considers that there are 288 CDs and 27 CMAs, the scope for non-comparability across provinces is very limited.

8.3 Other sources and methods

Based on what other statistical agencies⁷⁰ are doing to produce municipal population estimates, alternative Canadian sources of information have been identified, but not yet evaluated.⁷¹ These sources are the Vital Statistics (data on births and deaths available at the municipal level), Canada Post's Householder Counts (number of delivery points by Postal Code) and Municipal Assessment Rolls (number of residential properties by municipality). These data could be used as symptomatic indicators in regression approaches. If it were determined that these sources meet FC requirements of timeliness, coverage and comparability, they could become of interest to those searching for new ways to produce higher-quality municipality population estimates. Further investigation of income tax returns, from which STC gets most of its migration components to produce the official population estimates, should also be considered.

Moreover, the cohort-component approach, which is used by STC to produce its official estimates, might be usable for larger CSDs. Further investigation of the accuracy of the components of growth (vital statistics, migration components) at that geographical level has to be done in order to find a

70. The work of statistical agencies in the United States, the United Kingdom, Australia and New Zealand has been studied.

71. The cost of evaluating methodological enhancements inspired by the practices of other countries, and those already identified such as using the cohort-component method for large CSDs, are covered in the cost estimates presented in Table 21. Such potential enhancements will be adopted for producing the data only with FC's endorsement.

possible population size threshold from which this method could be used. Such a threshold could also be defined for the three STC census-based methods presented in the report.

8.4 Summary findings

- The cohort-component method that is used to produce the existing official subprovincial population estimates (CMA and CD levels) cannot, at this point in time, be reproduced at the municipality (CSD) level.
- CSD-level population estimates produced with the three STC census-based methods are of lower quality than STC's official provincial/territorial and subprovincial estimates.
- Among the three STC methods, the current CD growth rate method (method 2) is the best, slightly giving better results than the previous intercensal growth rate method, which is currently used by STC to produce unpublished CSD estimates.
- For all methods, the quality of the estimates improves with increasing CSD population.
- CSD-level population estimates produced by three provincial/territorial statistical agencies (Quebec, British Columbia and the Northwest Territories) were all found to be of better quality when compared with those based on any of the three STC methods.

8.5 Options and work plan for implementation (including costs and timetable)

Five methodological options can be considered by combining the three methods presented by STC with those by the provincial/territorial statistical agencies that produce CSD-level population estimates:

1. Last adjusted census method (method 1).
2. Current CD growth rate method (method 2).
3. Previous intercensal growth rate method (method 3).
4. Current CD growth rate method (method 2) with substitution of the population estimates produced by the provincial/territorial agencies, where available.
5. Previous intercensal growth rate method (method 3) with substitution of the population estimates produced by the provincial/territorial agencies, where available.

As can be seen, two of the options are variants of the STC census-based methods. These two options take into account the population estimates produced by the statistical agencies of British Columbia, the Northwest Territories and Quebec.

The following table shows, for each option previously discussed in this report, various elements of the work plan for implementation. These include timeliness, costs, interprovincial comparability, and data accountability. As the CSD-level population estimates are not official, STC will not recommend a specific option. If FC considers that one (or more) of the proposed options meets its specific requirements, STC will certify that the data have been generated according to the FC methodology but will not be accountable for these data.

Assuming the project starts by April 1, 2005, preliminary data for reference year 2004 (as of July 1) would be available in June 2005. The annual costs to produce the requested statistics range from about \$170,000 to \$210,000, depending on the selected option.

Table 21
Options for implementation: population estimates at the CSD (municipality) level

	Option 1 Last adjusted census method	Option 2 Current CD growth rate method	Option 3 Previous intercensal growth rate method	Option 4 (variant of option 2) Current CD growth rate method with estimates produced by the provincial/territorial agencies	Option 5 (variant of option 3) Previous intercensal growth rate method with estimates produced by the provincial/territorial agencies
First reference year (as of July 1)	2004	2004	2004	2004	2004
Timeliness	Yearly estimates reflecting boundary changes would be available six months after the reference date. ¹	Preliminary post-censal estimates are available six months after the reference date. Revised and final post-censal estimates are available 18 and 30 months after the reference date.	Same as option 2	Same as option 2	Same as option 2
Precision of the results (rank) ²	5	3	4	1	2
Interprovincial comparability	Highest	Highest	Highest	Not as high as options 1, 2 and 3 ³	Not as high as options 1, 2 and 3
Annual costs for 2005/06 (\$ millions)	Total: \$169 Salary: \$129 Non-salary: \$40	Total: \$189 Salary: \$147 Non-salary: \$42	Total: \$194 Salary: \$150 Non-salary: \$44	Total: \$203 Salary: \$158 Non-salary: \$45	Total: \$208 Salary: \$162 Non-salary: \$46
Data accountability	Finance Canada	Finance Canada	Finance Canada	Finance Canada	Finance Canada

1. These estimates, as of July 1 of the census year, are produced every 5 years, 30 months after Census Day.

2. The options are ordered according to the precision of their results, using the findings presented for the period 1996 to 2001, based on the mean absolute percent error (MAPE) of closure, with 1 having the highest precision and 5 the lowest.

3. Because the estimates produced by British Columbia, Quebec and the Northwest Territories are based on data sources that cannot be replicated throughout the country (and hence on methodologies that cannot be replicated), the options suggesting the use of estimates produced by the provincial/territorial agencies, while giving better results for these jurisdictions, do not provide strictly the same level of interprovincial comparability as provided by options 1, 2 and 3.

The following five main items were taken into consideration to arrive at the annual operations costs for all five options:

- Harmonization and managing the project's list of municipalities (CSDs)
Each year, work will be undertaken to update the project's list of CSDs for which data will be produced. This is an important step since this list will be used to build the sample needed for the survey of residential property value and to define the municipalities for tax revenue purposes. This list will take into account different sources of information such as the most recent census, the annual list produced for STC's Financial Management System, the MARs and the *Interim List of Changes to Municipal Boundaries, Status, and Names* produced by STC Geography Division. The *Interim List* identifies the municipal changes based on information received through provincial/territorial gazettes, letters patent, and orders-in-council. Given the fact that CSD geographical limits are often changing, this will create a significant workload (see Appendix H).
- Annual production of the CSD-level population estimates
Once the new CSD geographical limits are defined for each reference year, STC has to go back to the most recent census for which net undercoverage was calculated and recreate a new population base as of the date of that census. This new base will have to be used by all data-producing agencies involved in the population estimates process: STC and the three jurisdictions generating their own CSD estimates. The new base will be built by taking into account the net undercoverage rates, and the population challenges brought by external users.⁷² The new base will also require specific estimates for incompletely enumerated Indian reserves, even though these reserves are not part of the target CSDs.

Once this population base is done, the methodology chosen by FC will be applied and a new set of estimates will be produced. Finally a raking process will be applied to the new estimates so that the sum of the CSD populations within a CD equals the population of that CD. This will be done following the release of the official CD-level estimates by age and sex (as of July 1), which are produced in November of each year.

The production workload will vary according to the chosen option. While options 3 and 5 need population bases for the last two censuses, other options need only one population base.

- Informing the user community and addressing their questions
By using CSD-level population estimates for the Equalization program, we have to be ready, on an ongoing basis, to answer questions of a methodological nature raised by various users. As the producing agency, STC must allow resources to respond promptly and effectively to these inquiries.
- Development
Since actual CSD-level population estimates do not achieve the precision of the official estimates done at other geographical levels, STC will assess alternative ways to produce better CSD-level estimates. As well, proposals coming from provincial and territorial statistical focal points will be taken into account.

72. Following the publication of each census's CSD population counts, there are always some external challenges of those counts, generally by local officials.

The production item is the only one varying according to the option. Being the simplest to use, option 1 is the least costly. At the other end of the spectrum, options using STC method 3 will cost more because of the need for population bases from the two last censuses.

As the methods used to produce estimates are already developed, most of the costs come from ongoing operations. Assessment of new methods, which can be associated with development, will be done on an ongoing basis.

9. Next steps

This report represents a menu of feasible statistical programs from which FC can choose with a view to having new data series available for the Equalization formula in the future.

The next step is for FC to choose from the menu contained in this report and/or to suggest further small-scale investigations. However, both the time and the money available for supplementary investigations are very limited.

We will need to have a formal report from FC describing their choices as supporting document for the Treasury Board submission.

STC will approach the Treasury Board for funding for an ongoing program to produce the data series chosen by FC. This will be A-base funding of indefinite duration.

An extremely important issue is STC's financial capacity to begin the work on April 1, 2005. This will be fully discussed between STC and FC and resolved before that date.

Appendix A

Summary of the methodology used to conduct the field test for the proposed survey of residential property values at market prices

STC conducted a very small field test in Ottawa and Gatineau from mid-October to mid-December 2004. The objectives of the field test were to evaluate various operational logistics (i.e., contact with respondents, tracing, respondent relations, case management, etc.) and to determine respondents' willingness to participate in a survey of residential property values.

Prior to the start of the field test, STC conducted a preliminary privacy impact assessment and developed the necessary procedures to ensure confidentiality, privacy and security of the collected information.⁷³

The sample for the field test could not be drawn from municipal assessment rolls (MARs)—the preferred frame source being considered for the survey. Attempts were made to obtain access to the MARs from the City of Ottawa and the City of Gatineau, but we were unsuccessful in obtaining the data in time for the field test. The City of Ottawa was quite co-operative. However access could not be granted as MARs in Ontario are the property of the Municipal Property Assessment Corporation (MPAC). Negotiations with MPAC on obtaining a small sample of properties for the field test in Ottawa were unfruitful because of the high fee that MPAC requested for access to their files. The situation in Gatineau that prevented accessing MARs was related to access to information policies. STC is confident that these issues would be resolved in the context of a full-scale, ongoing survey.

In order to ensure that the field test could proceed, STC used two alternate frame sources. A number of households were selected for dwellings that had previously participated in the Labor Force Survey. The other properties were selected from the databases of the Multiple Listing Services (MLS).⁷⁴ Various types of residential properties were selected from both frame sources. Whether owner-occupied or rentals, the sample included single detached, semidetached, duplex, triplex, condominium apartments or row units, mobile homes, vacant lots and four-to-sixplexes, as well as a few larger multifamily rented properties.

73. Further work is required to involve the provincial/territorial privacy commissioners for the full-scale survey.

74. Our concern with using the LFS as a frame was that respondents would have just participated in a survey and any additional supplements for six months, potentially affecting their willingness to participate. Therefore, in order to introduce a 'fresh' sample and be able to select various types of properties in a relatively short period, we selected records from the MLS database.

The collection process⁷⁵ started with STC interviewers making the initial contact with the selected sample of property owners a few days after that the introduction package—letter and pamphlet—had been sent. Prior to sending out the introduction package to the MLS sample, interviewers were asked to trace respondents.⁷⁶ Once agreement to participate was obtained, cases were assigned to certified appraisers hired by the appraisal directorate of Public Works and Government Services Canada (PWGSC).⁷⁷ It is worth noting that time and budget constraints did not allow for the development of sophisticated collection procedures (such as computer-assisted interviewing software). Nevertheless, procedures were put in place that approximated the desired data flows (although these procedures were mostly manual).

The appraisal field work also involved collecting contextual information and preparing the appraisal reports. Appraisers were instructed to follow their usual appraisal techniques. Note that it was not the objective of the field test to develop and implement a consistent appraisal 'standard' although it will be required for a full-scale survey. However, appraisers were asked to use secure STC laptops (to ensure that collected information remained confidential) and prepare the appraisal reports using a variant of the Appraisal Institute of Canada's standard form. Appraisal reports, once completed and checked for completeness and overall quality control, were provided to the property owners who have requested a copy of the report.

75. Prior to the actual collection process, training was provided to the STC interviewers as well as to the certified appraisers.

76. With the LFS data, STC was quite confident that the majority of respondents still lived at the same address. With MLS data, on the other hand, STC could not be certain and wanted tracing to be done first. In addition, what made tracing respondents for this test more challenging than usual was trying to find the owners/landlords of large condominiums and incorporated businesses (those with a corporation number as identification instead of a name).

77. PWGSC provided contract management and quality control services to STC in conducting the field test. PWGSC also acted as the liaison with the appraisal community via the Appraisal Institute of Canada (AIC) and the Ordre des évaluateurs agréés du Québec (OEAQ).

Appendix B

State of New York: Market Value Survey

With the exception of the state of New York, all U.S. states have legal standards concerning the level of property assessment (LOA). The most common standard generally corresponds to 100% of market value. Some states use a fixed fraction of market value, such as 50% or 75% of market value. However, the same standard applies to each local government.

What is unique about the state of New York is that each local government can choose its own LOA (X% of market value); however, each property within a local government's territory must be assessed according to the same standard. If the LOA is 50% for a given city, each home in that city must be assessed at 50% of market value. New York's *Real Property Tax Law* (RPTL 503) requires each local government to determine its LOA and the state to verify whether the LOA has been determined properly. If not, a new LOA will be established by the state. The LOA is confirmed or corrected independently by the state using the Market Value Survey conducted by the Office of Real Property Services (ORPS). The LOA established by the ORPS corresponds to the equalization rate. If market conditions were to change and neither the LOA nor the assessments changed, the equalization rate would be different from the LOA.

The equalization rate is established annually for each municipality, city, town and village in the state. This rate is used to bring the value of the assessment roll for each entity back to the market value in order to achieve an equitable distribution of funds for schools or roads and to set taxes fairly among the different municipalities.

To estimate the equalization rate under the Market Value Survey, two major approaches are used, depending on whether or not municipalities have recently conducted a reassessment of the housing stock.

For entities that have recently conducted a reassessment of the housing stock, the approach consists of using the information available as a result of this reassessment. The ORPS checks the procedure followed and the products associated with the reassessment. To check the results, data on valid sales are compared with the current values on the assessment rolls and various statistical tests are used to confirm the level of assessment. Next, the ORPS makes sure that there were sufficient data available on dwelling characteristics and the overall market and that appropriate assessment techniques were used to estimate market values. If the date of reassessment does not coincide with the date on which market value is measured by the ORPS, macro-adjustments are made on the basis of the most recent market trends.

For entities that have not recently reassessed their roll, the ORPS uses various techniques to establish the full market value of the housing stock and the equalization rate. For entities that have data of sufficient quantity and quality on property characteristics and/or sales, the usual techniques are used:

- Sales ratio study: comparison of assessment with the price of properties sold (prices can sometimes be adjusted according to recent trends in the market)
- Computer-assisted mass appraisal ratio study (CAMA): comparison of assessed value of properties at market value on the basis of a computer-generated prediction of market value using regressions on the physical characteristics of properties.

Appendix C

Residential and non-residential properties: Aligning the parts

All provinces designate real property as residential or non-residential. However, the labelling system is not uniform across all provinces. For example, bed and breakfast establishments are residential in some provinces and non-residential in others. In three provinces, 'unmanaged forests' are designated as residential properties, and non-government care homes are variously classified.

FC requires the following:

- The types of properties going into the categories of residential and non-residential must be consistent across provinces.
- The types of properties to be included as residential or non-residential must reflect taxation practices in the majority of the provinces.
- The types of properties recognized as residential or non-residential in the survey of residential property values, and in data derived directly from the MARs, must be the same types of properties whose taxes are classified as residential or non-residential in the property tax revenue data.

It will, therefore, be necessary to ensure that the MAR-based frame from which the survey sample will be drawn is aligned with:

- the list of properties that will be used to derive property value data from the MARs, and
- the residential and non-residential property tax revenue data.

Provincial assessment acts and regulations were studied as part of this feasibility study. Based on the information collected, STC can identify the practices of each of the provinces in terms of the property types that they recognize and how they are allocated to the broad categories of residential and non-residential, as well as to the subcategories of non-residential. With this in hand, we can identify the practices of the majority of provinces in terms of residential and non-residential treatments. For example, this will determine the majority classification of day-care centres, non-government care homes, etc. In other words, this will yield the national treatment of each type of property.

The next task will be to take these national practices and, for each province, designate whether each property type is to be assigned to the national residential or non-residential category.

The labelling coming out of the above step will be used to:

- develop the sampling frame for the survey of residential property values
- identify the category (residential/non-residential) to be used in deriving property value data directly from the MARs
- determine the coverage of properties yielding residential and non-residential tax revenues in each province.

The Equalization Program and the Property Tax Base

This process will be executed in two stages. The first stage, described above, will be done on the basis of provincial assessment acts and regulations.

The second stage will be to replicate the process using the MAR microdata. This second stage is required because of the possibility that not all of the categories in a given province's legislation and regulations will be represented in that province's MAR microdata.

Appendix D

Use of the municipal assessment rolls (MARs) in the context of a sample survey

Those who have recommended producing aggregate residential property value estimates by adjusting the original MAR data using transaction prices have sometimes also argued that there is too much valid information in the provincial MARs to not use them, even if they are not demonstrably comparable. In fact, the survey's design is such that we will extract a great deal of information from the MARs.

Specifically, the sample design and estimation algorithms that are proposed for the survey exploit the MARs extensively—so much so that much larger samples would be required if we were not using MAR microdata (one record per property) as an integral part of the survey's design.⁷⁸

As mentioned earlier in this report, a two-stage sample design is proposed. In the first stage, a sample of municipalities is chosen. In the second stage, a random sample of properties to be appraised is selected. In this second stage, all of the properties in the selected municipalities will be assigned to strata based on the information contained in the MAR microdata. Random samples will be chosen from within each stratum.

At this second stage, in the absence of the MARs, it would be necessary to select a random sample from the entire municipality. The use of the MARs to create strata has a huge effect on the efficiency of the sample. The estimates using MAR-based samples in the second stage will have sampling variances that are one-tenth of what it would have been had those strata not been formed.

In addition, in the estimation process we will be using a regression-type estimator. This type of estimator exploits the correlation between the assessed values of properties found on the MARs and the appraised value that will be estimated by accredited appraisers in the course of the survey. This will add to the efficiency of the sample, in addition to the gains just mentioned of using the MARs to stratify the sample within municipalities. The efficiency added by the use of a regression-type estimator will depend fundamentally on how high the correlation is between the assessed and appraised values. However, until we have actually conducted the survey, we will not know what the correlation is. (The field test undertaken as part of the feasibility study was too small and too geographically concentrated to yield the required correlations.)

What can be said at this point is that the MARs will be used in very significant ways to make the survey vastly more efficient than it could be without the MARs.

78. Estimation (often referred to as 'weighting and estimation') is the process of turning the sample of appraisals that form the survey into estimates of the whole population.

Appendix E

Brief description of the property appraisal industry in Canada and its appraisal approaches

Under normal survey conditions, STC interviewers are responsible for the data collection phase of a survey. However, STC does not have the knowledge or capabilities to appraise residential properties. An appraisal is a formal, impartial estimate or opinion of value, usually written, of an adequately described property as of a specific date, and it is supported by the presentation and analysis of relevant data. Since FC requires the data to be comparable across provinces, it is necessary to hire certified appraisers to conduct the data collection component of the survey.

Appraisal industry in Canada

Like STC interviewers, certified appraisers are trained professionals in their field. It is an appraiser's professional responsibility to keep up to date with changes in market trends and laws that affect real estate values. They specialize in providing opinions of value of various types of property. They charge a fee based on the type and complexity of the property and purpose of the appraisal assignment. This fee is not based upon a predetermined value estimate and, therefore, an appraiser can provide an objective and independent value. To do so, appraisers must follow basic appraisal methods and use reports that are standard across the country.

There are currently 2,200 certified appraisers across Canada, all of whom are members of the Appraisal Institute of Canada (AIC) or *L'ordre des évaluateurs agréés du Québec* (OEAQ). The AIC is the national professional organization that designates and represents professional real estate appraisers and valuation consultants nationwide, except in Quebec where the OEAQ designates and represents the profession. Its designated members have fulfilled its rigorous educational and professional experience requirements from an approved college or university and adhere to the Canadian Uniform Standards of Professional Appraisal Practice and its Code of Ethics. Members of the OEAQ must adhere to its Professional Code. Since its creation in 1969, the mission of the OEAQ is to protect the public interest by ensuring the professionalism of its members. Further, the OEAQ has defined its objective of assuring the constant improvement of the professional services provided to the public by accredited appraisers. OEAQ members also adhere to the Canadian Uniform Standards of Professional Appraisal Practice.

Appraisal methods

Three methods are used to arrive at an indication of value:

- The cost approach estimates the cost to build a new building identical to the one being appraised, at current prices, subtracting accumulated depreciation and adding the estimated land value.
- The income approach is related to income-producing property and is based on the theory that value is the present worth of the income stream that the property is capable of producing when developed to its highest and best use. The net operating income from the property is capitalized into value by an appropriate method and rate.
- The direct comparison approach is based on the theory that an informed purchaser would pay no more for a property than the cost of acquiring another existing and equivalent property. The value estimate is based on the selling price and listings of comparable properties.

To arrive at a final estimate of value, the appraiser selects the value indicated by the approach most appropriate for the property and supported by the most reliable, factual and relevant market data that has been analysed and verified.

Appraisal reports

While professional standards do not dictate the form, format or style of reporting, the appraiser is bound by certain recognized rules in terms of type and content of reports. Typically, there are four types of reports:

- A full narrative report is appropriate where all aspects of an assignment are researched and reported. No modification or exclusion of a standard rule (requiring what is referred to as an extraordinary limiting condition) is permitted in a full narrative report.
- A regular narrative report may provide details generally equivalent to a full narrative, but is distinguished by the invoking of an extraordinary limiting condition. Examples are situations where no title search is made, or where no interior inspection of a building was possible.
- A short narrative report is concise and briefly descriptive.
- A form report or residential appraisal form report is generally represented by its standardized format combining check-off boxes and narrative comment. The report includes general information such as who owns the property and the address, legal description, taxes, assessed value and age of the dwelling. It also describes the neighbourhood in terms of its age, distance to schools and shopping centres, common types of dwellings, services and utilities available, etc.

Regardless of the type of report selected, each will contain the following variables:

- the estimate of value
- the effective date of the appraisal
- the certification and signature
- the purpose of the appraisal
- the qualifying conditions
- the condition of the neighbourhood
- an identification of the property and its ownership
- an analysis and interpretation of the data and the assumptions made
- the processing of the data by one or more of the three approaches to value
- other descriptive support material, such as maps, plans, charts photographs, etc.

Appendix F

Ratio studies

The design of the proposed survey is, to some extent, inspired by the Standard on Ratio Studies of the International Association of Assessing Officers (IAAO), but it adds the rigour of a statistical program developed specifically for the Equalization program and in accordance with STC's *Quality Assurance Framework*.

Ratio studies are used, for example, to evaluate appraisal performance in terms of the uniformity and level of assessments. Ratio studies compare assessed values estimated for municipal and school taxation purposes with an independent measure of market value based on either sales transaction prices or independent appraisals. The IAAO is responsible for defining standards in conducting ratio studies.

Sales ratio studies where transactions are selected require adjustments for personal property, special financing arrangements and time/trend adjustments to a common base date (valuation date). In areas where real estate markets are active, sales data provide a very good indication of real market value. However, the problem with using sales transactions is that they are not representative of the entire housing stock. Appraisals, while being more expensive than using sales data, offer an excellent measure of the market value of a randomly selected sample of properties.

Appendix G

Overview of some of the statistical properties of the municipal assessment rolls (to serve as data input to the survey of residential property values)				
Juris-dictions	Assessment authorities (responsibility)	Coverage	Availability of the key variables ¹	Major known issues
N.L.	City of St. John's Provincial agency	Full coverage for St. John's A data gap of about 50,000 dwellings in the remainder of the province	Yes	Many areas still do not levy municipal property taxes. The province was unable to suggest how this gap might be addressed.
P.E.I.	One provincial agency	Waiting for confirmation	Yes	
N.S.	One provincial agency	Full coverage	Yes	
N.B.	One provincial agency	Complete coverage of properties of any significance		
Que.	Municipalities conduct assessments. The department of municipal affairs is responsible for data dissemination and adjusting for comparability.	Complete coverage of properties of any significance	Yes	A data-sharing agreement is required for the microdata
Ont.	One provincial agency	Complete coverage	Yes	Significant costs to obtain microdata
Man.	The City of Winnipeg Provincial agency	By combining the two authorities, complete coverage	Yes	
Sask.	10 individual municipalities and 1 provincial agency for the remainder	Complete coverage is expected	Yes	
Alta.	Municipalities conduct assessments	Complete coverage	Yes	The micro data are collected by the province from the local jurisdictions for the purpose of school funding. Legislation under which data are collected is extremely narrow in scope. STC is prohibited from releasing the data or using it for any other purpose without the consent of all data owners (i.e., municipalities).
B.C.	One provincial agency	Complete coverage	Yes	Privacy issues have to be discussed before obtaining aggregate and microdata on a cost recovery.
Y.T. N.W.T. Nvt.		As for most provinces, coverage appears to be very good. Nunavut excludes data for CFB Alert— that should be available from the Department of Defence.	Yes	It should be noted that the territories determine assessments based upon depreciated replacement cost (in the case of Nunavut, it is two-thirds of the depreciated replacement cost of Edmonton, for example).

1. The key data variables are year of assessment roll, municipality identification, geospatial identification, unique lot identification, physical address of the property, type of building identification, the assessed value of the property.

Appendix H

Municipal geography and the Standard Geographical Classification

Municipal geography

There are approximately 3,700 municipalities in Canada. The list of municipalities is constantly changing, and even where municipalities remain on the list from one year to the next, their boundaries may change.

FC requires annual municipal data for property values, property tax revenues and population. Each year, FC needs the data on all three subjects to be based on exactly the same list of municipalities having exactly the same boundaries.

Achieving this harmonization of municipal geography will require that all of the divisions of Statistics Canada supplying the data integrate their work. This integration will be greatly facilitated by the program of STC's Geography Division. Their mandate is, *inter alia*, to maintain the Standard Geographical Classification (see below) and to update lists of municipalities and identify changes in their boundaries.

It will be necessary to continuously monitor the consistency of municipal geography for the two principal administrative datasets to be used in the ongoing program, namely the MARs and the tax revenue data, and to ensure that these align with the information held by Geography Division.

Because different time reference periods will be involved, we will have to deal on an ad hoc basis with changes in lists or boundaries through time. For example, the reference date for property values will be at least a year prior to the reference date for tax revenues. Similarly, at any point in time, the MARs available to STC may be several years old and not based on current geography.

Standard Geographical Classification

Statistics Canada maintains a Standard Geographical Classification (SGC) system. This is a hierarchical classification in which each successive level respects the boundaries of the higher levels:

- Canada is divided into provinces/territories.
- Provinces/territories are divided into census divisions (CDs).
- CDs are divided into census subdivisions (CSDs).

Both CDs and CSDs are exhaustive and mutually exclusive with respect to the next higher level of geography.

Census metropolitan areas (CMAs) overlay the above geography. CSDs are the building blocks of CMAs, with the result that CMA boundaries respect CSD boundaries. However, CMA boundaries may cross CD boundaries so that a given CMA may lie in parts of several CDs.

CSDs are composed of municipalities and other geographic areas, such as Indian reserves, not covered by municipal governments. In other words, all municipalities are CSDs, but not all CSDs are municipalities.

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In the case of CSDs that are municipalities, they respect municipal boundaries and there is a one-to-one relationship between CSDs and municipalities.

While new versions of the entire SGC are released only once every five years (1996, 2001 and so on), Statistics Canada continuously updates the list of CSDs and CSD boundaries to reflect changes implemented by provincial/territorial governments.

(See <http://www.statcan.ca/english/Subjects/Standard/sgc/geography.htm#2>)

Appendix I

Three census-based methods

	Method 1 Last adjusted census	Method 2 Current CD growth rate	Method 3 Previous intercensal growth rate
Description	<p>This is the simplest method. It uses the last census available, adjusts for net undercoverage, and keeps the population estimates constant until the next census information is available.</p>	<p>This method applies the CD population growth, which is calculated annually, to its CSD population estimates of the previous year. The results are then made consistent with CD population estimates through a raking process.</p>	<p>This is the current method used by STC. It can be summarized in the following steps:</p> <p>a) The 1996 and 2001 Census counts are adjusted for net undercoverage.</p> <p>b) The population is extrapolated (2002 on) using the population growth measured during the last intercensal period (1996 to 2001):</p> $r = \sqrt[5]{\frac{P_{01}}{P_{96}}} - 1$ <p>c) Special treatment is applied in the following cases:</p> <ul style="list-style-type: none"> - a threshold is established for growth rates with absolute values over 10% - for CSDs where pop=0 in 1996, the intercensal CD growth is applied - for CSDs where pop=0 in 2001, the population stays at 0 for the subsequent years. <p>d) The results are then made consistent with Census Divisions' population estimates through a raking process.</p>
Main assumptions	<p>a) The provincial net undercoverage rate is distributed equally among its CSDs.</p> <p>b) The population estimates remain constant throughout the period of study.</p>	<p>a) The provincial net undercoverage rate is distributed equally among its CSDs.</p> <p>b) Each CSD has the growth rate of the CD in which it is located.</p>	<p>a) The provincial undercoverage rate is distributed equally throughout all areas.</p> <p>b) The post-censal population growth trend (2002 and on) is the same as the previous intercensal (1996 to 2001) population growth trend.</p>
Data source	Adjusted census counts	Adjusted census counts	Adjusted census counts
Coverage	All CSDs are covered by that method. Annual boundary changes will be taken into account but this requires less work than for method 3.	All CSDs are covered by this method. Annual boundary changes will be taken into account but this requires less work than for method 3.	All CSDs are covered by this method. Annual boundary changes will be taken into account.