AN EVALUATION OF THE POTENTIAL HOUSING DEMAND PROJECTION MODEL

Prepared for:

Research Division
Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario
K1A OP7

CMHC Project Manager: Roger Lewis

Prepared by:

Clayton Research Associates Limited
Scarborough, Ontario

Clayton Research Project Manager: Patricia Arsenault

March 1993

This study was conducted for Canada Mortgage and Housing Corporation under Part IX of the National Housing Act. The analysis, interpretations and recommendations are those of the consultant and do not necessarily reflect the views of Canada Mortgage and Housing Corporation or those divisions of the Corporation that assisted in the study and its publication.

ABSTRACT

This review of CMHC's **Potential Housing Demand (PHD) Projection Model** focuses on two aspects of the model: 1) updating the base year household estimates and 2) the use of the PHD model in generating short-term housing starts projections. A proposed methodology to update the base year estimates is outlined and then illustrated using data for the Toronto area. Similarly, a methodology for generating short-term housing starts forecasts, using household projections generated within the PHD model as the starting point, is outlined; Toronto data is then used to illustrate the detailed steps in the methodology.

EXECUTIVE SUMMARY

Clayton Research Associates Limited was one of several firms commissioned by Canada Mortgage and Housing Corporation (CMHC), Research Division, to undertake an evaluation of CMHC's **Potential Housing Demand Projection Model** (hereafter referred to as the **PHD model**).

Clayton Research was asked to review two specific areas of the PHD model:

- First, the review would assess methods for updating the base year data to ensure that PHD model-generated estimates for the recent past are consistent with known trends, and therefore provide a sound basis for future projection exercises.

- Second, a review would be undertaken of the appropriateness of the PHD model for short versus longer term projections.

The following presents the highlights of the review.

UPDATING THE "BASE YEAR" DATA IN THE PHD MODEL BETWEEN CENSUSES

- The base year data currently incorporated into the PHD model are the latest Census year data available. However, particularly for periods that are further removed from that base year, these propensities could be substantially "outdated" and therefore not provide the best "jumping off" point for projection exercises.

- Therefore, it is recommended that the base year estimates in the PHD model be updated periodically before new Census information becomes available in order to account for trends since the last Census was undertaken. This updating becomes more important the further one is away from the last Census date.

- Unfortunately, little information is available which directly measures household growth for intercensal periods, particularly at subprovincial levels.

- However, by using completions data, and making assumptions about changes in vacant units and net additions to the existing stock, household growth by tenure and dwelling type can be estimated residually for any period. Adjustments can then be made to headship rates, tenure and dwelling type preferences in the PHD model to "calibrate" the model to a new base year.

- Adoption of the residual method of updating for a new base year would not require any alteration to the current structure of the PHD model. The

residual method of calculating household growth can be done itself within a separate spreadsheet. Adjustments to underlying propensities in order to reach the "target" household growth numbers shown by the residual method are themselves made within the PHD model in a manner similar to the procedure used to generate projections of future households.

- While it is recognized that the residual method of calculating household growth does itself have limitations, particularly with regard to the quality of the data on net additions to the existing stock, it can nonetheless be a useful tool in analysing the recent past and providing a better understanding of the myriad factors which determine the number of new housing units built in any period.

- The residual method of calculating household growth has its own limitations. In particular, the estimates of net replacement are based on assessments that are currently limited to an analysis of what is at best "soft" information. The reliability of the method would benefit greatly from further work to refine methods of estimating net replacement.

- At the provincial level, a more in-depth assessment of the annual household estimates currently being generated within StatsCan is required before any substantive conclusion can be drawn as to whether revised methodologies in recent years have rendered these more suitable proxies for measuring annual household growth than they have been in the past.

- Unfortunately, the problem of updating the base year data in the PHD model no longer applies only to non-Census years - rather it is an issue as well for the 1991 Census year. This is because the consistency of the household data has been compromised by the inclusion of the non-permanent population in 1991 - particularly for larger centres such as Toronto, Vancouver and Montreal, where the non-permanent population is relatively larger.[1] CMHC may wish to investigate further the extent of the problem, and its implications for trend analysis in the PHD model.

THE USE OF THE PHD MODEL FOR SHORT-TERM PROJECTION EXERCISES

- The PHD model is currently being used to generate both longer term (i.e. beyond five years) and short term (annual for up to the next five years) projections of housing demand.

---

[1] In the past, the base data in the PHD model could be easily updated by simply entering the Census data into the files. In 1991 however, the underlying base year propensities (e.g. headship rates, tenure and dwelling types, etc.) will be distorted by the inclusion of the non-permanent population. It will be difficult to assess whether a change in propensity is due to an underlying trend, or whether it is the result of the definitional change.

- The demographically-driven PHD model framework lends itself very well to longer-term analyses, since it shows the implications of the changing age structure of the population. However, it is less suited to short term analyses since it cannot adequately take account of short-term factors which impact the cyclical pattern of housing demand, such as the economy and current housing market conditions.

- It is recommended, therefore, that the PHD model be used primarily for generating projections of average annual household growth for five year periods (over which time, most cyclical variation is likely to be "smoothed" out).

- These average annual household growth projections generated within the PHD model for the current five year period can be used as a starting point for the short-term projections. Assumptions about the cyclical pattern of economic growth, etc. can then be used to derive an annual pattern of household growth over the period.

- Deriving this annual pattern is more efficiently done outside the PHD model than from within it. Rather than having to adjust age-specific propensities in each year of the period to reflect these cyclical factors, only the final output - the projections of household growth by tenure and dwelling type - need to be adjusted.

- The household growth assumptions by themselves, however, are inadequate in ultimately preparing housing starts projections. This is because consideration must also be given to net additions to the existing stock and changes in vacant units (and in some areas, the number of mobile homes sold) when determining the number of new units which will need to be built. Allowance for these factors can be readily made within a spreadsheet model as a supplement to the PHD model.

- While it has been proposed in this report that the structure of the PHD model renders it more useful for generating average annual, rather than annual, household growth projections, this does not mean that the annual capability should be removed from the model. The annual capability is essential if one wishes to update the base year estimates (as outlined in Chapter 2) to reflect a non-Census year. However, if the annual capability is retained primarily for this updating purpose, users of the model should be cautioned that the annual capability not be used **by itself** to generate short-term forecasts of housing demand.

- As with the methodology to update the base year data in the PHD model, the prime limitation to the outlined methodology in preparing short-term housing projections lies in the generation of assumptions about net replacement. The composition, level and direction (i.e. positive or negative net additions to the existing stock) could vary greatly both between areas

and within any area by time period. Further work in this area would enhance the overall reliability of the resulting starts forecasts.

- Work on linking the annual economic forecasts to the disaggregation of average annual household growth by year would also be beneficial in order to have a better understanding of both the magnitude of the impact and time lags between the factors. This type of work could range from simply plotting trends in housing starts against trends in macroeconomic factors to undertaking more involved statistical analyses including regression work.

- The methodology would also benefit from further work on estimated average start to completion lags. Based on the monthly starts and completions survey undertaken by CMHC, average lags which are specific to each major market could likely to generated.

RÉSUMÉ

Clayton Research Associates Limited comptait parmi plusieurs firmes embauchées par la Division de la recherche, Société canadienne d'hypothèques et de logement (SCHL), pour évaluer notre **Modèle de projection de la demande éventuelle de logements** (ci-après appelé **modèle PHD**).

La SCHL a demandé à la firme Clayton Research d'examiner deux aspects spécifiques du modèle PHD :

- D'une part, évaluer les méthodes de mise à jour des données pour une année de base afin de s'assurer que les estimations récentes générées par le modèle PHD sont conformes aux tendances connues, donc en mesure de servir de base solide à de futurs exercices de projection.

- D'autre part, examiner le modèle PHD afin de vérifier s'il convient pour effectuer des projections à court terme par opposition à long terme.

Voici donc les points saillants de l'étude.

MISE À JOUR DES DONNÉES DE L'«ANNÉE DE BASE» DU MODÈLE PHD ENTRE LES RECENSEMENTS

- Les données de l'année de base utilisées avec le modèle PHD sont celles de la plus récente des années de recensement. Toutefois, surtout dans le cas de périodes plus éloignées de cette année de base, les propensions pourraient être considérées «désuètes» et par conséquent ne pas être le meilleur «tremplin» pour les exercices de projection.

- C'est pourquoi l'étude recommande une mise à jour périodique des estimations de l'année de base du modèle PHD, jusqu'à ce que les renseignements provenant d'un nouveau recensement soient disponibles afin de tenir compte des tendances apparues depuis le dernier. Plus on s'éloigne de la date du dernier recensement, plus ces mises à jour deviennent importantes.

- Malheureusement, il existe peu de renseignements permettant de mesurer directement la croissance des ménages pour les périodes intercensitaires, surtout au niveau infraprovincial.

- Cependant, à l'aide de données sur les achèvements, et d'hypothèses relatives aux changements dans les logements inoccupés et aux ajouts nets au parc de logements existants, l'augmentation du nombre de ménages par mode d'occupation et type de logements peut faire l'objet d'une estimation résiduelle pour n'importe quelle période. On peut alors modifier les taux de chef, les modes d'occupation et les types de logements préférés dans le modèle PHD pour le «calibrer» selon une nouvelle année de base.

- Le choix de la méthode résiduelle de mise à jour pour une nouvelle année de base ne nécessiterait aucune modification de la structure actuelle du modèle PHD. Cette méthode de calcul de croissance des ménages peut être appliquée à l'aide d'un tableur à part. Les ajustements apportés aux propensions sous-jacentes afin d'atteindre le taux cible de croissance des ménages calculé par la méthode résiduelle sont eux-mêmes effectués à l'aide du modèle PHD, un peu comme l'est la procédure utilisée pour générer les projections des futurs ménages.

- Bien qu'on lui reconnaisse certaines limites, surtout par rapport à la qualité des données sur les ajouts nets au parc de logements existants, la méthode résiduelle de calcul de la croissance des ménages n'en est pas moins un outil utile dans l'analyse du passé récent et permet une meilleure compréhension de la myriade de facteurs déterminant le nombre de nouveaux logements construits, indépendamment de la période.

- La méthode résiduelle de calcul de la croissance des ménages a ses limites. En particulier, les estimations de remplacement net s'appuient sur des évaluations actuellement limitées à l'analyse de ce qu'on qualifierait au mieux de renseignements «incertains». Une amélioration des techniques d'estimation du remplacement net accroîtrait de beaucoup la fiabilité de cette méthode.

- À l'échelle provinciale, la révision en profondeur des estimations annuelles des ménages, qu'entreprend actuellement Statistique Canada, est requise avant que l'on puisse arriver à une conclusion significative qui permettrait de déterminer si les méthodologies révisées des dernières années ont donné à ces estimations une plus grande efficacité pour mesurer la croissance annuelle des ménages.

- Malheureusement, les difficultés de mise à jour des données de l'année de base dans le modèle PHD ne se limitent plus seulement aux années autres que celles des recensements, mais s'appliquent aussi à l'année de recensement 1991. En effet, la fidélité des données sur les ménages a été compromise par l'inclusion de la population non permanente, et c'est encore plus évident dans les grands centres comme Toronto, Vancouver et Montréal où la population non permanente est relativement plus nombreuse.[1] La SCHL pourrait choisir de pousser ses recherches afin d'évaluer l'étendue de ces difficultés et leurs effets sur l'analyse des tendances dans le modèle PHD.

L'UTILISATION DU MODÈLE PHD POUR EFFECTUER DES PROJECTIONS À LONG TERME

- Le modèle PHD sert actuellement à établir des projections de demandes de logements à long terme (c.-a-d. au delà de 5 ans), ainsi qu'à court terme (annuellement, pour les 5 années suivantes).

- Le modèle PHD, avec son orientation démographique, se prête très bien aux analyses à long terme puisqu'il montre les implications du changement de structure par âge de la population. Il se prête cependant moins bien aux analyses à court terme du fait qu'il ne peut correctement tenir compte des facteurs à court terme comme l'économie et les conditions actuelles du marché du logement qui influencent le cycle de la demande de logements.

- Il est donc recommandé d'utiliser le modèle PHD surtout pour établir des projections annuelles moyennes de la croissance des ménages pour des périodes de cinq ans (pendant ce temps, la plupart des variations cycliques devraient disparaître).

---

[1] Il fut un temps où la mise à jour des données de base du modèle PHD se faisait facilement en entrant tout simplement les données de recensement au fichier. Cependant, en 1991 les propensions sous-jacentes de l'année de base (c.-à-d. taux de chef, modes d'occupation, types de logements, etc.) sont faussées par l'ajout de la population non permanente. Il sera difficile d'évaluer si la modification des propensions est le résultat d'une tendance sous-jacente ou d'un changement définitionnel.

- Ces projections annuelles moyennes de la croissance des ménages calculées à l'aide du modèle PHD pour la période actuelle de cinq ans peuvent servir de point de départ aux projections à court terme. Les hypothèses relatives au cycle de croissance économique, et autres, pourront alors servir de base à la conception d'un cycle annuel de croissance des ménages pour cette période quinquennale.

- La conception de ce cycle annuel de croissance se fait plus efficacement sans l'aide du modèle PHD. Au lieu d'ajuster les propensions spécifiques à l'âge, pour chacune des années de chaque période de 5 ans, afin de refléter les facteurs cycliques, seul le résultat final -les projections de la croissance des ménages selon le mode d'occupation et le type de logement - a besoin d'ajustement.

- Les hypothèses relatives à la croissance des ménages ne suffisent pas en elles-mêmes à établir des projections des mises en chantier de logements. Lorsque l'on détermine le nombre de logements requis, il faut, en plus, tenir compte des ajouts nets au parc de logements existants, des changements dans les logements inoccupés, et dans certains cas, du nombre de maisons mobiles vendues. Il est possible de prendre en considération ces facteurs en utilisant un tableur comme supplément au modèle PHD.

- Bien que ce rapport suggère que la structure du modèle PHD rend ce dernier plus utile pour générer des projections moyennes annuelles, plutôt qu'annuelles, de la croissance des ménages, cela ne veut pas dire pour autant qu'il faille éliminer cette option de projections annuelles du modèle. Cette dernière est essentielle pour la mise à jour des estimations de l'année de base (comme le montre le chapitre 2) pour refléter une année autre que celle du recensement. Cependant, si cette fonction de projections annuelles est conservée essentiellement pour ce type de mise à jour, les utilisateurs doivent bien comprendre qu'elle ne peut servir **seule** à générer des projections à court terme de la demande de logements.

- Comme pour la méthodologie de mise à jour des données de l'année de base dans le modèle PHD, la plus grande limite de la méthodologie utilisée dans la préparation de projections de logements à court terme se situe au plan de l'élaboration d'hypothèses de remplacement net. La composition, le niveau et l'orientation

(c'est-à-dire les ajouts nets, positifs ou négatifs, au parc de logements existants) pourraient varier grandement d'une région à l'autre ou à l'intérieur même d'une région pour chaque période de 5 ans. Un travail plus poussé dans ce domaine augmentera la fiabilité d'ensemble des prévisions de mises en chantier de logements.

- Des efforts de liaison entre les prévisions économiques annuelles et la désagrégation par année de la croissance annuelle moyenne des ménages seraient également propices à une meilleure compréhension de l'ampleur de l'impact et des délais causés par divers facteurs. Ces efforts pourraient avoir l'aspect d'une simple comparaison entre les tendances dans les mises en chantier de logements et celles des facteurs macroéconomiques ou un aspect plus complexe comme par exemple des analyses statistiques et de régression.

- Une autre façon d'améliorer la méthodologie serait de travailler davantage sur les délais moyens entre les mises en chantier et les achèvements. Selon les relevés mensuels des mises en chantier et des achèvements effectués par la SCHL, il serait possible d'établir les délais moyens propres aux principaux marchés.

CMHC SCHL

Helping to house Canadians

Question habitation, comptez sur nous

National Office

700 Montreal Road
Ottawa, Ontario
K1A 0P7

Bureau National

700 chemin Montréal
Ottawa (Ontario)
K1A 0P7

Puisqu'on prévoit une demande restreinte pour ce document de recherche, seul le sommaire a été traduit.

La SCHL fera traduire le document si la demande le justifie.

Pour nous aider à déterminer si la demande justifie que ce rapport soit traduit en français, veuillez remplir la partie ci-dessous et la retourner à l'adresse suivante :

Le Centre canadien de documentation sur l'habitation
La Société canadienne d'hypothèques et de logement
700, chemin de Montréal, bureau C1-200
Ottawa (Ontario)
K1A 0P7

TITRE DU RAPPORT : _____

_____

Je préférerais que ce rapport soit disponible en français.

NOM _____

ADRESSE _____
rue *app.*

_____
ville *province* *code postal*

No de télephone ( ) _____

TABLE OF CONTENTS

1.0 INTRODUCTION

Clayton Research Associates Limited was one of three firms commissioned by Canada Mortgage and Housing Corporation (CMHC), Research Division, to undertake an evaluation of CMHC's **Potential Housing Demand Projection Model** (hereafter referred to as the **PHD model**).[1]

1.1 BACKGROUND ON THE PHD MODEL

The PHD model is a software package designed to run on DOS-based personal computers. It was developed by the Research Division of CMHC in 1989 and has been made available to CMHC analysts, as well as other parties who wish to undertake analyses of future housing requirements. The PHD model generates annual projections (up to 25 years) of population and households by age group. The household projections can be progressively disaggregated further into households by family type, tenure and structural type of dwelling occupied. The model has undergone numerous refinements since 1989, both in terms of structural enhancements and software upgrades.

1.2 PURPOSE OF THE MODEL REVIEW

The primary objective in commissioning the model reviews was to evaluate the theoretical basis for the model to determine its overall soundness, as well as the appropriateness of its particular projection components. A secondary objective was to assess the utility of the model software in practical terms. Based on these reviews, CMHC would determine whether the model would benefit from further refinements.

The focus taken for each of the individual evaluations varied. Clayton Research was asked to review two specific areas of the PHD model:

- First, the review would assess methods for updating the base year data to ensure that PHD model-generated estimates for the recent past are consistent with known trends, and therefore provide a sound basis for future projection exercises.

- Second, a review would be undertaken of the appropriateness of the PHD model for short versus longer term projections. If the model was deemed to be inappropriate for short term projections, a methodology was to be

---

[1] The other two evaluations are: George S. Masnick, William C. Apgar Jr., and H. James Brown, **Evaluation of the Potential Housing Demand Projection Model** and Neil Field, **Evaluation of the Potential Housing Demand Projection Model: Population Projection Component.**

outlined for preparing short-term projections that would reflect the impact of cyclical factors, as well as the demographic factors already dealt with in the PHD model.

1.3 REPORT FORMAT

The report is divided into three chapters:

- Chapter 1: This introduction;
- Chapter 2: Updating the base year data in the PHD model between Censuses; and
- Chapter 3: The use of the PHD model for short-term projection exercises.

1.4 CAVEAT

Examples are used where applicable within the course of the report to illustrate various points. In particular, the methodologies outlined in Chapter 2 (to update the base year data) and Chapter 3 (to generate short-term housing forecast) are illustrated in practical terms by following through examples for the Toronto Census Metropolitan Area (CMA).

It must be stressed, however, that these examples are intended only to clarify the methodological steps involved. Given the scope of the budget for the study, the work effort able to be directed towards the formulation of the "projections" was limited. Therefore any projections in this report should be treated as illustrative only and not be considered as necessarily representative of Clayton Research's "best estimate" scenario.

2.0 UPDATING THE "BASE YEAR" DATA IN THE PHD MODEL BETWEEN CENSUSES

This chapter explores a methodology for monitoring and updating the base year household estimates in the PHD model.

2.1 THE CURRENT LIMITATION

This section discusses the perceived current limitation to the model in terms of base year data.

2.1.1 Why is the Base Year Information Important?

The PHD model generates projections of households by age of head/maintainer, household type, tenure and dwelling type; these projections start from a "base year" and go out for a 25 year timeframe. Propensities to form households of different types, to own versus rent, and to occupy different types of dwellings, are calculated for the base year, and previous Census years as available. Projections are then made of these propensities into the future, either by holding the propensities constant at the base year rates, or by altering the base year propensities based on a review of past, and expected, future trends.

Because of this reliance on the base year propensities (either wholly, or in part) for formulating future projections, it is imperative that the base year information be as up-to-date as possible and that it incorporate whatever knowledge is available up to the point when the projections are being generated.

2.1.2 Base Year Data Becomes Increasingly Inadequate the Further Into the Intercensal Period[2]

Currently, the base year household data incorporated into the PHD model is the latest available Census of Canada data. The reliance on the Census of Canada data is appropriate, since Census data provide the most comprehensive information on households and housing choices, particularly for subprovincial areas. Unfortunately, however, the Census of Canada is conducted only quinquennially; therefore, the base year data for households in the model can be updated comprehensively only every five years.[3]

---

[2] The term "intercensal" is used in this study to refer to the years between two Censuses.

[3] Where possible, however, Statistics Canada postcensal estimates of population are used to update the base year population; for example, for the Toronto CMA, the base year population as of late 1992 has been updated to 1989.

Depending on the current year (that is, the year in which one is generating new projections), this reliance on Census of Canada household data could mean that the base year - the important "jumping off" point for the future projections - may be quite outdated. The problem would be less severe for years close to the last Census date, but could be substantial towards latter years of the intercensal period - or early into the next Census period, before the new Census data is released.

For example, the detailed 1991 Census household data necessary to update the PHD model from its current 1986 base only became available to CMHC in late 1992 and will not be incorporated into the model until early 1993. Therefore, as of late 1992, the base year for household data in the model would still be 1986.

However, six and one-half years have passed since the 1986 Census was conducted. And significant changes in the volume and nature of housing demand may have occurred in many areas over those six and one-half years which could render projections which are closely linked to the 1986 Census propensities "outdated".[4]

2.2 DATA CURRENTLY AVAILABLE TO "MONITOR" PHD MODEL GENERATED HOUSEHOLD PROJECTIONS

The previous section argued that some method of monitoring the accuracy of postcensal household projections produced by the PHD model was desirable, so that PHD model users can (1) track how well their short-term forecasts are performing and (2) if necessary, update the base year estimates in the model to use in generating longer-term projections before new Census of Canada data becomes available.

This section reviews the sources of household data currently available on intercensal household estimates and discusses their relative reliability.

2.2.1 Statistics Canada HFE Estimates

The Household Surveys division of Statistics Canada produces estimates of households by tenure and dwelling type as part of its **Households, Facilities and Equipment Survey (HFE)**, Catalogue 64-202. Unfortunately, there are three problems which must be recognized when using these estimates to help determine households in intercensal periods:

- **Coverage:** The household universe covered by the HFE estimates is smaller than that of the Census. In particular, the HFE universe excludes the

---

[4] For example, the strong growth in condominium demand in the Toronto CMA in the 1986-1991 period would not likely have been anticipated, based on a review of 1986 propensities and historical trends. However, other sources of information could have been monitored for the period since 1986, which would have revealed the shifting preferences; these data sources will be discussed in more detail in sections 2.3 and 2.4.

Yukon and Northwest Territories and Indian Reserves. Because of the differences in coverage, the HFE estimates should be used not in absolute terms to measure the actual number of households, but rather in relative terms, as an indication of household growth.

- **Geography:** Until recently, HFE estimates were only available at the national and provincial level. While in recent years estimates for selected Census Metropolitan Areas (CMAs) have also been made available on the **Household Income, Facilities and Equipment (HIFE)** data tape,[5] it is difficult at this early stage to test their accuracy.[6]

- **Reliability:** The HFE estimates have not proven to be particularly accurate in the past. Exhibit 2-1 compares the household growth shown by originally published HFE estimates, and the household growth shown by the Census for the 1981-1991 period. The data indicate that the estimates prepared for the 1981-1986 period where substantially higher than the actual household growth shown by the subsequent Census results, particularly for renter households. This was also the case when looking at the data on a regional basis (Exhibit 2-2).

  Largely because the reliability of the HFE estimates was questionable for the 1981-1986 period, the methodology for the estimates was changed following the 1986 Census. Previously, trends in average household size for the postcensal period were extrapolated from historical Census information; these average household sizes were then applied to Statistics Canada postcensal estimates of population to derive households. The recession of the early 1980s, however, led many persons, particularly in the younger age groups, to "double up" or move back in with parents or relatives. Therefore, extrapolating average household size from past trends severely overstated actual household growth in the 1981-1986 period.

  Now the estimates of total households are made based on information compiled by the Labour Force Survey section of Statistics Canada. The

---

[5] The centres for which data are now available include: Halifax, Quebec, Montreal, Ottawa (Ontario portion only), Toronto, Kitchener, Hamilton, St. Catharines, London, Windsor, Winnipeg, Calgary, Edmonton, Vancouver and Victoria

[6] If data were available for 1986, one could compare household growth shown by the estimates for the 1986-1991 period to actual Census growth, to determine how accurate the estimates were. However, since Statistics Canada has only made the CMA level estimates available in recent years, such a comparison will not be possible until the 1996 Census results are available. Moreover, Statistics Canada has made checks on the reliability of such information difficult, even at the national and provincial level, by changing the definition of population in the 1991 Census to include non-permanent population (i.e. those on Minister's permits, student and employment authorizations, and refugee claimants). The inclusion of this group has caused a "break" in the consistency of the Census series. Therefore, comparing household estimates produced by Statistics Canada for Census years to published Census data is not particularly useful for the 1986-1991 period, as it is currently unknown whether any discrepancy is due to the quality of the household estimates themselves or due to the change in the Census universe.

Exhibit 2-1
COMPARISON OF HFE HOUSEHOLD ESTIMATES BY TENURE WITH CENSUS OF CANADA HOUSEHOLD DATA, CANADA, 000s

	Total		Owner		Renter	
	HFE Estimates	Census	HFE Estimates	Census	HFE Estimates	Census
1981 *	8,026	8,049	5,107	4,948	2,919	3,101
1986 *	9,105	8,814	5,642	5,476	3,463	3,339
Average Annual Growth 1981-1986	215.8	153.1	107.0	105.5	108.8	47.6
1986 **	8,910	8,928	5,622	5,573	3,288	3,355
1991 **	9,873	9,966	6,285	6,262	3,588	3,704
Average Annual Growth 1986-1991	192.6	207.8	132.6	137.9	60.0	69.9

* Excludes mobile homes, as they were not included in the HFE estimates until 1984; 1981 data are revisions based on 1981 Census results; Census data include on reserve in 1981 and exclude Yukon and Northwest Territories in both years

** Includes mobile homes; 1986 HFE data are revised estimates based on 1986 Census results; Census data exclude on reserves and exclude Yukon and Northwest Territories

Source: Statistics Canada, Catalogue 64-202 and Census of Canada

Exhibit 2-2
COMPARISON OF HFE TOTAL HOUSEHOLD ESTIMATES WITH CENSUS OF CANADA HOUSEHOLD DATA BY REGION, 000s

	Atlantic Provinces		Quebec		Ontario		Prairie Provinces		British Columbia	
	HFE Estimates	Census	HFE Estimates	Census	HFE Estimates	Census	HFE Estimates	Census	HFE Estimates	Census
1981	638	640	2,128	2,136	2,938	2,945	1,376	1,386	946	943
1986	720	706	2,411	2,336	3,352	3,203	1,562	1,523	1,058	1,047
Average Annual Growth 1981-1986	16.4	13.3	56.6	40.0	82.8	51.6	37.2	27.5	22.4	20.7
1986	724	725	2,348	2,353	3,208	3,214	1,558	1,561	1,072	1,075
1991	801	795	2,618	2,633	3,585	3,634	1,646	1,663	1,225	1,241
Average Annual Growth 1986-1991	15.4	14.0	54.0	56.0	75.4	84.0	17.6	20.3	30.6	33.3

Note: See notes for Exhibit 2-1

Source: Statistics Canada, Catalogue 64-202 and Census of Canada

Labour Force section keeps track of changes in the their survey "universe" by means of examinations by interviewers. According to Statistics Canada:

> "Sampled dwellings are chosen from a list of dwellings in specific 'clusters' which have been selected for use in the survey. ... When a cluster is selected, a list of all habitable dwellings in the cluster, regardless of condition, is created as a result of an examination of the area by one of our interviewers. ... Clusters which are being used in the survey are updated each month during the survey. If, during the course of their work in the area, an interviewer comes across new construction, or perhaps a dwelling which was missed during the original listing, these will be added immediately to the existing list."[7]

Unfortunately, because of the break in the consistency of the universe covered in the 1991 Census, it is difficult to gauge how accurate the new methodology is.[8] However, it appears that the revised methodology is producing more reliable estimates. Exhibit 2-1 shows household growth as measured by the Census and the HFE estimates for the 1986-1991 period. The major discrepancy in the household growth shown by the two series is in the renter estimates - however, the higher renter estimate under the Census could likely be at least partially due to the consistency problem between the 1986 and 1991 Censuses.[9] It appears that the improved reliability also occurred at the regional level (Exhibit 2-2)

The conclusion is that at the moment it is still not clear whether the revised methodology for the HFE estimates is producing more accurate annual household estimates, although the methodological base is unquestionably sounder (i.e. in that it attempts to track current trends, not simply extrapolate from the past) and the preliminary look here is hopeful. Further investigation, however, would need to be conducted before any final conclusions can be made; it may well be that these estimates are reasonable for Canada and the provinces and can be used with some confidence in monitoring the projections of household growth in the PHD model.

---

[7] From a letter to Clayton Research from Ken Bennett, former Manager, Labour Survey Subdivision, Household Surveys Branch, Statistics Canada, September, 1990.

[8] See previous footnote. The household data in 1991 will be relatively overstated compared to 1986 to the extent that households are headed by someone who is a non-permanent resident. As it is likely that many of this group would be living with persons who are permanent residents, the overstatement in the number of households is likely less severe than for population. As well, because households headed by a non-permanent resident would likely have relatively higher propensities to rent (given their more transient nature), the distortion is likely relatively higher for rental than ownership households.

[9] See Footnote 4. Note that the tenure and structural type breakdown of units results from the HFE survey itself; they are not based on control totals, such as is the case for total households.

2.2.2 Statistics Canada Dwelling Stock Estimates

A second series of household estimates is produced by the Current Investment Indicators section of Statistics Canada. Annual estimates of the total dwelling stock, the occupied stock and the vacant stock are produced for the owner versus renter stock for Canada and each of the provinces. The annual estimates are as of December 31 in each year, although June first estimates are also produced for Census years.

In brief, the methodology used by Statistics Canada to generate the housing stock estimates for postcensal years is as follows:

- Estimates of total units, occupied units (defined to be equal to households) and vacant units by tenure and dwelling type (single-detached and multiple) for the last Census year available serve as the benchmark.

- Additions to the total stock in any year are determined based on CMHC completions data and building permits data on demolitions and conversions (the raw data on demolitions and conversions are adjusted to allow for non-reporting municipalities). The net additions to the stock in any year are then added to the estimated stock in the previous year to derive the total housing stock in that year

- The total stock is then divided into occupied and vacant units. The total occupied housing stock (i.e. households) is estimated using quarterly estimates of population and the projections of average number of persons per household prepared by the Demography division; once the occupied stock is known, total vacant units can be determined residually.

- The breakdown of vacant units by tenure is determined based on a consideration of CMHC's vacancy rate for privately-initiated rental apartment structures containing three or more units.

For the 1986-1991 period, the estimates for Canada appear to have closely captured what actually occurred (Exhibit 2-3), although again, as with the HFE estimates, the comparison is clouded by the change in Census definition.

2.2.3 Other Sources of Household Data

There are a few other household data sources that are specific to certain geographic areas.

For example, civic censuses are conducted in Alberta municipalities each year, which provide annual estimates of population and occupied dwellings. While no attempt has been made to examine in general terms the reliability of these estimates for this study, past work by Clayton Research with the household estimates for the City of

Exhibit 2-3
COMPARISON OF STATSCAN OCCUPIED HOUSING STOCK ESTIMATES BY TENURE WITH CENSUS OF CANADA HOUSEHOLD DATA, CANADA, 000s*

	Total		Owner		Renter	
	Stock Estimates	Census	Stock Estimates	Census	Stock Estimates	Census
1986	8,875	8,875	5,517	5,517	3,358	3,358
1991	9,827	9,837	6,121	6,139	3,706	3,698
Average Annual Growth 1986-1991	190.4	192.4	120.8	124.4	69.6	68.0

* Excludes mobile homes; includes Yukon and Northwest Territories and on reserves

Source: Statistics Canada and Census of Canada

Calgary indicates that they can prove to be very useful in monitoring intercensal household growth.

In Ontario, the municipal enumeration program is undertaken each three years (e.g. 1985, 1988, 1991) - household data are generated from this program that can be used to monitor household growth, but since it is undertaken only every three years, it is not much more timely than the Census of Canada data.

As well, Statistics Canada is currently working on an alternate source of household estimates. These estimates should be examined closely when they are released to determine their applicability in monitoring intercensal household estimates produced by the PHD model.

2.2.4 Another Method of Monitoring Intercensal Household Estimates Is Required At Subprovincial Level

While it has been suggested that either the Statistics Canada HFE or dwelling stock estimates may be of value in monitoring intercensal household growth in the PHD model, unfortunately, these estimates are available only for Canada and the provinces.[10] An alternate method therefore is required for those interested in monitoring intercensal household projections at the sub-provincial level; such an alternate method, which is referred to as the "residual method", is discussed in the following section. This method can be used not only at the subprovincial level, but also at the provincial level, as an independent means of confirming the broad accuracy of the household estimates produced by Statistics Canada if there are some doubts as to their reliability.

2.3 THE RESIDUAL METHOD OF ESTIMATING HOUSEHOLDS - AN OVERVIEW

This section explores a method (called the "residual method") of determining household growth, and ultimately the number of households, for intercensal years. The method could also be used to estimate households in a Census year before the actual Census data because available. As indicated earlier, the purpose of generating such estimates is to allow PHD model users to monitor the accuracy of their intercensal household estimates and, if necessary, to provide a basis for updating the base year household estimates in the PHD model in order to provide a sounder base for generating projections of future households.

---

[10] As mentioned earlier, there are now being produced HFE estimates at the CMA level, but there are currently insufficient means of measuring their accuracy.

2.3.1 The Supply/Demand Relationships for New Housing

Consider the following demand and supply relationships for new housing:

Demand:

$$d = a + b \qquad \text{Equation (1)}$$

where

d = Demand for additional housing units

a = Units needed to accommodate household growth (= household growth)

b = Units needed to replace units lost from the housing stock (due to demolitions, deconversions, etc.)

Supply:

$$s = c + e \qquad \text{Equation (2)}$$

where

s = Supply of additional housing units

c = Newly built units (i.e. completions plus mobile homes)

e = Units created within the existing stock (e.g. basement/accessory apartments; units created in non-residential structures)

and

$$s - d = v \qquad \text{Equation (3)}$$

where

v = net change in vacant units

Equation (3) indicates that if demand for additional housing units falls short of new units supplied, there will be an increase in vacant units; similarly, demand can exceed supply if some of the household growth is filled through existing vacant units (i.e. a decline in vacant units occurs). If "v" is positive (i.e. vacancies are increasing), then supply is greater than demand; if "v" is negative, demand is greater than supply and vacancies are declining.

In section 2.2.4, it was stated that if there is a lack of reliable data on intercensal household growth (i.e. such as for subprovincial areas), another method of estimating household growth would be required. Using equations (1), (2) and (3), household growth ("a") could be calculated **residually** if reasonable estimates of the other components of the demand/supply relationship were available.

The first step is to rewrite Equations (1), (2) and (3) to "solve" for household growth. Substitute equations (1) and (2) for "d" and "s" in Equation (3):

$$c + e - (a + b) = v$$

Then solve for household growth (i.e. "a"):

$$a = c + (e - b) - v \qquad \text{Equation (4)}$$

Household growth, therefore can be accommodated through:

1) newly built units ("c");
2) a net increase in units created within the existing stock ("e" minus "b");[11] or
3) a decline in vacant units ("v").

The equation becomes somewhat more complicated when one wishes to estimate ownership and rental household growth, rather than only total household growth. In this case, consideration must also be taken of shifts in tenure in the existing stock.

For example, if a unit which was previously occupied by its owner is now put on the rental market, there is no change in the number of total dwelling units in the stock, but there is a tenure shift: one unit is "lost" from the ownership stock and one unit is "gained" by the rental stock. Such tenure shifts can be treated as a subcomponent of net additions to the existing stock.

Having established that household growth can be estimated residually, the next section examines what information sources are available to help in this task.

2.3.2 An Examination of Data Sources Which Can Be Used to Help Estimate Household Growth Residually

As shown by Equation (4) in the previous section, data on newly built units, net additions to the existing stock and change in vacant units can be used to estimate household growth residually.

---

[11] If e < b, then more units are being lost from the existing stock than are being created within the stock; therefore, some of the newly built units would need to go towards replacing some of the units lost, and household growth would be correspondingly less.

Exhibit 2-4 summarizes the available data sources for this residual calculation and their perceived reliability. Some of the data sources are used to directly measure one of the three determinants of household growth; other sources are used as a "softer" guide to general trends. A brief discussion of each source for each component of the analysis follows below; an example of how one might generate estimates of each of the components for the Toronto CMA follows in Section 2.4.

It should be noted that the assessment of the usefulness of the data for estimating the relevant variables should not be interpreted as a judgement on the reliability of the information **in measuring what it was originally intended to measure**. Rather, the assessment relates solely to its usefulness in measuring the associated variable in Equation (4). For example, CMHC data on completed but unabsorbed units in and of itself is considered to be highly accurate; however, it is assessed (see Exhibit 2-4) as being only "low to moderate" in its usefulness in measuring changes in vacant units among the ownership housing stock. This is because newly built stock at any point in time is a very small proportion of the total stock.

2.3.2.1 Component 1: Newly built units

The first component to be estimated in Equation (4) is newly built units. This section examines the sources of data which can be used to measure newly constructed units (Exhibit 2-4, (1)).

The key source of information for estimating newly built units is CMHC **completions** data. Fortunately, CMHC has set in place a comprehensive monitoring system which makes completions data available quickly and which ensures the data have a very high degree of accuracy associated with them. The high reliability of these data is imperative to the residual calculation, since the bulk of household growth in any period is generally filled through newly built units. If the reliability of this data series was questionable, then the residual calculation would not be a recommended approach.

As completions data are available for all centres of 10,000 or more population, they can be used by analysts preparing forecasts at the national, provincial, CMA or Census Agglomeration (CA) levels.

The other source of newly built units is mobile homes. Some data exists from Statistics Canada's Census of Manufactures on mobile home shipments. However, the data program for the Census of Manufactures has been reduced significantly in recent years and estimates are now only prepared at the national level and with a considerable lag.

The lack of data on mobile home shipments is not considered to be a severe limitation to the current exercise for the following reasons:

Exhibit 2-4
DATA SOURCES WHICH CAN BE USED TO CALCULATE HOUSEHOLD GROWTH RESIDUALLY

Variable	Sources of Information	Geographic Areas Covered	Frequency and Timeliness	Usefulness in Estimating Variable
NEWLY BUILT UNITS (1)				
Newly Constructed	CMHC Completions data	All centres of 10,000+ population	Monthly Within 1 month of reference period	Very High
Mobile Homes	Statistics Canada Mobile Home Shipments Census of Manufactures Contact Division	Previously regional Now only Canada	Annual Within 18 months of reference period (e.g. 1990 data released mid 1992)	Moderate
NET ADDITIONS TO THE EXISTING STOCK (2)				
a) "Total" Method	Combination of data from: Census Household & vacant unit data CMHC Completions data	Canada and provinces CMAs	Every five years when Census data are released	Moderate
b) Component Method				
Demolitions	Statistics Canada Building Permits data Catalogue 64-203	Canada and provinces CMAs Data for other areas may be available from local building departments	Annual Within six months of reference year	Moderate * Some undercoverage
Net Conversions	Statistics Canada Building Permits data Catalogue 64-001	Canada and provinces CMAs and CAs Most other municipalities	Monthly Within 3 months of reference period	Low * Most conversions do not involve a building permit
	Some local studies on accessory/basement apartments	Varies	n/a	Will vary
Tenure shifts	Some local studies	Varies	n/a	Will vary
CHANGE IN VACANT UNITS (3)				
Total	Census of Canada	Canada and provinces CMAs * Note: CMA level data not published in 1986	Every five years	Moderate to High * Some overstatement (roughly 20%) in 1991 Census
	Statistics Canada Housing stock estimates Contact Current Investment Indicators Section	Canada and provinces	Annual	Moderate
Rental	CMHC Rental Market Survey	CMAs and CAs	Semi-annual Within 2 months of reference period	High * Degree will depend on proportion of rental stock covered by survey
Ownership	MLS Active Listings data Local Real Estate Boards	Varies by board	Monthly Generally within few weeks of the reference period	Moderate * Used mainly as a "guide"
	CMHC Completed but unabsorbed data for single/semi units	CMAs and CAs	Monthly Within 1 month of reference period	Low to moderate * Due to small amount of stock involved; used mainly as a "guide"

Source: Compiled by Clayton Research

- There has not been any substantial penetration of this housing form in the Canadian market. Less than two percent of 1991 households occupied mobile homes.

- For analyses at the CMA level, the impact will be even less, as mobile home parks are generally located outside of major urban areas.

- There is likely a higher replacement rate of mobile homes than other dwelling types (i.e. shorter life span than other housing forms), so that the net impact of new supply is reduced.

For most centres, ignoring mobile homes due to the lack of good data is unlikely to result in any substantial distortion of the final conclusions. Analysts, however, need to consider the situation in their own areas on an individual basis.

2.3.2.2 Component 2: Net additions to the existing stock

In addition to information on newly built units, estimates of net additions to the existing stock are required as the second component of the residual method of estimating household growth (Exhibit 2-4, (2)).

The term "**net additions to the existing stock**" is used as a "catch-all" which incorporates the combined impacts of the following:[12]

- Units lost from the existing housing stock due to demolitions and fires, etc.;
- Units lost from the existing stock due to deconversion to single-family units or to non-residential purposes; and
- Units gained within the existing stock due to conversions from single-family units (etc. basement apartments/accessory units) or from non-residential purposes.

When dealing with rental versus ownership housing, there is another aspect of net additions to the existing stock which must also be considered:

- Tenure shifts - e.g. if a single-family unit shifts from ownership to rental tenure there would be demand for another ownership unit to replace that unit that has become rental; these shifts may be temporary or more permanent (e.g. a more permanent shift would be a rental building shifting to condominium).

---

[12] "Net additions to the existing stock" is equivalent to the more common term "net replacement demand" except that it is opposite in sign i.e. a positive amount of net replacement demand would be equal to a "negative" amount (same absolute value) of "net additions to the existing stock". The term net additions to the existing stock is used in this report, because it is felt that it is easier to comprehend.

Because of the complexity of its nature, no comprehensive data exists on net additions to the existing stock.[13] Nor is it necessarily a relatively "steady" amount in any area in any given time period. Rather, it will tend to fluctuate with market conditions.

However, there are some data sources which can help analysts gain a "feel" for the importance of this component in their area. There are two methods which can be used to measure net additions to the existing stock:

- **Total method**: in this method, net additions to the existing stock is calculated as a "whole" i.e. not accounting for each of the individual components;
- **Component method:** in this method, separate estimates of each of the key components of net additions to the existing stock are generated.

Each of these methods is discussed separately below.

2.3.2.2.1 "Total" method of calculating net additions to the existing stock

This section outlines a method for generating estimates of total net additions to the existing stock in total.

Recall Equation (4):

$$a = c + (e - b) - v \qquad \text{Equation (4)}$$

where

a =	household growth
c =	newly built units and mobile homes
e - b =	net change in units created within the existing stock (i.e. net additions to the existing stock)
v =	net change in vacant units

If we allow n = e - b, Equation (4) can be rewritten to solve for total net additions to the existing stock, "n", as follows:

$$n = a - c + v \qquad \text{Equation (5)}$$

---

[13] A comprehensive review of net replacement demand, including difficulties in measurement, was undertaken for CMHC in 1979 by Vischer Skaburskis, **Demolitions, Conversions, Abandonments.**

Both household growth ("a") and change in vacant units ("v") can be obtained from the Census at the national, provincial and CMA level.[14] Completions data, and estimates of mobile home shipments, where available, can provide the number of newly built units ("c").

Exhibit 2-5 shows how total net additions to the existing stock was calculated for Canada using this method for the 1971-1986 period. The values fluctuate substantially from one period to the next, however the indication is that the average for the 15 year period was a net gain in units of about 6,000-7,000 per year.

This simple calculation may be useful when more detailed information is not available on each of the components of net additions to the existing stock, particularly if the residual is shown to be relatively stable in an area over a series of Census periods. However, it does suffer from two important limitations:

1) The calculation is based on historical data; to the extent that market conditions change from one period to the next, it may no longer be representative of the period that the analyst is currently looking at; and

2) Data can only be generated at a "total" level; therefore separate estimates, for example of owner versus renter are not possible.

2.3.2.2.2 Component method of estimating net additions to the existing stock

This section examines how to prepare estimates of net additions to the existing stock by looking at each component separately.

As indicated earlier, net additions to the existing stock can fluctuate from one period to the next depending on market conditions. Therefore, rather than depending on a historically calculated measure of overall net additions to the existing stock, it would be preferable to monitor the individual components (i.e. demolitions, net conversions and tenure shifts) on a regular basis.

Of course, depending on the information available for any particular area, the reliability of each component may not be very high, and it may require a good deal of judgement on the part of the analyst. However, the advantage of the component method of estimating net additions to the existing stock is that it provides a better understanding of the intricate workings of the housing market - and the factors other than household growth which will impact the demand for newly built housing units. An understanding of these factors is a critical tool in preparing short-term forecasts of housing starts - as will be discussed in Chapter 3 of this report.

---

[14] Data on vacant units were not published for the CMAs in 1986, but are available for other Census years. However, it is understood that CMHC has obtained a custom tabulation of this information.

Exhibit 2-5
COMPARISON OF AVERAGE ANNUAL NEW HOUSING SUPPLY AND GROWTH IN PRIVATE DWELLING CANADA, 1971-1986

Census Periods	("a") Growth in Occupied Dwellings	New Supply: Completions	New Supply: Mobile Home Shipments	New Supply: ("c") Total New Supply	("v") Change in Vacant Units	("n") Residual ("Net Additions to the Existing Stock")
1971-1976	226,318	235,087	21,751	256,838	15,134	(15,386)
1976-1981	223,087	222,329	11,075	233,404	10,660	343
1981-1986	142,034	152,120	4,520	156,640	49,445	34,839
Average 1971-1986	197,146	203,179	12,449	215,627	25,080	6,599

Note: "n" equals "a" minus "c" plus "v"; refer to text, section 2.3.2.2.1

Source: Clayton Research based on data from CMHC, Census of Canada and Statistics Canada

The following section outlines briefly some of the information that is available to help with this monitoring of net additions to the existing stock. It must be stressed however that the current exercise cannot by its scope deal in any comprehensive way with the complex issue of net additions to the existing stock; further research in this area is highly warranted. However, it can serve as a guideline for analysts as to what various data series may be of assistance in their analysis.

2.3.2.2.2.1 Units lost from the stock due to demolitions, fires, etc.

Data on **demolitions permits issued** by dwelling type are published by Statistics Canada at the national, provincial and CMA level in the annual **Building Permits** publication (catalogue 64-203); data may be available for other areas from local building departments (Exhibit 2-4, 2b). These data will understate all demolitions to some degree, as they represent only those units for **which a permit was obtained**. However, trends in the number of permits issued will help to identify fluctuations in this component and rough adjustments can be made to the recorded levels to account for undercoverage.[15]

2.3.2.2.2.2 Net conversions

Net conversions are one of the hardest components of net additions to the existing stock to measure.[16] In some areas it will not be a significant source of new supply, however, particularly in larger centres, it could be substantial. There is no comprehensive information available on this variable. Statistics Canada does publish data on conversions for which a building permit was obtained, but these severely understate the level of activity, as most converted units are created without acquiring a building permit (Exhibit 2-4, 2b). Moreover, the data do not indicate how many units are being **deconverted** (e.g. where a single-detached unit divided into two units reverts back to single-household occupancy).

Fortunately, there are increasingly being done local-specific studies on the subject of conversions/accessory/basement apartments; an idea of the penetration and estimates of new units being added may be available for some areas.

Market conditions will also make suggestions about how important this source of supply is in any period of time. In an area where population is growing rapidly due to in-migration, there will be more pressure for accessory apartments, since this housing form can be added relatively quickly to the stock. On the other hand, in an oversupplied rental market with high vacancy rates and weak rent increases, there

---

[15] Unfortunately, the extent of undercoverage could vary substantially from one centre to another. Discussions with building department staff in a particular geographic area may be useful in trying to determine the extent in that area.

[16] A discussion of accessory apartments, including available methods of estimation is presented in a study undertaken for CMHC by Regional Real Estate Consultants, **Accessory Apartments: Characteristics, Issues, Opportunities**, 1990

will be less incentive for homeowners to convert their extra space - in fact, net deconversions may occur.

2.3.2.2.2.3 Tenure shifts

Taking account of tenure shifts is not necessary if the focus is on estimating net additions to the total housing stock, but it is critical when disaggregated owner and renter estimates are required. Again, there is no hard information available on tenure shifts, but softer information may allow analysts to make some reasonable assumptions.[17]

For example, many persons who purchased condominium apartment units in Toronto in the latter 1980s rented them out; the completions data, however, would have recorded these units as condominium ownership units. An allowance, therefore, would have to be made for less ownership and more rental stock than the completions data might imply.

2.3.2.3 Component 3: Change in vacant units

As well as information on newly built units, and net additions to the existing stock, the third component that must be accounted for when calculating household growth residually as per Equation (4) is change in vacant units.

The Census provides benchmark vacancy data for provinces and CMAs in Census years (Exhibit 2-4, (3)). However, there is no comprehensive source of information on changes in vacant housing units for most areas for intercensal periods. There are, however, several partial sources of information which can be used to monitor changes in vacant units.

2.3.2.3.1 Statistics Canada vacant stock estimates

Statistics Canada Current Investment Indicators section prepares annual estimates of the number of total, occupied and vacant housing units at the national and provincial level (Exhibit 2-4, (3)).

As with the occupied stock estimates, comparable data for vacant units are not available at the sub-provincial level. Therefore, other methods of estimating changes in vacancies are required.

---

[17] For example, see Marion Steele, **Conversions, Condominiums and Capital Gains: Changes in the Structure of the Ontario Rental Housing Market** and Clayton Research Associates, **Rental Housing: A Study of Selected Local Markets.**

2.3.2.3.2 CMHC'S Rental Market Survey

Reliable information on changes in vacant units and vacancy rates in the rental stock is available from CMHC's semi-annual **Rental Market Survey** (Exhibit 2-4, (3)). While the coverage varies from one area to another, in most areas the majority of the conventional rental stock would be included. Therefore, the trends in vacancy rates in the CMHC universe are likely fairly representative of the conventional stock. For the non-conventional stock (e.g. accessory apartments, houses and condominiums being rented), the underlying vacancy rate may be somewhat different, but the trends in rates likely exhibit similar patterns. Therefore, applying the overall CMHC vacancy rate to the entire rental stock is likely not an unreasonable assumption in terms of determining **changes** in vacant units.

2.3.2.3.3 CMHC data on completed but unabsorbed units

As part of its Market Absorption Survey, CMHC tracks unsold newly built units (Exhibit 2-4, (3)). Trends in unabsorbed single-detached and semi-detached units can provide some indication of changing vacancies among the ownership stock. However, the fact that the new stock is very small relative to the total stock must be kept in mind. These data, therefore, are not useful in absolute terms (i.e. they tell us little about the overall level of vacant ownership units), but they can be used as a guide to **trends only** in changes in vacant units among the ownership stock.

2.3.2.3.4 MLS data on active listings

It is very important to also look at trends in vacant units among the existing ownership stock. Unfortunately, there are no surveys of the ownership stock which provide a good indication of these trends.

However, most of the larger real estate boards in Canada collect information on the number of residential resale listings outstanding at the end of a period (Exhibit 2-4, (3)). While the majority of these listings will not be physically vacant units, they nevertheless can provide an indication of **broad trends** in vacancies among ownership units. For example, if the number of active listings increases dramatically from one period to the next, one might surmise that the number of vacant units in the ownership stock has also increased.

2.4 THE RESIDUAL METHOD OF ESTIMATING HOUSEHOLDS - AN EXAMPLE FOR THE TORONTO CMA

Section 2.3.2 looked in general terms at the sources of information which could be used to estimate household growth residually. This section attempts to clarify by way of example just how those data sources can be used. Specifically, the section illustrates how estimates of completions, net additions to the existing stock and

Exhibit 2-6
ESTIMATING ANNUAL HOUSEHOLDS BY TENURE AND DWELLING TYPE
TORONTO CMA, 1986-1991

TENURE: TOTAL

		Net Additions to the Existing Stock						(8)	(9)	
	(1)	(2)	(3)	(4)		(6)	(7)	Total	Forecast	
	CMHC		Net Structural	Shifts	(5)	Increase	Total	Households	Households	(10)
	Completions	Demolitions	Conversions	to Rental	Total	in Vacant	Household Growth	End of Period	Using PHD Model	Census Households
All Dwelling Types										1,199,761 (86)
1986-1987	30,529	1,238	3,500	0	2,263	1,530	31,261	1,231,022	1,243,071	
1987-1988	37,750	1,529	4,550	0	3,021	(450)	41,222	1,272,244	1,280,874	
1988-1989	38,884	1,975	4,200	0	2,225	3,573	37,536	1,309,780	1,303,904	
1989-1990	34,722	1,605	2,800	0	1,195	6,780	29,137	1,338,918	1,337,675	
1990-1991	25,580	1,928	2,450	0	523	3,141	22,961	1,361,879	1,372,439	1,366,680 (91)
Average Annual	33,493	1,655	3,500	0	1,845	2,915	32,424			
Single-detached										517,668 (86)
1986-1987	23,499	1,065	(1,000)	0	(2,065)	2,108	19,326	536,994	534,635	
1987-1988	27,013	1,193	(1,300)	0	(2,493)	(725)	25,245	562,240	549,509	
1988-1989	20,026	1,895	(1,200)	0	(3,095)	2,081	14,850	577,089	558,442	
1989-1990	15,499	1,546	(800)	0	(2,346)	2,380	10,773	587,862	571,885	
1990-1991	9,773	1,594	(700)	0	(2,294)	(350)	7,829	595,692	585,932	607,460 (91)
Average Annual	19,162	1,459	(1,000)	0	(2,459)	1,099	15,605			
Apartment										484,993 (86)
1986-1987	5,227	143	1,250	0	1,106	(601)	6,936	471,929	484,221	
1987-1988	8,207	334	1,625	0	1,291	273	9,225	481,154	500,435	
1988-1989	15,295	70	1,500	0	1,430	1,173	15,552	496,706	510,643	
1989-1990	16,754	48	1,000	0	953	3,787	13,919	510,625	525,246	
1990-1991	13,541	189	875	0	686	3,046	11,181	521,806	539,974	517,365 (91)
Average Annual	11,805	157	1,250	0	1,094	1,536	11,363			
All Other										217,100 (86)
1986-1987	1,803	30	3,250	0	3,220	23	5,000	222,100	224,215	
1987-1988	2,530	3	4,225	0	4,223	2	6,751	228,850	230,930	
1988-1989	3,563	10	3,900	0	3,890	318	7,135	235,985	234,819	
1989-1990	2,469	11	2,600	0	2,589	613	4,445	240,430	240,544	
1990-1991	2,266	145	2,275	0	2,130	445	3,951	244,381	246,533	241,855 (91)
Average Annual	2,526	40	3,250	0	3,210	280	5,456			

Notes:
(1) See Exhibit 2-7
(2) See Exhibit 2-8
(3) See Text section 2.4.2.2
(4) See Text section 2.4.2.3
(5) (3)+(4)-(2)
(6) See Exhibit 2-9
(7) (1)+(5)-(6)
(8) (8) in previous period plus (7)
(9) See text section 2.5
(10) Published data

Source: Clayton Research based on data from CMHC, Statistics Canada and Toronto Real Estate Board

change in vacant units can be used to derive residually estimates of household growth by tenure and dwelling type for the Toronto CMA for the 1986-1991 period. The analysis is assumed to take place in early 1992, before 1991 Census data became available.

Exhibit 2-6 provides a summary of the results of the procedures to ultimately estimate households by tenure and structural type for each year in the 1987-1991 period. Exhibit 2-6 is an extremely complicated exhibit, but necessary to the demonstration of the generation of the ultimate household estimates for intercensal years using equation (4) on page 9. A brief description of Exhibit 2-6 follows; this is followed by more detailed information in the next sections:

- There are two main parts to the table. The first part, opposite the previous page, shows the relevant information to ultimately generate estimates of total households. The second part, opposite this page, provides comparable information, but for owner and renter households separately. Note that if one were to add the owner and renter estimates on the second part of the table, the result would be the total estimates on the first part of the table.

- As well as tenure, the information is shown for total, all dwelling types, as well as three types of dwellings: single-detached, apartment and "all other".

- Column 1 contains information on completions; this would be equivalent to "c" in Equation (4).[18] The background data used to derive the Census year completions by dwelling type and tenure is shown on Exhibit 2-7.

- Columns 2 through 4 contain information on net additions to the existing stock, using the component method. Column 5 is the sum of Column 3 plus Column 4 less Column 2, and is equivalent to "e - b" in Equation (4) or "n" in Equation (5). Background information for estimating demolitions by dwelling type and tenure (Column 2) are shown on Exhibit 2-8. The derivation of Columns 3 and 4 are discussed in the text, sections 2.4.2.2 and 2.4.2.3, respectively.

- Column 6 shows assumptions on the change in vacant dwellings. Background information used to derive these estimates is found in Exhibits 2-10 and 2-11.

- Column 7 provides the estimates of household growth; these are calculated by adding Column 1 (completions) and Column 5 (net additions to the existing stock) and then subtracting Column 6 (increase in vacant units).

- Column 8 shows the annual household estimates generated by the residual method. These are calculated by adding household growth (Column 7) in period t to households in period t-1.

---

[18] If dealing with an area where mobile homes are also an important source of newly built housing, then an allowance would also be made here for estimates of these units.

Exhibit 2-6 (Continued)

TENURE: OWNER

	(1) CMHC Completions	Net Additions to the Existing Stock (2) Demolitions	(3) Net Structural Conversions	(4) Shifts to Rental	(5) Total	(6) Increase in Vacant	(7) Total Household Growth	(8) Total Households End of Period	(9) Forecast Households Using PHD Model	(10) Census Households
All Dwelling Types										699,378 (86)
1986-1987	27,155	548	0	(4,519)	(5,067)	2,523	19,565	718,943	721,751	
1987-1988	34,934	596	0	(7,512)	(8,109)	(991)	27,816	746,759	741,779	
1988-1989	34,076	953	0	(9,920)	(10,872)	3,537	19,667	766,426	753,851	
1989-1990	28,220	779	0	(8,475)	(9,254)	3,939	15,028	781,453	771,971	
1990-1991	21,372	869	0	(7,460)	(8,330)	(1,546)	14,588	796,042	791,001	791,830 (91)
Average Annual	29,151	749	0	(7,577)	(8,326)	1,492	19,333			
Single-detached										479,554 (86)
1986-1987	23,499	533	(1,000)	(3,000)	(4,533)	2,184	16,783	496,337	494,932	
1987-1988	27,013	596	(1,300)	(4,000)	(5,896)	(766)	21,883	518,220	508,492	
1988-1989	20,026	948	(1,200)	(3,500)	(5,648)	2,079	12,300	530,520	516,672	
1989-1990	15,499	773	(800)	(2,500)	(4,073)	2,163	9,263	539,782	529,025	
1990-1991	9,773	797	(700)	(2,000)	(3,497)	(707)	6,983	546,765	541,972	549,625 (91)
Average Annual	19,162	729	(1,000)	(3,000)	(4,729)	990	13,442			
Apartment										63,297 (86)
1986-1987	2,111	0	0	(1,056)	(1,056)	196	859	64,156	65,436	
1987-1988	5,877	0	0	(2,839)	(2,839)	(161)	3,000	67,156	67,288	
1988-1989	11,024	0	0	(5,512)	(5,512)	1,144	4,368	71,524	68,488	
1989-1990	10,793	0	0	(5,397)	(5,397)	1,506	3,890	75,414	70,248	
1990-1991	9,903	0	0	(4,952)	(4,952)	(716)	5,668	81,082	72,077	81,350 (91)
Average Annual	7,902	0	0	(3,951)	(3,951)	394	3,557			
All Other										156,527 (86)
1986-1987	1,545	15	1,000	(464)	522	144	1,923	158,450	161,383	
1987-1988	2,244	1	1,300	(673)	626	(64)	2,933	161,383	165,999	
1988-1989	3,026	5	1,200	(908)	287	314	2,999	164,382	168,691	
1989-1990	1,928	6	800	(578)	216	269	1,875	166,257	172,698	
1990-1991	1,696	73	700	(509)	119	(123)	1,937	168,195	176,952	160,855 (91)
Average Annual	2,088	20	1,000	(626)	354	108	2,334			

Notes: *(1) See Exhibit 2-7* *(2) See Exhibit 2-8* *(3) See Text section 2.4.2.2* *(4) See Text section 2.4.2.3* *(5) (3)+(4)-(2)* *(6) See Exhibit 2-9* *(7) (1)+(5)-(6)* *(8) (8) in previous period plus (7)* *(9) See text section 2.5* *(10) Published data*

Source: Clayton Research based on data from CMHC, Statistics Canada and Toronto Real Estate Board

Exhibit 2-6 (Continued)

TENURE: RENTER

	(1) CMHC Completions	Net Additions to the Existing Stock (2) Demolitions	(3) Net Structural Conversions	(4) Shifts to Rental	(5) Total	(6) Increase in Vacant	(7) Total Household Growth	(8) Total Households End of Period	(9) Forecast Households Using PHD Model	(10) Census Households
All Dwelling Types										500,383 (86)
1986-1987	3,374	690	3,500	4,519	7,329	(993)	11,696	512,079	521,320	
1987-1988	2,816	931	4,550	7,512	11,130	540	13,406	525,485	539,095	
1988-1989	4,808	1,023	4,200	9,920	13,097	36	17,869	543,355	550,053	
1989-1990	6,502	826	2,800	6,475	10,449	2,841	14,110	557,464	565,704	
1990-1991	4,208	1,058	2,450	7,460	8,852	4,887	8,373	565,837	581,438	574,850 (91)
Average Annual	4,342	906	3,500	7,577	10,172	1,422	13,091			
Single-detached										38,114 (86)
1986-1987	0	533	0	3,000	2,468	(76)	2,543	40,657	39,703	
1987-1988	0	596	0	4,000	3,404	41	3,363	44,020	41,017	
1988-1989	0	948	0	3,500	2,553	3	2,550	46,569	41,770	
1989-1990	0	773	0	2,500	1,727	216	1,510	48,080	42,860	
1990-1991	0	797	0	2,000	1,203	357	846	48,926	43,960	57,835 (91)
Average Annual	0	729	0	3,000	2,271	108	2,162			
Apartment										401,696 (86)
1986-1987	3,116	143	1,250	1,056	2,163	(797)	6,076	407,772	418,785	
1987-1988	2,530	334	1,625	2,839	4,130	434	6,226	413,998	433,147	
1988-1989	4,271	70	1,500	5,512	6,942	29	11,184	425,182	442,155	
1989-1990	5,961	48	1,000	5,397	6,349	2,281	10,029	435,212	454,998	
1990-1991	3,638	189	875	4,952	5,638	3,763	5,513	440,725	467,897	436,015 (91)
Average Annual	3,903	157	1,250	3,951	5,044	1,142	7,806			
All Other										60,573 (86)
1986-1987	258	15	2,250	464	2,699	(120)	3,077	63,650	62,832	
1987-1988	286	1	2,925	673	3,597	65	3,818	67,467	64,931	
1988-1989	537	5	2,700	908	3,603	4	4,135	71,603	66,128	
1989-1990	541	6	1,800	578	2,373	344	2,570	74,173	67,846	
1990-1991	570	73	1,575	509	2,011	567	2,014	76,186	69,581	81,000 (91)
Average Annual	438	20	2,250	626	2,856	172	3,123			

Notes: *(1) See Exhibit 2-7* *(2) See Exhibit 2-8* *(3) See Text section 2.4.2.2* *(4) See Text section 2.4.2.3* *(5) (3)+(4)-(2)* *(6) See Exhibit 2-9* *(7) (1)+(5)-(6)* *(8) (8) in previous period plus (7)* *(9) See text section 2.5* *(10) Published data*

Source: Clayton Research based on data from CMHC, Statistics Canada and Toronto Real Estate Board

- Column 9 shows illustrative household "projections" which were generated for this exercise within the PHD model.

- Column 10 shows actual Census households in 1986 and 1991.

The actual methods used to generate the data for each column (which themselves follow Equation 4) is discussed in more detail below. In each section, reference back to the location of the information on Exhibit 2-6 will be made, to assist the reader in following the progression of the estimates.

It should be noted that because of the varying degree of both availability and reliability of data to measure each of the relevant components of Equation (4) at the Toronto CMA level, some of the estimates are by necessity more "arbitrary" than others. When a highly arbitrary decision has been made, it is highlighted as such.

2.4.1 Component 1: Newly Built Units

The first component of Equation 4 (Column 1 on Exhibit 2-6) to be estimated for Toronto is newly built units.

Exhibit 2-7 provides information on CMHC completions by tenure and dwelling type. These data are directly from the CMHC Toronto Office **Local Housing Market Report**.

The data have been compiled into "Census periods" (i.e. June to May), to correspond with the Census year basis used in the PHD model. These were then entered into Column 1 of Exhibit 2-6.

Mobile homes have been ignored in this analysis for Toronto. They are not a significant component of the Toronto CMA housing stock - only 760 Toronto households occupied mobile homes in 1991.

2.4.2 Component 2: Net Additions to the Existing Stock

The second component to be estimated for Equation 4 (Column 5 of Exhibit 2-6) is net additions to the existing stock.

For this exercise, rather than calculating net additions to the existing stock in total as a residual, separate estimates were prepared of the three key components of net additions to the existing stock: losses due to demolitions, fires, etc; net conversions and tenure shifts. Again, it must be noted that the estimates used in the Toronto example are rough estimates used primarily to illustrate the proposed methodology; they should not necessarily be interpreted as "best estimates".

Each component of the calculation is discussed separately below.

Exhibit 2-7
COMPLETIONS BY TENURE
TORONTO CMA

	Ownership				Rental				Total			
	Single-Detached	Apartment	All Other	Total	Single-Detached	Apartment	All Other	Total	Single-Detached	Apartment	All Other	Total
1986 Total	20,757	1,975	1,198	23,930	0	3,565	312	3,877	20,757	5,540	1,510	27,807
Jan.-May	7,185	780	478	8,443	0	1,367	177	1,544	7,185	2,147	655	9,987
June-Dec.	13,572	1,195	720	15,487	0	2,198	135	2,333	13,572	3,393	855	17,820
1987 Total	26,603	5,662	2,053	34,318	0	1,984	222	2,206	26,603	7,646	2,275	36,524
Jan.-May	9,927	916	825	11,668	0	918	123	1,041	9,927	1,834	948	12,709
June-Dec.	16,676	4,746	1,228	22,650	0	1,066	99	1,165	16,676	5,812	1,327	23,815
1988 Total	22,794	4,335	3,044	30,173	0	3,486	583	4,069	22,794	7,821	3,627	34,242
Jan.-May	10,337	931	1,016	12,284	0	1,464	187	1,651	10,337	2,395	1,203	13,935
June-Dec.	12,457	3,404	2,028	17,889	0	2,022	396	2,418	12,457	5,426	2,424	20,307
1989 Total	17,852	13,344	2,522	33,718	0	5,197	482	5,679	17,852	18,541	3,004	39,397
Jan.-May	7,569	7,620	998	16,187	0	2,249	141	2,390	7,569	9,869	1,139	18,577
June-Dec.	10,283	5,724	1,524	17,531	0	2,948	341	3,289	10,283	8,672	1,865	20,820
1990 Total	11,555	10,409	1,150	23,114	0	4,296	658	4,954	11,555	14,705	1,808	28,068
Jan.-May	5,216	5,069	404	10,689	0	3,013	200	3,213	5,216	8,082	604	13,902
June-Dec.	6,339	5,340	746	12,425	0	1,283	458	1,741	6,339	6,623	1,204	14,166
1991 Total	9,795	8,581	1,683	20,059	0	5,029	915	5,944	9,795	13,610	2,598	26,003
Jan.-May	3,434	4,563	950	8,947	0	2,355	112	2,467	3,434	6,918	1,062	11,414
Census Years												
1986-87	23,499	2,111	1,545	27,155	0	3,116	258	3,374	23,499	5,227	1,803	30,529
1987-88	27,013	5,677	2,244	34,934	0	2,530	286	2,816	27,013	8,207	2,530	37,750
1988-89	20,026	11,024	3,026	34,076	0	4,271	537	4,808	20,026	15,295	3,563	38,884
1989-90	15,499	10,793	1,928	28,220	0	5,961	541	6,502	15,499	16,754	2,469	34,722
1990-91	9,773	9,903	1,696	21,372	0	3,638	570	4,208	9,773	13,541	2,266	25,580

Source: Compiled by Clayton Research based on data in CMHC Toronto Local Housing Report

2.4.2.1 Losses from the stock due to demolitions, fires, etc.

Units lost from the housing stock due to demolitions, fires, etc. are estimated based on Statistics Canada published data on demolitions by dwelling type. These data will undercount, however, as they only include units for which a building permit was obtained. **An arbitrary adjustment of the data was made to account for this undercoverage**; specifically, for these illustrative purposes it was assumed that the actual demolitions were 25 percent higher than recorded by demolitions permits. The actual recorded demolitions, as well as the 25 percent adjustment, are shown on Exhibit 2-8.

The adjusted numbers were then divided broadly by tenure. The demolitions permits do not provide information on tenure, so some arbitrary assumptions had to be made. It is likely that proportionately more of the demolished single-family units would have been in the rental stock prior to demolition than the share of the housing stock accounted for by rental single-family units would indicate. **It was arbitrarily assumed** that one-half of single-detached, semi-detached and row units were owner-occupied prior to "leaving" the stock, and one-half renter. For apartments, it seems more likely that all would be in the rental stock, given the relatively more recent nature of condominium tenure, so it was assumed that 0 percent were in the owner stock.

The recorded demolitions data are on a calendar basis, however the analysis to determine household growth residually requires Census year data. **It was therefore arbitrarily assumed** that demolition permits taken out in any given calendar year pertained to actual demolitions in the following Census year (i.e. data for calendar year 1987 were used to approximate data for Census year 1987-1988). This was deemed acceptable, given some likely delay between the time the permit was taken out, and the time the demolition actually occurred.

A summary of the actual demolitions data and the adjustments made to 1) account for undercoverage and 2) disaggregate by tenure are presented on Exhibit 2-8. These are repeated in Column 2 of Exhibit 2-6.

2.4.2.2 Net units created within the stock

The most important source of new units created within the stock (i.e. net conversions) in the Toronto CMA is in the form of basement/accessory apartments. Conversions to/from non-residential uses are not considered to be substantial.

The flow of accessory apartments into and out of the housing stock can be very fluid. During periods of high rental demand, the number of net units created can be expected to increase rapidly. They will not, however, necessarily become part of the stock permanently. For example, during times of "weaker" rental demand, fewer units would likely be created within the existing stock; at the same time, there may also be more deconverting of units previously created (i.e. back to space within the house for the owner's own usage).

Exhibit 2-8
ESTIMATING DEMOLITIONS BY DWELLING TYPE AND TENURE
TORONTO CMA, 1986-1991

	Single-Detached	Semi-Detached	Row	Apartment	Total	Subtotal Semi/Row
	Total - Published Demolition Permits					
1986	852	4	20	114	990	24
1987	954	2	0	267	1,223	2
1988	1,516	6	2	56	1,580	8
1989	1,237	7	2	38	1,284	9
1990	1,275	13	103	151	1,542	116
1991	726	5	7	85	823	12
	Total - Adjusted for undercoverage and converted to Census years*					
Adjustment factor	25.0%	25.0%	25.0%	25.0%		
1986-1987	1,065	5	25	143	1,238	30
1987-1988	1,193	3	0	334	1,529	3
1988-1989	1,895	8	3	70	1,975	10
1989-1990	1,546	9	3	48	1,605	11
1990-1991	1,594	16	129	189	1,928	145
Avg. Annual	1,459	8	32	157	1,655	40
	Owner**					
% owner	50.0%	50.0%	50.0%	0.0%		
1986-1987	533	3	13	0	548	15
1987-1988	596	1	0	0	598	1
1988-1989	948	4	1	0	953	5
1989-1990	773	4	1	0	779	6
1990-1991	797	8	64	0	869	73
Avg. Annual	729	4	16	0	749	20
	Renter**					
1986-1987	533	3	13	143	690	15
1987-1988	596	1	0	334	931	1
1988-1989	948	4	1	70	1,023	5
1989-1990	773	4	1	48	826	6
1990-1991	797	8	64	189	1,058	73
Avg. Annual	729	4	16	157	906	20

* Assumes that permits taken out in calendar year apply to demolitions in census year e.g. permits for 1986 related to actual demolitions in Census year 1986-1987

** Assumes that proportionately more units (relative to the stock) are in the rental stock when they are demolished

Source: Estimates by Clayton Research based on Statistics Canada data

There are various ways in which conversions can occur; a few examples follow:

- A basement apartment could be added to a single-detached ownership unit. According to Census of Canada definitions, the result would be a "loss" of one single-detached ownership unit, the "gain" of one "other" ownership unit and the "gain" of one "other" rental unit.[19]

- A basement apartment could be added to a rental semi-detached unit. The original rental semi-detached would still be an "other rental" unit, and in addition there would be another "other" rental unit.

- A basement apartment is added to a two-storey single-detached house which itself had been previously subdivided into two rental flats. The two flats would remain "other" rental and a third "other" rental unit would be added.

- A single-detached ownership house is converted into three rental units. There would be a loss of one ownership single-detached unit and the gain of three "other" rental units.

The combinations and permutations are obviously lengthy and the actual nature of conversion activity can impact the number of units created, as well as the type and tenure. **For illustrative purposes, it was arbitrarily assumed** that 3,500 net "other" rental units were gained on average each year in the Toronto CMA in the 1986-1991 period with the following configuration:[20]

- 1,000 of the units are assumed to be created through the addition of basement apartments to owner-occupied single-detached units (resulting in a loss of 1,000 ownership single-detached units, a gain of 1,000 ownership other ("apartment or flat in a detached duplex) units and a gain of 1,000 other rental units);

- 1,250 are assumed to be created by adding another unit to houses already subdivided into rental flats (which adds 1,250 new low-rise apartment rental units, without any changes in tenure or dwelling type for the original units); and

- 1,250 are units added in other ownership units where the main unit is occupied by the owner (which adds 1,250 other rental units, with no change in the tenure or dwelling type of the original units).

---

[19] These structural classifications are based on Clayton Research interpretation of structural types as outlined in the 1991 Census of Canada Dictionary. Although attempts were made to confirm these classifications with Statistics Canada, they did not provide any satisfactory answers - which leads one to question how explicit the instructions are which are given to Census enumerators.

[20] Some local analyses (such as for Scarborough and Brampton) undertaken by Clayton Research for other clients, suggest that this broad level of conversion activity was likely in the 1986-1991 period when conventional apartment construction was very low.

The net result of these configurations are:

- A loss of 1,000 ownership single-detached units per year (these are recorded with a negative sign in Column 3, owner section of Exhibit 2-6);
- A gain of 1,000 "other" ownership units per year;
- A gain of 1,250 rental apartment units per year;
- A gain of 2,250 "other" rental units per year; and
- In summary, an overall gain of 3,500 units per year.

The annual pattern of the creation of these units would likely not be smooth throughout the period. It is felt that the activity levels would have been relatively higher in the earlier years of the period, when the economy was stronger, net migration was higher and rental vacancy rates lower; these would have put more stress on rental markets than later in the period.

The resulting estimates of net conversions are shown on Exhibit 2-6 in Column 3. Note that a positive value indicates a gain of units and a negative value a loss.

2.4.2.3 Tenure shifts

Tenure shifts will also be occurring within the stock (not including those due to conversions, as outlined above). Again these are not easy to measure.

Few single-detached units are intended for the rental market upon completion. However, there will be some shifting in single-detached units to rental within the existing stock.

One method of getting a rough idea of the extent to which this occurs is to look at the growth in single-detached rental households between Censuses. In the 1976-1986 period, renter households living in single-detached units in the Toronto CMA grew by about 1,100 units per year on average (Exhibit 2-9). Due to the high level of investing/speculating which occurred in the 1986-1991 period, it is likely that this number was substantially higher in the latter 1980s. **It was arbitrarily assumed** that the level increased to about 3,000 units per year in the 1986-1991 period.[21]

Again, it was felt that these shifts would have been more pronounced earlier in the 1986-1991 period; for the actual annual assumptions used, see Column 4 of Exhibit 2-6. Note that the shifts from owner are recorded as a negative value and the shift to rental is recorded as a positive value.

Another key tenure shift occurring in the Toronto area in the 1986-1991 period was the proportion of condominium apartments being rented out. Estimates by Clayton Research indicated that roughly 50 percent of condominium apartments built in the

---

[21] In fact, a look at 1991 Census data suggests that even this figure is conservative - renter single-detached households grew by just under 4,000 per year, although this may partially be the impact of the inconsistency in the definition of population/universe.

Exhibit 2-9
CALCULATING ROUGH ANNUAL SHIFTS IN TENURE AMONG SINGLE-DETACHED UNITS, TORONTO CMA

	Number of Renter Households Occupying Single-Detached Units	Average Annual Increase
1976	24,285	--
1981	30,670	1,277
1986 *	35,060	878
1986 **	38,125	
1991 ***	57,825	3,940

* Based on 1981 CMA boundaries
** Based on 1986 CMA boundaries
*** Based on 1991 CMA boundaries; includes households headed by non-permanent residents

Source: Census of Canada

1986-1991 period ended up in the rental universe.[22] This proportion was applied to the number of new ownership apartment units (virtually all of which were condominium tenure) completed in each year to derive shifts from ownership to rental. For example, Exhibit 2-6 (owner section) shows that there were 5,677 ownership apartment completions in the Toronto CMA in the 1987-1988 Census year; half of these, or 2,839 units, were therefore assumed to have ended up in the rental stock. This shows up as a negative value of 2,839 in Column 4 of the owner section of the table, and a positive value of 2,839 in the renter section.

For "other" types of units, **it was arbitrarily assumed** that a much lower (albeit still significant) 30 percent of new units were being rented out.

The assumptions outlined above for apartment and other units only related to newly completed units. Of course, it is also possible that there could be shifts in tenure among units in the existing stock. However, for simplicity, **it was arbitrarily assumed** that no **net** tenure changes occurred within the existing stock for apartment and other units.

These tenure shifts are not necessarily permanent. For example, as the condominium market picks up, one might expect many of the condominium units currently being rented out to revert back to ownership tenure; such shifts would need to be taken into account when preparing future projections, as will be discussed in Chapter 3 of this report.

2.4.3 Component 3: Change in Vacant Units

The final component of Equation 4 that needs to be estimated is the change in vacant units (Column 6 of Exhibit 2-6)

The estimates prepared of the change in vacant units take into account information from the Census of Canada, CMHC data on vacancy rates and completed but unabsorbed single-detached and semi units and Toronto Real Estate Board information on active listings.

To begin, base estimates of the vacancy rate and vacant units were prepared for the years 1981 and 1986. Unfortunately, in the 1986 Census overall vacant units were not published at the CMA level.[23] Therefore the number of vacant units and the vacancy rate in 1986 were extrapolated from overall provincial data by assuming Toronto accounted for the same share of total Ontario vacant units as in 1981. Exhibit 2-10 shows this estimation. Note that data on the dwelling stock in Census

---

[22] Clayton Research Associates, **A Preliminary Study of Investors in the Toronto Area Condominium Apartment Market**, prepared for CMHC, 1990.

[23] However, it appears that the Market Analysis Centre of CMHC has obtained a custom tabulation of vacancy data at the CMA level; for those with access to this information, the estimation of 1986 data based on the provincial level data would not be required.

Exhibit 2-10
ESTIMATING VACANT UNITS
TORONTO CMA, 1986

	Ontario	Toronto CMA
	Households, Usual Residents (1)	
1981	2,969,785	1,040,320
1986	3,221,725	1,199,761
	Vacant Units (2)	
1981	127,055	28,010
1986	113,665	25,058 *
	Vacancy Rate, % (3)	
1981	4.10	2.62
1986	3.41	2.05 *
	Estimated Stock (4)	
1981	3,096,840	1,068,330
1986	3,335,390	1,224,819 *

* Estimated; assumes Toronto has the same share of Ontario-wide vacant units as in 1981

(1) Published household data
(2) Published vacant data except Toronto 1986; see note with asterisk
(3) (2) divided by (4) times 100
(4) (1) plus (2)

Source: Estimates by Clayton Research based on Census of Canada data

years was approximated by adding the occupied dwelling stock (i.e., households) and vacant dwelling units; the vacancy rate is calculated by dividing the number of vacant units by the estimated dwelling stock and multiplying by 100.

For this analysis, it was also necessary to divide the total dwelling stock, and vacant units, into ownership and rental tenure; Exhibit 2-11 illustrates the procedure used. Because estimates of these variables by tenure are not available, the base year estimates for 1986 were generated in the following manner:

- The total stock (Column 1) is approximated by the occupied dwelling stock (Column 4) plus vacant units (Column 7). Total occupied dwellings are available in published data; the number of vacant units in 1986 were estimated as described above and shown on Exhibit 2-10.

- The April, 1986 CMHC rental vacancy rate was assumed to apply to the entire rental stock (Column 12 of Exhibit 2-11).

- The number of rental households in 1986 was known from the Census (i.e. 500,383) - Column 6 of Exhibit 2-11. By dividing the number of occupied rental units by 1 minus the CMHC vacancy rate (1-.003 or .997), one obtains an estimate of the total rental stock (500,383 divided by .997 = 501,889), as shown in Column 3 of Exhibit 2-11. The occupied stock can then be subtracted from the total stock to obtain the number of vacant rental units (Column 9 of Exhibit 2-11).

- Knowing total vacant units (Column 7) and rental vacant units (Column 9), the number of owner vacant units in 1986 could be calculated residually (Column 8). A similar method was used to calculate total owner dwellings residually (Column 2).

- The vacancy rate for the ownership stock in 1986 (Column 11) was then calculated by dividing vacant owner units (Column 8) by the total owner stock (Column 2) and then multiplying by 100.

Once this base for 1986 was established, the next task was to generate estimates of how vacant units changed over the 1986-1991 period. This was done in the following manner:

- Estimates of the total, owner and renter stock in year t were generated by adding completions (from Column 1 in Exhibit 2-6) plus net additions to the existing stock (Column 5 in Exhibit 2-6) to the stock in year t-1. For example, the rental stock in mid 1987 is estimated at 512,592 (Column 3, Exhibit 2-11); this is the rental stock in 1986 (501,880 from Column 3 of Exhibit 2-11) plus 3,374 total rental completions over the mid 1986 to mid 1987 period (Column 1, rental section of Exhibit 2-6) plus 7,329 net additions to the existing stock (Column 5, rental section of Exhibit 2-6).

Exhibit 2-11
ESTIMATING CHANGE IN VACANT UNITS
TORONTO CMA, 1986-1991

	Housing Stock			Occupied Units			Vacant Units			Vacancy Rate (%)			(13) CMHC Single/semi Units Unabsorbed End of May	(14) TREB Active Listings End of May
	(1) Total	(2) Owner	(3) Renter	(4) Total	(5) Owner	(6) Renter	(7) Total	(8) Owner	(9) Renter	(10) Total	(11) Owner	(12) Renter	Units	
1986	1,224,819	722,930	501,889	1,199,761	699,378	500,383	25,058	23,552	1,506	2.05	3.26	0.3	246	12,550
1987	1,257,611	745,019	512,592	1,231,022	718,943	512,079	26,588	26,076	513	2.11	3.50	0.1	255	20,680
1988	1,298,382	771,844	526,538	1,272,244	746,759	525,485	26,138	25,085	1,053	2.01	3.25	0.2	379	17,743
1989	1,339,491	795,047	544,443	1,309,780	766,426	543,355	29,711	28,622	1,089	2.22	3.60	0.2	137	26,895
1990	1,375,408	814,014	561,394	1,338,918	781,453	557,464	36,490	32,561	3,930	2.65	4.00	0.7	1,051	36,535
1991	1,401,510	827,056	574,454	1,361,879	796,042	565,837	39,631	31,015	8,617	2.83	3.75	1.5	615	32,949
Year to year Changes														
1986-1987	32,792	22,089	10,703	31,261	19,565	11,696	1,530	2,523	(993)					
1987-1988	40,771	26,825	13,946	41,222	27,816	13,406	(450)	(991)	540					
1988-1989	41,109	23,204	17,905	37,536	19,667	17,869	3,573	3,537	36					
1989-1990	35,917	18,966	16,951	29,137	15,028	14,110	6,780	3,939	2,841					
1990-1991	26,103	13,042	13,060	22,961	14,588	8,373	3,141	(1,546)	4,687					
Average Annual Change														
1986-1991	35,338	20,825	14,513	32,424	19,333	13,091	2,915	1,492	1,422					

(1) (2) plus (3)
(2) Stock in previous year plus completions (Column 1, owner section of Ex. 2-6) plus net additions to the existing stock (Column 5, owner section of Ex. 2-6)
(3) Stock in previous year plus completions (Column 1, renter section of Ex. 2-6) plus net additions to the existing stock (Column 5, renter section of Ex. 2-6)
(4) (5) plus (6)
(5) (2) minus (8)
(6) (3) minus (9)
(7) (8) plus (9)
(8) (11) divided by 100 times (2)
(9) (12) divided by 100 times (3)
(10) (7) divided by (1) times 100
(11) 1986 equals (8) divided by (2); other years entered manually based on consideration of (13) and (14)
(12) CMHC April vacancy rate, privately initiated structures of 6+ units.
(13) CMHC data; entered; not used in direct calculation but rather considered when estimating (11)
(14) TREB data; entered; not used in direct calculation but rather considered when estimating (11)

Source: Estimates by Clayton Research based on data from CMHC, Census of Canada and Toronto Real Estate Board

- As was done for the 1986 base year, the CMHC April rental vacancy rate was assumed to apply to the entire rental stock in each year of the 1987-1991 period (the rates are shown in Column 12 of Exhibit 2-11).[24] These rates were then applied to the estimates of the rental stock in Column 3 to determine the number of vacant rental units (Column 9). For example, in the previous bullet point, it was estimated that the rental stock in mid 1987 was 512,592 units. The CMHC rental vacancy rate in April 1987 was .1 percent. Multiplying .1 percent times 512,592 yields 513 vacant rental units, as shown in Column 9.

- The change in vacant rental units could then be easily calculated by subtracting vacant units in two time periods. The result was then entered in Column 6 of Exhibit 2-6, renter, all dwelling types. For example, the change in vacant rental units from mid 1986 to mid 1987 is 513 minus 1,506 (from Column 9 of Exhibit 2-11) or a decline of 993 units (as shown on Exhibit 2-6).

- For ownership vacant units. it was first necessary to estimate what the change in the vacancy rates would be over the period. By necessity, this was highly arbitrary, as there are no surveys available of ownership vacancies. To assist in the analysis, two data series were examined: CMHC data on newly completed but unabsorbed units (Column 13 of Exhibit 2-11) and Toronto Real Estate Board data on active listings (Column 14).

  As indicated in section 2.3.2.3, both these indicators are imperfect measures of the change in ownership vacant units. They were used here, however, to try and establish a trend for the ownership vacancy rate from the 1986 estimated base. More emphasis was put on the active listings data, as the newly completed but unoccupied data measure only a small component of the total ownership stock.

  Based on the trends shown by these two data sources, the ownership vacancy rate estimated for 1986 was "projected" forward to 1991 (as shown in Column 11 of Exhibit 2-11). The estimated ownership vacancy rates were then applied to the previously estimated stock of ownership units (Column 2) to derive the number of vacant ownership units.

- To divide the change in ownership vacant units by dwelling type, **it was arbitrarily assumed** that the split by dwelling type within each tenure was the same as the split of completions over the period. For example, in the 1986-1987 period, out of 27,155 total ownership completions, 23,499 (or 86.5 percent) were single-detached units (Column 1 of Exhibit 2-6). Applying this 86.5 percent to the total change in vacant ownership units in 1986-1987 of 2,523 yields an increase in vacant single-detached units of 2,184.

---

[24] The CMHC April vacancy rate for privately-initiated buildings of 6 or more units was used.

- For the rental stock, the share of the change in vacant units was assumed to be proportional to the 1986 occupied rental stock by dwelling type. For example, in 1986, apartments accounted for 80.3 percent of the occupied rental stock or households (Column 10 of Exhibit 2-6). Applying this 80.3 percent to the change in total vacant rental units of 4,687 in 1990-1991 yields a 3,763 increase in vacant rental apartment units (Column 6 of Exhibit 2-6).

2.4.4 Estimating household growth and total households

Ultimately, household growth was estimated residually based on subtracting the estimated increase in vacant units (Column 6 of Exhibit 2-6) from the sum of the additions to the existing stock (Column 5) and completions (Column 1). This was done separately for each tenure and structural type group.

Total households for each intercensal year then were estimated by adding household growth during a period to households at the end of the previous period (Column 8 of Exhibit 2-6).

2.5 COMPARING TORONTO CMA HOUSEHOLDS CALCULATED RESIDUALLY TO THOSE GENERATED IN THE PHD MODEL

The importance of generating the annual estimates of households in Section 2.4 was so that they could be used to monitor projections of households generated within the PHD model to see whether the PHD model assumptions are appropriate.

The 1991 estimates of Toronto CMA households were compared to a set of 1991 household projections generated independently in the PHD model by Clayton Research to see whether some adjustments in the PHD scenario for 1991 were warranted and whether the estimates should be updated to a new base year.

In generating the independent PHD model estimates, the following assumptions were made; in general, these were chosen to be broadly consistent with the assumptions used by CMHC in the study **Potential Housing Demand Projections: Canada and the Provinces, 1986-2011:**[25]

- The base population are 1989 StatsCan estimates.

---

[25] Another important consideration was that it was desirable to generate a PHD model set of projections for 1991 which would show some variation from the 1991 household estimates generated in Section 2.4, so that a method of making adjustments in the PHD model could be illustrated. If a different set of assumptions had been chosen for the PHD model, the resulting comparison might show different results. That, however, is not considered to be important to the analysis here, as the key point of this section is to show how such comparisons can be made, and how the PHD model might be "adjusted" as a result.

- Net migration is assumed to average 25,000 per year in 1989-1990 and 1990-1991 (the base year population estimates in the model are currently updated to 1989); these net migration assumptions are consistent with estimates used by the Toronto CMHC office.

- Ontario-wide survivorship rates are used.[26]

- Toronto fertility rates are based on 1988 births and 1986 population.[27]

- The age/sex distribution of migrants is based on the Toronto 1986-1989 situation.[28]

- In general, headship rates are assumed to change by 12.5% of the absolute change between 1976 and 1986 in the 1986-1991 period, with the change linear from year to year. The exception was that some increase was built into non-family headship rates in the under 30 age groups (back to 1981 rates), to account for better economic conditions after the 1981-1982 recession.[29]

- Only total family and non-family projections are generated.

- Tenure and dwelling type propensities are kept constant at 1986 rates.

Exhibits 2-12 through 2-14 present a comparison of household growth by tenure and dwelling type as estimated in this report using the residual method and as "projected" using the assumptions outlined above within the PHD model; the total household numbers are compared in Exhibit 2-6. The comparison suggests that:

- **Total household growth**: Estimated total household growth generated within the PHD model based on the headship rate scenario outlined above is higher than that shown by the residual method for the 1986-1991 period.

---

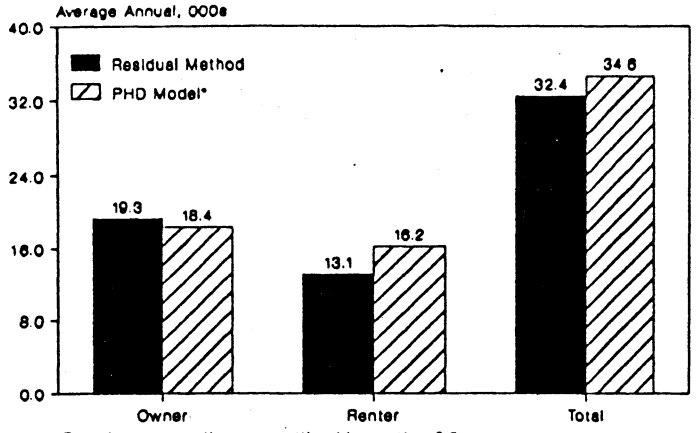
[26] These assumptions were supplied by CMHC for this analysis.

[27] Ibid.

[28] Ibid.

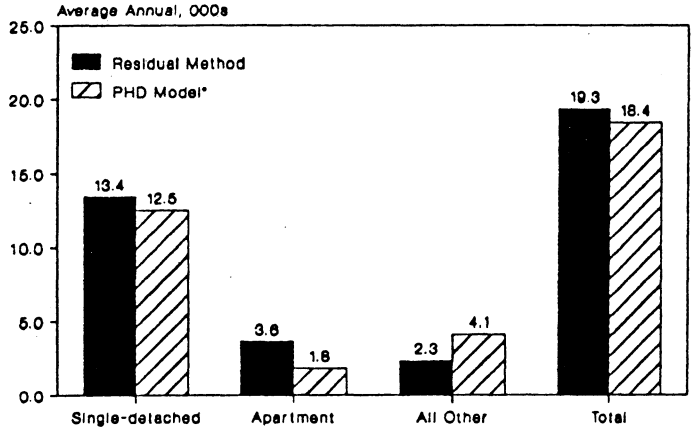
[29] This broadly reflects the assumption used by CMHC to project national and provincial headship rates in **Potential Housing Demand Projections: Canada and the Provinces, 1986-2011.** For those projections, headship rates over the 1986-2011 period were assumed to show one-half of the absolute change recorded in the 1976-1986 period; 25 percent of that change was assumed to occur in the 1986-1991 period. CMHC also made some refinement to ensure that changes looked reasonable, and to account for some rebound in headship rates in younger age groups following the recession of the early 1980s. While these assumptions are considered reasonable, the increase in non-family headship rates among the younger population was built in, in order to ensure some variation between the PHD model generated 1991 household estimates and those generated by the residual method. In this way, one could later illustrate how headship rates could be adjusted within the PHD model in order to arrive at the "target" number of households shown by the residual method.

Exhibit 2-12
COMPARISON OF HOUSEHOLD GROWTH
TORONTO CMA, 1986-1991



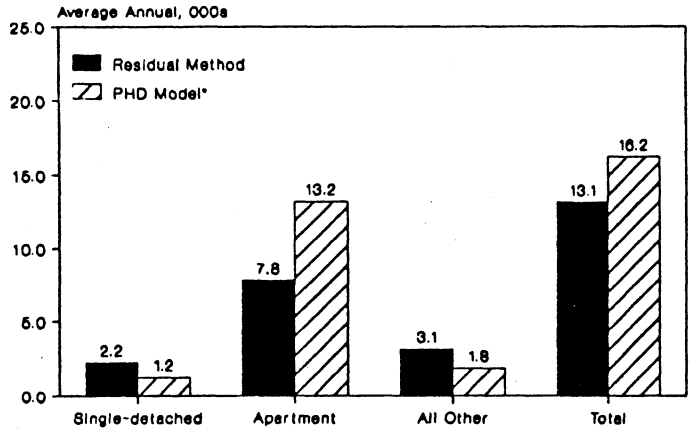
* Based on assumptions as outlined in section 2.5
Source: Clayton Research

Exhibit 2-13
COMPARISON OF OWNER HOUSEHOLD GROWTH
BY DWELLING TYPE, TORONTO CMA, 1986-1991



* Based on assumptions as outlined in section 2.5
Source: Clayton Research

Exhibit 2-14
COMPARISON OF RENTER HOUSEHOLD GROWTH
BY DWELLING TYPE, TORONTO CMA, 1986-1991



* Based on assumptions outlined in section 2.5
Source: Clayton Research

This suggests that some adjustments in the headship rates assumed for the PHD model projections are warranted to update to a new base.

- **Household growth by tenure**: The estimates of household growth generated in the PHD model show more renter household growth (and less owner household growth) relative to the estimates generated by the residual method. This implies that some upward adjustments to the 1986 ownership propensities used to generate the PHD model estimates are warranted.

- **Household growth by tenure and dwelling type**: The estimates under the two methods vary much more substantially by dwelling type. On the ownership side, the use of the 1986 propensities in the PHD model appears to understate single-detached and apartment household growth, and overstate growth in all other units. For renter households, apartments appear to be seriously overstated in the PHD model at the expense of both single-detached and other units. The suggestion for an analyst faced with these comparisons is that the 1986 base structural type propensities in the PHD model might require some adjusting.

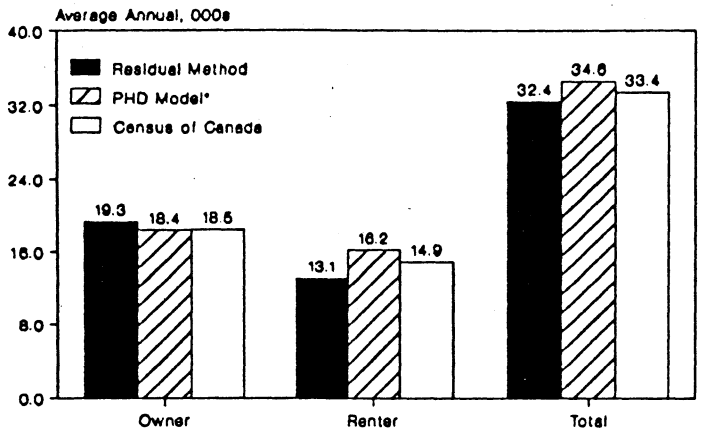
The estimates of household growth generated residually can serve as "target" for analysts in adjusting assumptions in the PHD model. To what extent analysts attempt to "duplicate" the residual numbers exactly will depend on the degree of confidence that the analyst has in each method. If an analyst is fairly comfortable with the "fuzzy" assumptions about net replacement in the residual method, then he/she may want to actually duplicate the residual numbers. If, on the other hand, confidence in these values is lower, the analyst may want to assume some "middle ground" between the two sets of projections.

2.6 COMPARING TORONTO CMA HOUSEHOLDS CALCULATED RESIDUALLY AND IN THE PHD MODEL TO CENSUS DATA

Of course, given the "questionable" degree of reliability associated with some of the estimated series used to generate household growth using the residual method (particularly net additions to the existing stock), one could validly question whether the updating exercise has indeed produced more reliable estimates for 1991. To try and address this, a comparison was made of the household growth estimates generated using the residual method, those produced within the PHD model and actual Census results; the comparisons are shown on Exhibits 2-15 through 2-17.

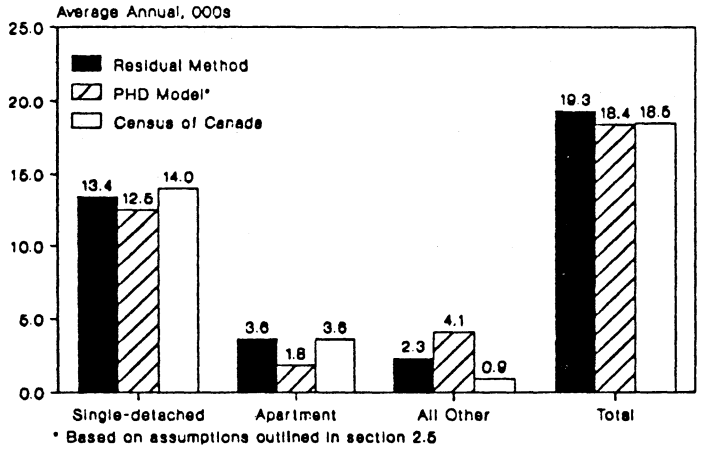
The comparison is somewhat complicated by the fact that non-permanent population were recorded in the 1991 Census, but not the 1986 Census. To the extent that such persons are living in a household headed by a permanent resident, there is no distortion in the household estimates. However, if they are occupying their own unit, there would tend to be some overstatement in household growth over the 1986-1991 period. The overstatement would likely be concentrated in the rental sector.

Exhibit 2-15
COMPARISON OF HOUSEHOLD GROWTH
TORONTO CMA, 1986-1991



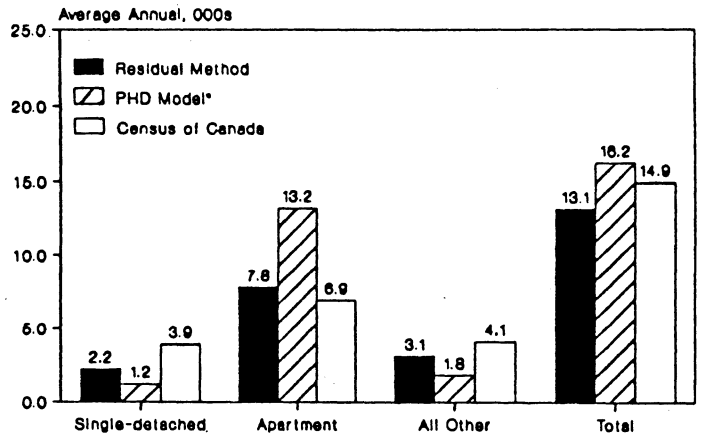
* Based on assumptions outlined in section 2.5
Source: Census of Canada and Clayton Research

Exhibit 2-16
COMPARISON OF OWNER HOUSEHOLD GROWTH
BY DWELLING TYPE, TORONTO CMA, 1986-1991



* Based on assumptions outlined in section 2.5
Source: Census of Canada and Clayton Research

Exhibit 2-17
COMPARISON OF RENTER HOUSEHOLD GROWTH
BY DWELLING TYPE, TORONTO CMA, 1986-1991



* Based on assumptions outlined in section 2.5
Source: Census of Canada and Clayton Research

The comparison shows the following:

- All three sources are fairly close in terms of total household growth, with the Census value falling about mid-way between the other two sources of information.

- By tenure, the residual method may have overstated ownership household growth slightly.

- However, by dwelling type, the residual method of estimating household growth for the 1986-1991 period appears to have in general produced estimates much closer to the Census results than the "constant 1986" propensities incorporated into the PHD model.

The comparison would seem to lend support to the conclusion that some adjustments to the 1986 propensities in the PHD model would have been justified to update the base year and better reflect the actual activity over the 1986-1991 period.

2.7 MAKING ADJUSTMENTS WITHIN THE PHD MODEL TO UPDATE THE BASE YEAR

This section reviews how an analyst might make adjustments to the 1991 assumptions within the PHD model to reflect the household growth numbers generated by the residual analysis for the 1986-1991 period. For this particular example, it is assumed that the analyst has a high degree of confidence in the reliability of the residual estimates, and therefore wishes to reproduce exactly the residual method household growth estimates.

The next subsections outline the three adjustments which must be made:

- Adjust headship rates to achieve targeted total household growth;

- Adjust ownership propensities to achieve targeted owner/renter household growth; and

- Adjust structural type propensities by tenure to achieve targeted household growth by structural type, owners and renters.

2.7.1 Step 1: Adjust Headship Rates

Recall that the total household growth produced within the PHD model was higher than that shown by the residual method (Exhibit 2-12). Therefore, to achieve the target households shown by the residual method, it will be necessary to make some downward adjustments to the headship rate assumptions incorporated into the PHD

Exhibit 2-18
HEADSHIP RATE ASSUMPTIONS FOR PHD MODEL, TORONTO CMA

		15-19			20-24			25-29			30-34		
		Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total
Actual	1986	0.007	0.006	0.013	0.080	0.084	0.164	0.136	0.257	0.393	0.120	0.368	0.488
Initial (1)	1991	0.011	0.006	0.017	0.101	0.079	0.180	0.146	0.250	0.396	0.124	0.362	0.486
Adjusted (2)	1991	0.007	0.006	0.013	0.080	0.079	0.159	0.139	0.250	0.389	0.124	0.362	0.486

		35-39			40-44			45-49			50-54		
		Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total
Actual	1986	0.096	0.434	0.530	0.086	0.469	0.555	0.079	0.478	0.557	0.088	0.474	0.562
Initial (1)	1991	0.100	0.431	0.531	0.090	0.468	0.558	0.081	0.478	0.559	0.089	0.476	0.565
Adjusted (2)	1991	0.100	0.431	0.531	0.090	0.468	0.558	0.081	0.478	0.559	0.089	0.476	0.565

		55-59			60-64			65-69			70-74		
		Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total
Actual	1986	0.110	0.455	0.565	0.149	0.413	0.562	0.207	0.377	0.584	0.276	0.327	0.603
Initial (1)	1991	0.111	0.456	0.567	0.149	0.413	0.562	0.206	0.379	0.585	0.276	0.329	0.605
Adjusted (2)	1991	0.111	0.456	0.567	0.149	0.413	0.562	0.206	0.379	0.585	0.276	0.329	0.605

		75+		
		Non-Fam.	Fam.	Total
Actual	1986	0.342	0.208	0.550
Initial (1)	1991	0.346	0.206	0.552
Adjusted (2)	1991	0.346	0.206	0.552

Assumptions:
(1) For the initial headship rates, assumed rates changed in 1986-1991 by 12.5% of the absolute change 1976-1986; exception was non-family under 30, where increase back to 1981 rates was assumed.
(2) This produced overall household growth higher than shown by the residual method (34,600 per year compared to 32,400). Therefore, non-family headship rates were adjusted back down in the under 30 age groups, to calibrate to the residual method household numbers.

Source: Census of Canada and assumptions by Clayton Research

model. These adjustments are somewhat arbitrary, but should be based on some sound underlying assumptions.

Recall that for the initial headship rate assumptions, it was assumed that there would be some rebound in non-family headship rates among younger population, as this group recovered from the devastating impact of the recession of the early 1980s. In light of the "too high" household growth produced within the PHD model, however, when this assumption is used, it might prompt the analyst to rethink this assumption, and to conclude that even though rates may have rebounded after 1986, by mid 1991, the recession of 1990-1991 could have wiped out these gains once again.

Following such logic, the analyst would start "tinkering" with the non-family headship rate assumptions in the PHD model for these younger age groups, until the target number of households was reached. The specific adjustments used in the illustration on Exhibit 2-18 assume that non-family rates in the 15-19 and 20-24 age groups stayed constant at 1986 rates and only a very small increase occurred for the 25-29 year age group. These adjustments are highlighted on Exhibit 2-18.

2.7.2 Step 2: Adjust Ownership Propensities

Recall that using 1986 ownership propensities in the PHD model produced too many renter households and too few owner households for 1991 in comparison to the residual method of household growth, **based on the initial headship rates assumptions** (Exhibit 2-12).

If one re-ran the projections by tenure with the adjusted headship rates (i.e. lower non-family headship rates for younger population), some of this discrepancy would be reduced. This is because fewer younger non-family households would mean fewer rental dwellings. However, the adjustment to headship rates alone would not be sufficient to achieve the targeted number of owner and renter households in 1991. Therefore, as with headship rates, some adjustments would be required to the 1986 propensities.

The following considerations underlie the adjustments that were made for the illustrative projections in this report:

- Affordability was very good in the early part of the 1986-1991 period in Toronto, and might have led to some shifts to ownership among younger age groups in the early years of the period; by the latter years, however, affordability had deteriorated substantially. It was therefore felt that overall there would not have been any increases in ownership propensities among younger age groups (either family, or non-family), so ownership propensities in the younger age groups were still kept at 1986 rates in the adjusted propensities (Exhibit 2-19).

Exhibit 2-19
HOMEOWNERSHIP PROPENSITIES ASSUMPTIONS IN PHD MODEL, TORONTO CMA

		Non-family						
		15-24	25-34	35-44	45-54	55-64	65-74	75+
Actual	1986	0.069	0.146	0.279	0.344	0.407	0.420	0.377
Initial (1)	1991	0.069	0.146	0.279	0.344	0.407	0.420	0.377
Adjusted (2)	1991	0.069	0.146	0.279	0.344	0.422	0.435	0.382

		Family						
		15-24	25-34	35-44	45-54	55-64	65-74	75+
Actual	1986	0.203	0.520	0.720	0.798	0.813	0.773	0.683
Initial (1)	1991	0.203	0.520	0.720	0.798	0.813	0.773	0.683
Adjusted (2)	1991	0.203	0.520	0.720	0.798	0.828	0.793	0.693

Assumptions:
(1) Initial homeownership propensities were set constant at 1986 rates
(2) Constant 1986 rates produced too few owners, too many renters
Adjusted ownership propensities upward for empty-nester and senior age groups to account for prevalence of lifestyle condominium apartments in 1986-1991 period, targeted largely at these age groups

Source: Census of Canada and assumptions by Clayton Research

- As well, there were no striking reasons to believe that propensities might have change significantly among middle-aged households, so these were also kept constant at 1986 rates for the adjusted propensities (Exhibit 2-19).

- There was a prominent trend, however, that needed to be accounted for. This was the increasing incidence of empty-nester and senior households continuing to own, where in the past relatively more would have shifted to rental in their later years. This trend has been occurring for several years, largely due to increasing relative incomes for older households due to better retirement planning. In 1986-1991, however, the trend was reinforced by the prevalence of condominium apartment units targeted at these age groups. During the housing boom, older households could take advantage of substantial capital gains on selling their single-detached home, and "downgrading" to a smaller unit; whereas in the past, few options were available in this respect other than to shift to rental tenure, many older households in the 1986-1991 period were able to remain homeowners through switching to low-maintenance condominium living.

  Therefore, it was assumed that there were some shifts to ownership tenure among both family and non-family households with heads aged 55 and over in the 1986-1991 period. The degree of the adjustments were arrived at by a consideration of past changes, and "trial and error". The actual changes in propensities assumed are highlighted on Exhibit 2-19.

2.7.3 Step 3: Adjust Structural Type Propensities

Recall that in the initial PHD projections, there was too few single-detached and apartment ownership units "forecast" for 1991, and too many "other" units relative to the estimates produced by the residual method (Exhibit 2-13). For rental households, apartment household growth was overstated, and single-detached and other units understated (Exhibit 2-14). Note that these initial projections incorporated the **initial** assumptions of headship rates and ownership propensities.

Even when the revised headship rate and ownership propensities are incorporated into the PHD model, these discrepancies between the structural type projections using the PHD and the residual method persist. Therefore, it is necessary to adjust the 1986 dwelling type propensities to achieve the target for households by dwelling type in 1991.

The following considerations underlie the adjustments that were made for the illustrative projections of ownership households by dwelling type in this report (the actual adjustments made are highlighted on Exhibit 2-20):

- Affordability problems among younger households suggested that shifts to single-detached units would not have occurred in the under 35 age groups, and that likely shifts from "other" units to more affordable apartment units would have occurred.

Exhibit 2-20
DWELLING CHOICE ASSUMPTIONS IN PHD MODEL, TORONTO CMA

		15-34			35-64			65+		
		Single-Detached	Apt.	Other	Single-Detached	Apt.	Other	Single-Detached	Apt.	Other
		Owner, Family								
Actual	1986	0.666	0.062	0.273	0.715	0.061	0.224	0.722	0.121	0.157
Initial (1)	1991	0.666	0.062	0.273	0.715	0.061	0.224	0.722	0.121	0.157
Adjusted (2)	1991	0.665	0.072	0.262	0.718	0.071	0.211	0.715	0.136	0.149
		Owner, Non-Family								
Actual	1986	0.424	0.284	0.292	0.487	0.274	0.239	0.658	0.179	0.163
Initial (1)	1991	0.424	0.284	0.292	0.487	0.274	0.239	0.658	0.179	0.163
Adjusted (2)	1991	0.424	0.304	0.271	0.487	0.289	0.223	0.658	0.199	0.143
		Renter, Family								
Actual	1986	0.096	0.750	0.154	0.119	0.680	0.200	0.062	0.871	0.067
Initial (1)	1991	0.096	0.750	0.154	0.119	0.680	0.200	0.062	0.871	0.067
Adjusted (3)	1991	0.111	0.720	0.169	0.139	0.651	0.210	0.072	0.851	0.077
		Renter, Non-Family								
Actual	1986	0.056	0.850	0.093	0.042	0.898	0.060	0.026	0.949	0.025
Initial (1)	1991	0.056	0.850	0.093	0.042	0.898	0.060	0.026	0.949	0.025
Adjusted (3)	1991	0.066	0.811	0.123	0.042	0.888	0.070	0.026	0.949	0.025

Assumptions:

(1) Initial 1991 is constant 1986

(2) Initial 1991 resulted in too few singles and apartment for owner; too many "other"
Adjusted owner assume that some shift to apartment in younger groups due to affordability problems; more substantial shifts in empty-nester and senior due to prevalence of lifestyle condominium projects; general shift away from "other"

(3) Initial 1991 resulted in too few singles and "other" for renter; too many "apartment"
Assume general shifts in most age groups to single-detached (due to investor units being rented out) and to "other" (prominence of basement apartments), away from conventional apartments

Source: Census of Canada and assumptions by Clayton Research

- The most likely group to experience a shift to single-detached units was family households in the middle-aged groups. Some shift was also built in towards apartment units, to account for the part of the group comprised of empty-nesters, and the prevalence of lifestyle condominiums aimed at this group.

- Again, the popularity of lifestyle condominiums would have had an impact as well on the 65 and older age groups; moderate shifts from both single-detached and other dwelling units towards apartments were therefore assumed.

On the rental side, the following factors came into play (see actual adjustments on Exhibit 2-20):

- Some general shifts towards single-detached units were assumed, given the increased number of investor-owned units that were put on the rental market in the 1986-1991 period.

- The poor economics of rental apartment construction in this period forced a shift in preferences away from apartments to "other" dwelling units, in particular basement/accessory apartments as discussed in section 2.4.2.2. These shifts were assumed to be fairly broadly based. In cases where no shifts have been assumed, it is because propensities in these groups had remained relatively constant over several Census periods.

2.7.4 Final Result: Adjusted 1991 Households Consistent with the Residual Method

When all of the above adjustments were made, the household growth in the PHD model for the 1996-1991 period was virtually identical to the household growth estimates shown on Exhibits 2-12 through 2-14; they will not therefore be shown again here.

2.7.5 Implications of Adjustments for Projecting Beyond 1991

The adjustments made in sections 2.7.1 through 2.7.3 have effectively updated the base year data in the PHD model to 1991 - prior to 1991 Census data being available.

When undertaking projection exercises beyond 1991, the analyst therefore could consider the new 1991 propensities as forming a new base year. What weight the analyst gives to these data, however, as with any individual Census year, is up to the analyst. He/she may choose to forecast by keeping the propensities constant at 1991 rates over the projection period or by looking at longer term trends in rates and making appropriate adjustments. The advantage of having updated the propensities, however, is that now the analyst has more information from which to formulate those future assumptions.

2.8 CONCLUSIONS AND RECOMMENDED FURTHER WORK

This section outlines the conclusions resulting from the exercise to update the base year data in the PHD model and recommends areas where further work is indicated.

2.8.1 Conclusions and Recommendations

The following are the key conclusions and recommendations arising from the exercise to update the base year data in the PHD model:

- The base year data currently incorporated into the PHD model are the latest Census year data available. However, particularly for periods that are further removed from that base year, these propensities could be substantially "outdated" and therefore not provide the best "jumping off" point for projection exercises.

- Therefore, it is recommended that the base year estimates in the PHD model be updated periodically before new Census information becomes available in order to account for trends since the last Census was undertaken. This updating becomes more important the further one is away from the last Census date.

- Unfortunately, little information is available which directly measures household growth for intercensal periods, particularly at subprovincial levels.

- However, by using completions data, and making assumptions about changes in vacant units and net additions to the existing stock, household growth by tenure and dwelling type can be estimated residually for any period. Adjustments can then be made to headship rates, tenure and dwelling type preferences in the PHD model to "calibrate" the model to a new base year.

- Adoption of the residual method of updating for a new base year would not require any alteration to the current structure of the PHD model. The residual method of calculating household growth can be done itself within a separate spreadsheet. Adjustments to underlying propensities in order to reach the "target" household growth numbers shown by the residual method are themselves made within the PHD model in a manner similar to the procedure used to generate projections of future households.

- While it is recognized that the residual method of calculating household growth does itself have limitations, particularly with regard to the quality of the data on net additions to the existing stock, it can nonetheless be a useful tool in analysing the recent past and providing a better

understanding of the myriad factors which determine the number of new housing units built in any period.

2.8.2 Further Work

The proposed methodology to update the base year in the PHD model by generating household growth estimates residually would benefit from further work:

- The residual method of calculating household growth has its own limitations. In particular, the estimates of net replacement are based on assessments that are currently limited to an analysis of what is at best "soft" information. The reliability of the method would benefit greatly from further work to refine methods of estimating net replacement.

- At the provincial level, a more in-depth assessment of the annual household estimates currently being generated within StatsCan is required before any substantive conclusion can be drawn as to whether revised methodologies in recent years have rendered these more suitable proxies for measuring annual household growth than they have been in the past.

- Unfortunately, the problem of updating the base year data in the PHD model no longer applies only to non-Census years - rather it is an issue as well for the 1991 Census year. This is because the consistency of the household data has been compromised by the inclusion of the non-permanent population in 1991 - particularly for larger centres such as Toronto, Vancouver and Montreal, where the non-permanent population is relatively larger.[30] CMHC may wish to investigate further the extent of the problem, and its implications for trend analysis in the PHD model.

[30] In the past, the base data in the PHD model could be easily updated by simply entering the Census data into the files. In 1991 however, the underlying base year propensities (e.g. headship rates, tenure and dwelling types, etc.) will be distorted by the inclusion of the non-permanent population. It will be difficult to assess whether a change in propensity is due to an underlying trend, or whether it is the result of the definitional change.

3.0 THE USE OF THE PHD MODEL FOR SHORT-TERM PROJECTION EXERCISES

This chapter first addresses the issue of whether the PHD projection model is appropriate for short-term housing demand projection exercises; this is followed by the development of an alternate methodology for generating short-term projections within the PHD framework.

3.1 THE APPROPRIATENESS OF THE PHD MODEL FOR SHORT-TERM PROJECTION EXERCISES

This section discusses the appropriateness of the PHD model for generating short-term projections.

3.1.1. Definition of "Short-term" Versus "Long-term"

In this chapter, the term "short-term" is used in reference to projections prepared for the first five year Census period of a longer overall projection period. For example, currently the short-term time-frame would refer to projections for the 1991-1996 Census period. In these short-term projections there is a focus on **annual** data; therefore cyclical factors are important.

The term "long-term" refers to projections generated for periods beyond this five year timeframe. For example, the longer-term projections currently generated would be for the 1996-2001, 2001-2006, etc. periods. For these longer-term projections, the focus is on five-year **average annual** levels, therefore cyclical factors do not play as significant a role.

3.1.2 The Purpose of Short-term Versus Long-term Projections Not Necessarily the Same

The purpose of generating longer-term household projections is essentially for longer-term planning purposes. For these types of analyses, annual fluctuations in the level of household growth are not of critical importance; rather it is the overall trends which are important.

In the short-term, however, the household growth projections generated in the PHD model can take on a different role. Many local market analysts are using the household growth projections generated within the PHD model as one (but not the only) input into their annual projections of **housing starts**. Therefore it is important that account be taken of fluctuations in the annual household growth numbers. To do this, analysts must consider short-term, cyclical factors.

As well, as outlined as part of the discussions in Chapter 2, factors other than household growth (such as changes in vacant units and net additions to the existing stock) can play a key role in the number of new units constructed in any time period. Therefore, short-term housing starts forecasts cannot rely solely on projections of household growth generated within the PHD model.

3.1.3 Different Factors Important in Generating Short-term Versus Long-term Projections

Consideration of the following factors is important to all housing demand analyses - whether they be short or longer term forecasts.

- **Demographic factors**

  Both total population and the age structure of the population are important determinants of housing demand.

  For example:

  - **Total population growth:** The more people there are, the more people that need to be housed.

  - **The age structure of the population**: Persons of different ages have different propensities to form households, to own versus rent and to occupy dwelling of different structural types. The relative weighting of the population among various age groups can therefore have a significant impact on overall housing demand.

- **Economic factors**

  Economic factors are important, in that they can impact underlying age-specific propensities to form households, to own or rent or to occupy dwellings of different types.

  For example:

  - **Interest rates**: higher prevailing interest rates in one period relative to another will directly impact the affordability of homeownership - and homeownership rates.

  - **Employment growth/unemployment rates:** while population growth is important to housing demand, it must be backed up with income. Unemployed persons will be more likely to double up rather than form their own households. And high unemployment rates mean an excess of labour, which will dampen incomes and therefore affordability.

- **Government programs**

  Government programs can impact both the supply and demand for housing. For example, the high levels of social housing units being built in Ontario in recent years have contributed to higher vacant units and led to a softer rental market than might have otherwise occurred.

- **Housing market conditions**

  Current housing market conditions are also important factors to consider in any housing demand analysis.

  For example:

  - **Excess supply of vacant units**: if there is an excess supply of vacant units, part of housing demand can be filled by them, thereby lowering the requirement for newly built units.

While these factors are all important to both short and long term housing analyses, the relative importance of each factor varies between short and long-term analyses.

For the longer-term, demographic factors will be the most important determinants of housing demand, although changes in average levels of interest rates, unemployment etc. relative to previous periods will also play a role.

In the short-term, underlying demographic factors are important for setting the framework for the five year period as a whole, but annual projections will be impacted more strongly by current economic and housing market conditions, as well as any short-term housing programs in place.

3.1.4 The PHD Model Adequately Accounts for The Longer-Term Issues, but Not Designed to Deal with Short-Term Factors

The methodology underlying the PHD model deals very well with the implication on housing demand of longer-term demographic trends. The incorporation into the model of projections of total population and its age structure, as well as age-specific propensities to form households, guarantees this.

However, the model by itself cannot adequately address the short-term, cyclical issues. This is because it does not explicitly take account of those factors which more directly influence housing cycles - such as interest rates and employment growth.

Implicitly, these factors could be taken into account when formulating the assumptions about headship rates and tenure propensities incorporated into the PHD model. Annual assumptions about headship rates, etc. could be made which recognize the cyclical factors, as opposed to simply longer term trends. For example, if in one year, more households were thought to be doubling up, headship rates could be

reduced. Then, as they are thought to start to "undouble" the next year as the economy improves, the headship rates could be increased again.

However, such an approach would require quite a bit of "fiddling" with propensities on a year by year basis over the short-term projection period. An alternate method which focuses on using the PHD model for generating "average annual" projections of household growth, and other techniques to allocate that growth on a year by year basis, is outlined in the next section. These annual household growth projections will then be considered, along with assumptions about the other components of the demand for housing (i.e. net additions to the existing stock and changes in vacant units),[31] when formulating forecasts of annual housing starts.

3.2 A METHODOLOGY FOR FORMULATING SHORT-TERM HOUSING STARTS PROJECTIONS WITHIN THE PHD MODEL FRAMEWORK

This section outlines a methodology for generating annual, short-term projections of housing starts within the context of average annual household growth projections generated within the PHD model framework.

3.2.1 Methods of Forecasting Short-Term Housing Demand/Housing Starts

There are various techniques which are regularly employed to project short-term housing demand/starts.

One method is to use a "macromodel" of the economy, wherein all the important considerations with regard to interest rates, employment, etc. can be dealt with simultaneously in a series of equations. While such models are employed extensively, they require good underlying data to develop. Unfortunately, at most local levels, the required area-specific reliable data would not be available.

A second technique is to use single-equation regression analysis. In regression analysis, statistical methods are used to identify the relationship between the "dependent" variable (in this case housing starts) and one or more "independent" variables which are determined outside of the model. Again, however, developing a viable equation requires information that may not be available or reliable at the local level.

A third option for short-term forecasting is to use time series analysis, such as ARIMA models and Box Jenkins methods. In these models there is a focus on using historical values for the series to be forecast in order to help predict the future value. For example, past levels of housing starts could be analyzed using time series methods to determine whether or not there are any recurring patterns that would help to forecast future levels of starts. Time series analysis potentially has an

---

[31] Refer to Equation 4 in Chapter 2.

advantage over the two methods previously discussed, in that the input data required (in this case, past levels of housing starts) is readily available at a local level. However, the techniques themselves are not easy to master and not all local market analysts would necessarily have formal training in the use of these methods.

The limitations of the short-term forecasting options, as outlined above, mean that local housing market analysts generally need to depend on "softer" types of analyses in generating their housing starts forecasts. It is not a question of simply plugging assumptions into a "black box" and seeing what is churned out.

For this study, a methodology is outlined which takes advantage of the underlying average annual household growth projections already being generated from within the PHD model exercises. It does not, however, use the PHD model to generate annual projections of household growth. Rather, the underlying projections of average annual household growth for the period are supplemented by a "softer" analysis of other factors which influence the cyclical pattern, in order to generate short-term household growth and, ultimately, housing starts forecasts by dwelling type.

3.2.2 A Proposed Methodology to Project Short-Term Housing Starts

The following section works through an example of how a short-term housing starts forecast that makes use of average annual household growth projections generated within the PHD model can be prepared for the Toronto CMA.[32]

3.2.2.1 The Steps in the Methodology

This section makes no pretence of formulating a "definitive" model to project short-term housing starts. To do so would require a great deal more time and effort than proscribed within the scope of this study. Rather, the focus is on setting up a practical framework which builds on the information already being generated from the PHD model.

The methodology to formulate short-term housing starts projections includes the following steps; each will be discussed in more detail in the following sections:

1) "Reconcile" annual household growth and new housing built in the previous five year period by comparing completions data, estimates of net additions to the existing stock and estimates of changes in vacant units, as was done in Exhibit 2-6.

---

[32] Note that the projections prepared for the Toronto CMA are intended to be illustrative and should not necessarily be interpreted as Clayton Research's "best estimate" projection at this time.

2) Formulate assumptions on the annual pattern of key short-term factors such as net migration, interest rates, employment growth, etc.

3) Project headship rates, household type, tenure and dwelling type propensities for 1996, and incorporate them into the PHD model in order to derive average annual household growth by tenure and dwelling type for the 1991-1996 period as a whole.

4) By considering the annual pattern of the underlying background assumptions, translate the average annual household projections into annual household projections.

5) By making assumptions about net additions to the existing stock and changes in vacant units, determine what the level of newly built units (completions) would need to be to meet the annual household growth in each year.

6) Translate the completions data into housing starts data.

Exhibit 3-1 shows the framework which is used to translate the initial projections of average annual household growth generated within the PHD (Step 3 above) to, ultimately, annual housing starts (Step 6 above). A brief description of Exhibit 3-1 follows below; more detail is provided in subsequent sections:

- The table is very similar in construction to Exhibit 2-6. However, the progression of steps is reversed. In Exhibit 2-6, one ultimately estimated household growth based on first considering completions; for future projections of housing starts, however, one starts with projections of household growth and works through ultimately to housing starts based on the following relationships:

$$c = a - n + v \qquad \text{Equation (6)}$$

where

c = completions
a = household growth
n = net additions to the housing stock
v = change in vacant units

and

$$f_y = c_{t+1} \qquad \text{Equation (7)}$$

where

Exhibit 3-1
FORECASTING ANNUAL HOUSING STARTS BY TENURE AND DWELLING TYPE
TORONTO CMA, 1991-1996

TENURE: TOTAL

	(1) Forecast Household Growth Using PHD Model	(2) Total Household Growth	Net Additions to the Existing Stock (3) Demolitions	(4) Net Structural Conversions	(5) Shifts to Rental	(6) Total	(7) Increase in Vacant	(8) Completions		(9) Annual Starts
All Dwelling Types										
1991-1992		22,706	1,600	1,100	0	(500)	750	23,956	1991	18,814
1992-1993		18,207	1,600	1,300	0	(300)	(200)	18,307	1992	20,770
1993-1994		27,232	1,600	2,300	0	700	(1,500)	25,032	1993	25,800
1994-1995		36,700	1,600	3,400	0	1,800	(2,650)	32,250	1994	33,200
1995-1996		42,400	1,600	4,100	0	2,500	(3,650)	36,250	1995	36,750
Average Annual	29,600	29,449	1,600	2,440	0	840	(1,450)	27,159	1991-95	27,067
Single-detached										
1991-1992		9,626	1,400	(300)	0	(1,700)	(1,300)	10,026	1991	9,459
1992-1993		8,627	1,400	(300)	0	(1,700)	(1,300)	9,027	1992	9,027
1993-1994		10,800	1,400	(500)	0	(1,900)	(200)	12,500	1993	12,500
1994-1995		17,100	1,400	(600)	0	(2,000)	(300)	18,800	1994	18,800
1995-1996		19,900	1,400	(700)	0	(2,100)	(400)	21,600	1995	21,600
Average Annual	13,300	13,211	1,400	(480)	0	(1,880)	(700)	14,391	1991-95	14,277
Apartment										
1991-1992		9,246	150	400	0	250	1,800	10,796	1991	6,119
1992-1993		5,469	150	500	0	350	1,000	6,119	1992	8,582
1993-1994		10,432	150	900	0	750	(1,100)	8,582	1993	9,350
1994-1995		12,500	150	1,400	0	1,250	(1,900)	9,350	1994	10,300
1995-1996		14,500	150	1,700	0	1,550	(2,650)	10,300	1995	10,800
Average Annual	10,400	10,429	150	980	0	830	(570)	9,029	1991-95	9,030
All Other										
1991-1992		3,834	50	1,000	0	950	250	3,134	1991	3,236
1992-1993		4,111	50	1,100	0	1,050	100	3,161	1992	3,161
1993-1994		6,000	50	1,900	0	1,850	(200)	3,950	1993	3,950
1994-1995		7,100	50	2,600	0	2,550	(450)	4,100	1994	4,100
1995-1996		8,000	50	3,100	0	3,050	(600)	4,350	1995	4,350
Average Annual	5,900	5,809	50	1,940	0	1,890	(180)	3,739	1991-95	3,759

Notes:
(1) See text section 3.2.2.1.3
(2) See text section 3.2.2.1.4
(3) See text section 3.2.2.1.5.2
(4) See text section 3.2.2.1.5.2
(5) See text section 3.2.2.1.5.2
(6) (3)+(4)-(2)
(7) See Exhibit 3-7 and text section 3.2.2.1.5.1
(8) (2)+(7)-(6); see text section 3.2.2.1.5.3
(9) Historical and lagged (8) - see text section 3.2.2.1.6

Source: Clayton Research and CMHC data

f = housing starts
c = completions
y = current calendar year
t = current 12 month period beginning June 1 of calendar year y
l = lag factor (e.g. if l=0, starts in calendar year y are equal to completions in the 12 month period beginning June 1 of the same calendar year; this is discussed in more detail in section 3.2.2.1.6)

- As with Exhibit 2-6, there are two main parts to the table. The first part, opposite this page, shows the relevant information to generate total housing starts. The second part of the exhibit, opposite the next page, provides comparable information for owner and renter housing start separately. Note that if one adds the owner and renter sections together, the result is the totals on the first part of the table.

- Column 1 shows the average annual projections of household growth by tenure and dwelling type as generated in the PHD model, based on the assumptions which will be outlined later in section 3.2.2.1.3. and shown on Exhibits 3-2, 3-3 and 3-4

- Column 2 shows the annual pattern of the average annual household growth, based on the assumptions discussed in section 3.2.2.1.2 and shown on Exhibit 3-2.

- Columns 3 through 5 contain information on net additions to the existing housing stock. Column 6 is the sum of Column 4 plus Column 5 less Column 3. The assumptions underlying these projections are discussed in section 3.2.2.1.5.2.

- Column 7 shows assumptions on the change in vacant units, as discussed in section 3.2.2.1.5.1.

- Column 8 shows the level of completions which would be required to meet the household growth shown in Column 2, after accounting for net additions to the existing stock and changes in vacant units. For historical years, the data are actual CMHC completions data (e.g. 1991-1992 in these projections); for other years, completions are calculated as Column 2 (household growth) plus Column 7 (increase in vacant units) less Column 6 (net additions to the existing stock).

- Column 9 shows annual housing starts. For historical periods (i.e. in this case, 1991 and 1992) data are actual CMHC data; for other years, they are calculated based on the completions data in Column 8 and assumptions about start-to-completions lags, as discussed later in Section 3.2.2.1.6.

The following sections discuss the six steps in the methodology outlined above in more detail.

Exhibit 3-1 (Continued)

TENURE: OWNER

	(1) Forecast Household Growth Using PHD Model	(2) Total Household Growth	Net Additions to the Existing Stock (3) Demolitions	(4) Net Structural Conversions	(5) Shifts to Rental	(6) Total	(7) Increase in Vacant	(8) Completions		(9) Annual Starts
All Dwelling Types										
1991-1992		15,782	725	0	(3,012)	(3,737)	(1,500)	18,019	1991	12,892
1992-1993		12,170	725	0	(1,500)	(2,225)	(1,500)	12,895	1992	11,929
1993-1994		15,608	725	0	400	(325)	0	15,933	1993	17,325
1994-1995		22,200	725	0	(800)	(1,525)	0	23,725	1994	24,725
1995-1996		25,000	725	0	(2,000)	(2,725)	0	27,725	1995	26,225
Average Annual	18,200	18,152	725	0	(1,382)	(2,107)	(600)	19,859	1991-95	19,019
Single-detached										
1991-1992		9,226	700	(300)	(1,100)	(2,100)	(1,300)	10,026	1991	9,459
1992-1993		8,127	700	(300)	(1,200)	(2,200)	(1,300)	9,027	1992	9,027
1993-1994		10,000	700	(500)	(1,300)	(2,500)	0	12,500	1993	12,500
1994-1995		16,000	700	(600)	(1,500)	(2,800)	0	18,800	1994	18,800
1995-1996		18,500	700	(700)	(1,700)	(3,100)	0	21,600	1995	21,600
Average Annual	12,400	12,371	700	(480)	(1,360)	(2,540)	(520)	14,391	1991-95	14,277
Apartment										
1991-1992		4,795	0	0	(1,565)	(1,565)	(100)	6,260	1991	1,574
1992-1993		1,874	0	0	0	0	(100)	1,574	1992	608
1993-1994		2,608	0	0	2,000	2,000	0	608	1993	2,000
1994-1995		3,000	0	0	1,000	1,000	0	2,000	1994	3,000
1995-1996		3,000	0	0	0	0	0	3,000	1995	3,500
Average Annual	3,000	3,015	0	0	287	287	(40)	2,888	1991-95	2,136
All Other										
1991-1992		1,761	25	300	(347)	(72)	(100)	1,733	1991	1,859
1992-1993		2,369	25	300	(300)	(25)	(100)	2,294	1992	2,294
1993-1994		3,000	25	500	(300)	175	0	2,825	1993	2,825
1994-1995		3,200	25	600	(300)	275	0	2,925	1994	2,925
1995-1996		3,500	25	700	(300)	375	0	3,125	1995	3,125
Average Annual	2,800	2,766	25	480	(309)	146	(40)	2,580	1991-95	2,606

Notes:
(1) See text section 3.2.2.1.3
(2) See text section 3.2.2.1.4
(3) See text section 3.2.2.1.5.2
(4) See text section 3.2.2.1.5.2
(5) See text section 3.2.2.1.5.2
(6) (3)+(4)-(2)
(7) See Exhibit 3-7 and text section 3.2.2.1.5.1
(8) (2)+(7)-(6); see text section 3.2.2.1.5.3
(9) Historical and lagged (8) - see text section 3.2.2.1.6

Source: *Clayton Research and CMHC data*

Exhibit 3-1 (Continued)

TENURE: RENTER

	(1) Forecast Household Growth Using PHD Model	(2) Total Household Growth	Net Additions to the Existing Stock (3) Demolitions	(4) Net Structural Conversions	(5) Shifts to Rental	(6) Total	(7) Increase in Vacant	(8) Completions		(9) Annual Starts
All Dwelling Types										
1991-1992		6,924	875	1,100	3,012	3,237	2,250	5,937	1991	5,922
1992-1993		6,037	875	1,300	1,500	1,925	1,300	5,412	1992	8,841
1993-1994		11,624	875	2,300	(400)	1,025	(1,500)	9,099	1993	8,475
1994-1995		14,500	875	3,400	800	3,325	(2,650)	8,525	1994	8,475
1995-1996		17,400	875	4,100	2,000	5,225	(3,650)	8,525	1995	8,525
Average Annual	11,400	11,297	875	2,440	1,382	2,947	(850)	7,500	1991-95	8,048
Single-detached										
1991-1992		400	700	0	1,100	400	0	0	1991	0
1992-1993		500	700	0	1,200	500	0	0	1992	0
1993-1994		800	700	0	1,300	600	(200)	0	1993	0
1994-1995		1,100	700	0	1,500	800	(300)	0	1994	0
1995-1996		1,400	700	0	1,700	1,000	(400)	0	1995	0
Average Annual	900	840	700	0	1,360	660	(180)	0	1991-95	0
Apartment										
1991-1992		4,451	150	400	1,565	1,815	1,900	4,536	1991	4,545
1992-1993		3,795	150	500	0	350	1,100	4,545	1992	7,974
1993-1994		7,824	150	900	(2,000)	(1,250)	(1,100)	7,974	1993	7,350
1994-1995		9,500	150	1,400	(1,000)	250	(1,900)	7,350	1994	7,300
1995-1996		11,500	150	1,700	0	1,550	(2,650)	7,300	1995	7,300
Average Annual	7,400	7,414	150	980	(287)	543	(530)	6,341	1991-95	6,894
All Other										
1991-1992		2,073	25	700	347	1,022	350	1,401	1991	1,377
1992-1993		1,742	25	800	300	1,075	200	867	1992	867
1993-1994		3,000	25	1,400	300	1,675	(200)	1,125	1993	1,125
1994-1995		3,900	25	2,000	300	2,275	(450)	1,175	1994	1,175
1995-1996		4,500	25	2,400	300	2,675	(600)	1,225	1995	1,225
Average Annual	3,100	3,043	25	1,460	309	1,744	(140)	1,159	1991-95	1,154

Notes:
(1) See text section 3.2.2.1.3
(2) See text section 3.2.2.1.4
(3) See text section 3.2.2.1.5.2
(4) See text section 3.2.2.1.5.2
(5) See text section 3.2.2.1.5.2
(6) (3)+(4)-(2)
(7) See Exhibit 3-7 and text section 3.2.2.1.5.1
(8) (2)+(7)-(6); see text section 3.2.2.1.5.3
(9) Historical and lagged (8) - see text section 3.2.2.1.6

Source: *Clayton Research and CMHC data*

3.2.2.1.1 Step 1: Prepare annual estimates of household growth, changes in vacant units and net additions to the existing stock for the 1986-1991 period

In Chapter 2, estimates of household growth for the 1986-1991 intercensal period were derived based on a "residual method" (Exhibit 2-6). This base data for the 1986-1991 period is important to the analysis in this chapter as well. This is because a "reversal" of the approach used to produce the household estimates for 1986-1991 will be used to ultimately derive housing starts in the next five year period (as per Exhibit 3-1). In particular, it is critical to have a good "feel" for the estimates of net additions to the existing stock and changes in vacancies for the previous five-year period if one is to project these forward for the next five year period.

3.2.2.1.2 Step 2: Formulate key background assumptions by year

The next step in the generation of the short-term housing starts projections is to formulate an underlying scenario which incorporates assumptions about key factors expected to impact the pattern of household growth for the five year period under consideration (in this case, mid 1991 to mid 1996). Factors to be included in this outlook might include employment growth, the unemployment rate, interest rates, house price increases, affordability, etc. These underlying assumptions will serve two purposes:

- **Assist in the formulation of assumptions to incorporate in the PHD model**

  The average annual data which falls out of the annual outlook will allow comparisons to be made about the expected "performance" for the 1991-1996 period as a whole relative to the 1986-1991 period - this can then be used, if desired, in formulating the assumptions in the PHD model about headship rates, tenure preferences, etc. For example, if the average unemployment rate for the 1991-1996 period as a whole is substantially higher than that prevailing in the 1986-1991 period, the implication is that real household incomes, and therefore household formation rates, may be dampened in the next five year period relative to the last five years.

- **Assist in establishing the annual pattern of household growth outside of the PHD model**

  The annual data on underlying assumptions will allow adjustments to be made to the average annual household growth data generated within the PHD model to account for the cyclical nature of household growth/housing starts.

Exhibit 3-2 shows annual and average annual data for key assumptions to be considered in the analysis; data for both the historical 1986-1991 and forecast 1991-

Exhibit 3-2
BACKGROUND ASSUMPTIONS, TORONTO CMA

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average Annual* 1986-1991	Average Annual* 1991-1996
Census year													
Net Migration (12 months beginning indicated year, 000s)	60	53	36	25	25	25	27	32	35	37	40	40	31
Calendar years, average annual													
Employment (% Growth)	4.1	3.9	2.4	2.5	-0.5	-5.5	-2.8	2.0	3.0	3.5	3.5	2.5	0.0
Unemployment Rate (%)	5.5	4.5	3.7	4.0	5.3	9.8	11.8	12.0	11.4	10.5	9.5	4.6	11.1
Factors impacting affordability:													
Mortgage Rates (%):													
5 Year	11.2	11.2	11.7	12.1	13.4	11.1	9.5	8.5	8.00	8.25	8.50	11.9	9.1
1 Year	10.2	9.9	10.8	12.9	13.4	10.1	8.0	7.5	7.00	7.25	7.50	11.4	8.0
Rate of Inflation (%)**	4.7	5.6	5.0	6.3	4.7	4.2	0.8	1.5	2.0	2.0	2.0	5.3	2.1
House Prices (% change):													
Resale	27.3	36.1	21.4	19.2	-6.8	-8.1	-8.3	0.0	2.0	5.0	8.0	19.5	-1.9
New	16.6	26.2	16.6	22.4	-3.8	-15.0	-4.3	0.0	3.0	7.0	10.0	15.6	-1.9
Affordability Indicator (%)***	25	32	36	39	40	33	27	25	25	26	28	34	27

* Calendar year data is average 1986-1990 and 1991-1995

** Used to determine growth in average family income

*** Percent of average family income required to carry an average-priced MLS home.

Source: Statistics Canada, Bank of Canada, CMHC and projections by Clayton Research

1996 Census periods are provided. The following data were compiled for this exercise:

- **Net migration**

  While natural increase is also an important contributor to population growth, it does not fluctuate very much on a year-to-year basis; therefore, net migration is the more important short-term indicator of population growth. As household growth can be expected to follow net migration (and population growth) with a lag,[33] these lags need to also be considered when using this variable to help allocate year-to-year household growth.

- **Employment indicators**

  Projections were prepared of both employment growth and the unemployment rate, as both can be important to annual housing demand. For example, employment growth is expected to be positive in 1993 following several years of job losses; however, while this is positive for housing demand, the fact that the unemployment rate continues to rise (since job growth does not keep pace with labour force growth) is negative for consumer confidence, which will have some offsetting impact. As with net migration, employment growth is likely to have a delayed impact on housing demand.

- **Affordability indicator**

  Variables such as mortgage rates, house price increases, inflation (particularly as it impacts incomes) will impact the affordability of homeownership. The "affordability indicator" on Exhibit 3-2 is a calculation which takes account of these factors. More specifically, it measures the percent of average family income which would be required to meet the mortgage principal and interest payments on an average-priced MLS home. As the indicator rises, affordability worsens, and homeownership becomes relatively less attractive.

The assumptions outlined in Exhibit 3-2 were chosen for the analysis here, but they are not necessarily the only factors that could be considered.

Because the data are not being used as input into a formal calculation (such as a regression model), the actual numerical value of the assumptions in general is of less importance to the analysis than the **relative year to year change**. The exception is the variables underlying the affordability indicator (i.e mortgage rates, house prices and increases in income), since the actual values of each are input directly into the calculation of the affordability indicator.

---

[33] Newly arrived residents would be more likely to "double up" until they are more firmly established in jobs, etc.

The specific assumptions shown on Exhibit 3-2 should be considered as illustrative only; they are not necessarily Clayton Research's best estimates. The main purpose of the analysis here is to illustrate the proposed methodology; outlining a methodology for the development of the underlying assumptions themselves is beyond the limited scope of the study.[34]

It should be noted here that the factors examined in Exhibit 3-1 are those that are expected to impact most directly on housing demand - they do not therefore include housing supply indicators. At this stage of the analysis, we are interested only in determining the annual pattern of household growth - not forecasting housing starts. At the subsequent stages of the analysis, when that household growth is ultimately translated into housing starts, account will have to be taken of other factors, such as vacancy rates, units supplied from within the existing stock, etc.[35]

3.2.2.1.3 Step 3: Project average annual household growth in the PHD model

Average annual assumptions about net migration, headship rates and tenure and dwelling type propensities were incorporated into the PHD model in order to derive projections of average annual household growth by tenure and dwelling type for the 1991-1996 period as a whole.[36] The specific assumptions made are discussed below:

- **Population**

  Net migration was assumed to gradually increase from current levels, to result in an average of 31,000 per year in 1991-1996, somewhat below the roughly 40,000 per year in the 1986-1991 period.[37]

  The same assumptions about fertility and mortality rates and the age/sex distribution of migrants were used as were incorporated into the estimates of the 1986-1991 period (as discussed in section 2.5).

---

[34] CMHC's Market Analysis Centre and CMHC local market analysts have undertaken substantive work in developing methodologies for forecasting such background assumptions and already have systems in place to undertake this part of the analysis.

[35] This is somewhat simplistic, since supply and demand are more intricately linked than this suggests. For example, if there is an oversupply of rental units, rents will be more favourable, which may induce more households to be formed.

[36] Again, these assumptions should be considered as illustrative only - they do not necessarily represent Clayton Research's "best estimate".

[37] Although international migration will be higher on average, this will be countered by lower levels of interprovincial migration.

- **Household headship rates**

  The assumptions about the economic outlook in 1991-1996 relative to 1986-1991 were considered when formulating the 1996 assumptions about headship rates (as well as tenure and dwelling type propensities). The relatively poor economic climate relative to 1986-1991 (e.g. zero employment growth as a whole for the 1991-1996 period, compared to 2.5 percent per year on average in 1986-1991) was assumed to dampen household headship rates. As the same time, it was felt that this was likely to be reinforced by the shift in composition of migrants towards international migrants, who have been shown to have relatively lower headship rates than the base population upon initial arrival in Canada.[38]

  More specifically, family headship rates in general were assumed to continue to decline in the 1991-1996 period, but without any corresponding increases in non-family rates. The specific assumptions used are shown on Exhibit 3-3; rates that have been changed from the 1991 rates are highlighted.

- **Ownership propensities**

  Ownership propensities were held constant at the estimated 1991 rates. Although affordability is forecast to be better in the first half of the 1990s relative to the latter 1980s (as shown by the affordability indicator ratio of 27 percent relative to 34 percent) due to lower interest rates and house prices, this is expected to be countered by the negative impact on consumer confidence of high unemployment (average of over 11 percent, compared to less than 5 percent in the latter 1980s), as well as good deals to be had in the relatively "oversupplied" rental market. The 1996 ownership rates are the same as those estimated for 1991, which were displayed on Exhibit 2-19).

- **Structural type propensities**

  For structural type, it was assumed that there continued to be some shift towards high-rise apartments at the expense of other multiples among owner households, but at more moderate rates than in the latter 1990s. For renter households, continued shifts away from high-rise apartments to other multiple units was assumed, albeit at more moderate rates. The actual rates used are shown on Exhibit 3-4; changes from 1991 rates are highlighted.

The assumptions about headship rates, and tenure and dwelling type propensities were incorporated into the PHD model to derive estimates of average annual

---

[38] This is based on preliminary work undertaken by Clayton Research as part of a study currently in progress for CMHC on immigrant housing choices.

Exhibit 3-3
HEADSHIP RATE ASSUMPTIONS FOR PHD MODEL, TORONTO CMA

		15-19			20-24			25-29			30-34		
		Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total
Actual	1986	0.007	0.006	0.013	0.080	0.084	0.164	0.136	0.257	0.393	0.120	0.368	0.488
Estimated (1)	1991	0.007	0.006	0.013	0.080	0.079	0.159	0.139	0.250	0.389	0.124	0.362	0.486
Forecast (2)	1996	0.007	0.006	0.013	0.080	0.070	0.150	0.139	0.230	0.369	0.124	0.342	0.466

		35-39			40-44			45-49			50-54		
		Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total
Actual	1986	0.096	0.434	0.530	0.086	0.469	0.555	0.079	0.478	0.557	0.088	0.474	0.562
Estimated (1)	1991	0.100	0.431	0.531	0.090	0.468	0.558	0.081	0.478	0.559	0.089	0.476	0.565
Forecast (2)	1996	0.100	0.410	0.510	0.090	0.458	0.548	0.081	0.478	0.559	0.089	0.476	0.565

		55-59			60-64			65-69			70-74		
		Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total	Non-Fam.	Fam.	Total
Actual	1986	0.110	0.455	0.565	0.149	0.413	0.562	0.207	0.377	0.584	0.276	0.327	0.603
Estimated (1)	1991	0.111	0.456	0.567	0.149	0.413	0.562	0.206	0.379	0.585	0.276	0.329	0.605
Forecast (2)	1996	0.111	0.456	0.567	0.149	0.413	0.562	0.206	0.379	0.585	0.276	0.329	0.605

		75+		
		Non-Fam.	Fam.	Total
Actual	1986	0.342	0.208	0.550
Estimated (1)	1991	0.346	0.206	0.552
Forecast (2)	1996	0.346	0.206	0.552

Assumptions:
(1) For estimated 1991, see Exhibit 2-18
(2) Assumed that very poor economic conditions in early 1990s suppressed any further growth in non-family headship rates; reinforced by higher immigration and relatively lower headship rates among newer immigrants; family rates assumed to continue to decline; again, decline reinforced by higher proportion of recent immigrants to base population

Source: Census of Canada and assumptions by Clayton Research

household growth by tenure and dwelling type for the 1991-1996 period. The resulting projections are shown on Exhibit 3-5 and in Column 1 of Exhibit 3-1.

3.2.2.1.4 Step 4: Translate average annual household growth into annual household growth

If the annual projections of household growth were being derived using regression analysis, one could simply input the key underlying assumptions (on interest rates, employment growth, etc.) into an equation to generate the annual projections of household growth.

Here, a softer analysis must be used. By looking at the pattern of key background assumptions, a pattern of annual household growth was derived for the 1991-1996 period.

In the early years of the period, the pattern is dictated largely by known housing construction (i.e. information for 1991 and 1992 on starts and completions). For example, completions for the 1991-1992 Census period are already known - when considered in conjunction with assumptions about net additions to the existing stock and change in vacant units, this will dictate to a large extent what annual household growth will be in the 1991-1992 period.

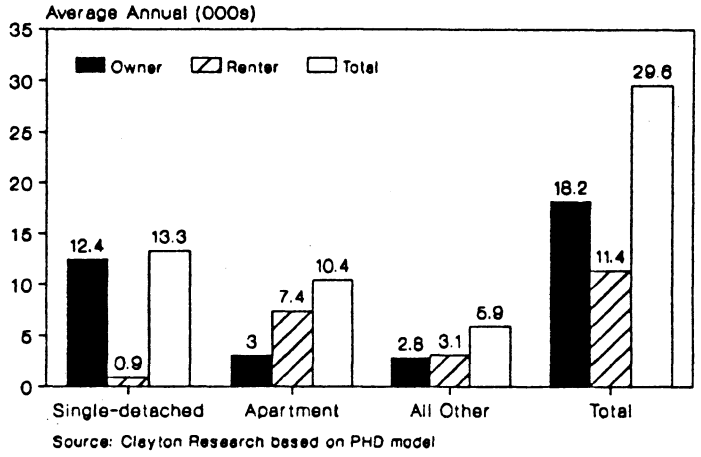
For example, consider owner household growth, single-detached units, for the year 1991-1992. Housing completions for mid 1991 to mid 1992 are already known (10,026, as shown in Column 8 of Exhibit 3-1). Additions to the existing stock are assumed at a net loss of 2,100 units (Column 6) and vacant units are assumed to decline by 1,300 units). Given this information, household growth in 1991-1992 is calculated (again, using Equation 4 on page 13) at 9,226 i.e. 10,026 plus (-2,100) minus (-1,300).

In later years of the forecast period, the pattern of household growth has been tied more closely to the economic outlook, with the pattern of employment growth playing a particularly important role.

The pattern of the economic performance/employment growth (as shown on Exhibit 3-2) suggests that household growth will be weaker towards the early part of the period, then pick up steam later in the period as employment growth takes hold and unemployment rates start to decline. Note that there is no "mechanical" link between the annual economic forecasts and the annual forecasts of household growth; rather the economic forecast, as well as "estimated" household growth for the early years of the period, is taken into consideration when formulating a reasonable household growth pattern.

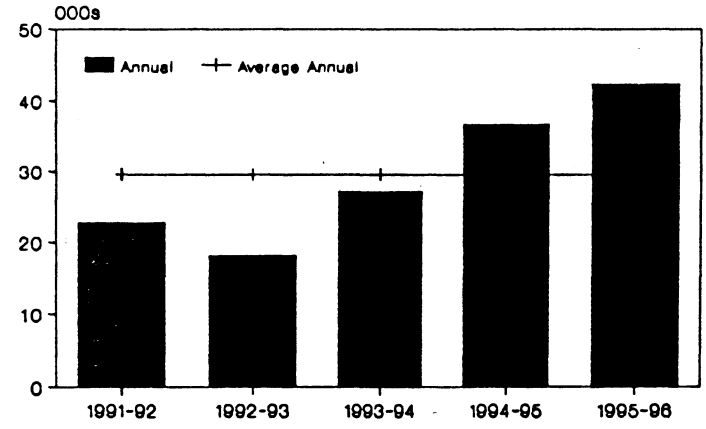
One guide in this task is to compare the annual level of the underlying variable to the average annual value of the variable over the forecast period. For example, employment growth is below the average annual 1991-1996 growth of zero percent

Exhibit 3-5
PROJECTED HOUSEHOLD GROWTH IN PHD MODEL
TORONTO CMA, 1991-1996



Source: Clayton Research based on PHD model

Exhibit 3-6
ANNUAL AND AVERAGE ANNUAL TOTAL
HOUSEHOLD GROWTH, TORONTO CMA, 1991-1996



Source: Clayton Research

in 1991 and 1992, but above it in 1993-1995. We may then wish to show a similar pattern for household growth, but allowing for some lag.

Exhibit 3-6 presents the average annual total household growth for the 1991-1996 period generated within the PHD model and the corresponding annual pattern of household growth which has been assumed for these illustrative projections.[39] The actual assumptions used in any year are arbitrary, but are based on the considerations outlined above. Similar patterns were shown for household growth by tenure and type of dwelling occupied (Column 2 of Exhibit 3-1).

In all cases, the average annual household growth numbers generated in the PHD model served as the "target" for growth for the five year period. The annual pattern of household growth was then devised such that this average annual would be met.

For example, consider single-detached, owner household growth. The PHD model indicated average annual growth of 18,200 for the 1991-1996 period as a whole (from Column 1 of Exhibit 3-1). Based on known completions for 1991-1992 and estimated net additions to the existing stock and change in vacant units, it was previously determined that household growth in this category for 1991-1992 was an estimated 9,226. Household growth for 1992-1993 is also known in a similar fashion, if one assumes starts in calendar year 1992 - a known quantity of 9,027 units - are roughly equal to completions in the mid 1992-mid 1993 period.

With two years of "known" household growth data, annual data only still needed to be estimated for the 1993-1996 period. The rough annual pattern of household growth (i.e. increasing over the period 1992-1996) was established by previous analysis of background indicators, as discussed above. The actual levels assumed were arrived at by "trial and error", but to match ultimately the target average annual level for the period as a whole.

It would be up to the analyst as to how closely he/she wished the calculated average of the annual household growth numbers to duplicate the targeted average annual growth in the PHD model. This would depend on the analyst's relative confidence in the underlying assumptions in the PHD model analysis versus the assumptions in the analysis associated with Exhibit 3-1.

As well, the analysis in Exhibit 3-1 could point out some "flaws" in the assumptions incorporated into the PHD model. For example, if the PHD model showed some level of renter household growth for apartments which implied a higher level of apartment construction than the analyst felt was reasonable, given starts already in the period, the economics of private rental construction and announced social housing units, then the analyst might feel that the PHD model assumptions about dwelling type preferences for apartments were unrealistically high.

---

[39] The detailed annual projections of household growth by tenure and dwelling type are presented in Exhibit 3-1.

Exhibit 3-7
ESTIMATING CHANGE IN VACANT UNITS
TORONTO CMA, 1991-1996

	Housing Stock			Occupied Units			Vacant Units			Vacancy Rate (%)		
	(1) Total	(2) Owner	(3) Renter	(4) Total	(5) Owner	(6) Renter	(7) Total	(8) Owner	(9) Renter	(10) Total	(11) Owner	(12) Renter
1986	1,224,819	722,930	501,889	1,199,761	699,378	500,383	25,058	23,552	1,506	2.05	3.26	0.3
1987	1,257,611	745,019	512,592	1,231,022	718,943	512,079	26,588	26,076	513	2.11	3.50	0.1
1988	1,298,382	771,844	526,538	1,272,244	746,759	525,485	26,138	25,085	1,053	2.01	3.25	0.2
1989	1,339,491	795,047	544,443	1,309,780	766,426	543,355	29,711	28,622	1,089	2.22	3.60	0.2
1990	1,375,408	814,014	561,394	1,338,918	781,453	557,464	36,490	32,561	3,930	2.65	4.00	0.7
1991	1,401,510	827,056	574,454	1,361,879	796,042	565,837	39,631	31,015	8,617	2.83	3.75	1.5
1992	1,424,966	841,339	583,628	1,384,585	811,824	572,761	40,381	29,515	10,867	2.83	3.51	1.9
1993	1,443,023	852,009	591,015	1,402,792	823,994	578,798	40,231	28,015	12,217	2.79	3.29	2.1
1994	1,468,755	867,617	601,139	1,430,024	839,602	590,422	38,731	28,015	10,717	2.64	3.23	1.8
1995	1,502,805	889,817	612,989	1,466,724	861,802	604,922	36,081	28,015	8,067	2.40	3.15	1.3
1996	1,541,555	914,817	626,739	1,509,124	886,802	622,322	32,431	28,015	4,417	2.10	3.06	0.7
Year to Year Changes												
1986-1987	32,792	22,089	10,703	31,261	19,565	11,696	1,530	2,523	(993)			
1987-1988	40,771	26,825	13,946	41,222	27,816	13,406	(450)	(991)	540			
1988-1989	41,109	23,204	17,905	37,536	19,667	17,869	3,573	3,537	36			
1989-1990	35,917	18,966	16,951	29,137	15,028	14,110	6,780	3,939	2,841			
1990-1991	26,103	13,042	13,060	22,961	14,588	8,373	3,141	(1,546)	4,687			
1991-1992	23,456	14,282	9,174	22,706	15,782	6,924	750	(1,500)	2,250			
1992-1993	18,057	10,670	7,387	18,207	12,170	6,037	(150)	(1,500)	1,350			
1993-1994	25,732	15,608	10,124	27,232	15,608	11,624	(1,500)	0	(1,500)			
1994-1995	34,050	22,200	11,850	36,700	22,200	14,500	(2,650)	0	(2,650)			
1995-1996	38,750	25,000	13,750	42,400	25,000	17,400	(3,650)	0	(3,650)			
Average Annual Change												
1986-1991	35,338	20,825	14,513	32,424	19,333	13,091	2,915	1,492	1,422			
1991-1996	28,009	17,552	10,457	29,449	18,152	11,297	(1,440)	(600)	(840)			

Assumptions for 1986-1991: see Exhibit 2-11

Assumptions 1991-1996:

(1) (2) plus (3)
(2) (5) plus (8)
(3) (6) plus (9)
(4) (5) plus (6)
(5) Growth is entered from Exhibit 3-1; total is total in previous year plus growth
(6) Growth is entered from Exhibit 3-1; total is total in previous year plus growth
(7) (8) plus (9)
(8) Change is entered (see text 3.2.2.1.5.1); total is total in previous year plus change
(9) Change is entered (see text 3.2.2.1.5.1); total is total in previous year plus change
(10) (7) divided by (1) times 100
(11) (8) divided by (2) times 100
(12) (9) divided by (3) times 100

Source: Clayton Research based and data from CMHC and Census of Canada

3.2.2.1.5 Step 5: Make assumptions about net additions to the existing stock and changes in vacancies in order to derive required newly built units

Not all of the household growth will be accommodated by newly built units - some households will occupy previously vacant units or units added to the housing stock through conversions/basement/accessory apartments. Therefore, it is imperative to also consider these factors when translating household growth into new units required/housing starts. The assumptions here build on the analysis underlying the formulation of the estimates in Exhibit 2-6.

3.2.2.1.5.1 Changes in vacant units

For rental units, **it was arbitrarily assumed** that the vacant units increased through 1993 (due to the softness in the housing market, and the high number of assisted units yet to be completed), then declined over the subsequent three years. The corresponding rental vacancy rate increases from 1.5 percent in 1991 to 2.1 percent in 1993, then declines to 0.7 percent by mid 1996 as household growth picks up.

For the ownership sector, **it was arbitrarily assumed** that some further declines in excess vacancies occur in the 1991-1993 period (of about 1,500 units per year); this would result in the vacancy rate declining to near the 3 percent range by 1996.

Exhibit 3-7 presents the actual assumptions used to generate the trends in vacant units as well as the changes in overall vacant units themselves. This table is very similar to Exhibit 2-11 in Chapter 2 and therefore will not be discussed in detail here. The key data which must be entered are highlighted; the change in occupied units is from Exhibit 3-1, Column 2, while the vacant unit information is an arbitrary assumption. All other data are calculated.

The changes in vacant units from this table are also entered on Exhibit 3-1, Column 7.

3.2.2.1.5.2 Net additions to the existing stock

Demolitions in each year of the period were assumed to be roughly the average level recorded in the 1986-1991 period in 1991-1996 (Column 3 of Exhibit 3-1).

For net structural conversions and tenure shifts, it was assumed that in general the relative oversupply in the rental market would result in lower levels of both in the 1991-1996 period relative to the 1986-1991 period, but with the levels increasing as the period progresses and the rental "oversupply" is worked down.

For condominium apartments, however, it was assumed that there would be some shifting back of units currently being rented out to ownership tenure. As the

condominium market improves and prices increases, many investors who are currently renting out units at rents substantially below their monthly carrying costs are expected to put their units back on the market.

The actual assumed levels for net additions to the existing stock are shown on Exhibit 3-1, columns 3 through 6. Again, the actual levels assumed and the annual pattern are **arbitrary assumptions**, based on the general assumptions outlined above and are intended mainly to illustrate the methodological steps.

3.2.2.1.5.3 Estimating completions

Having estimated household growth, net additions to the existing housing stock and the change in vacant units, the number of newly built units required (i.e. completions) could be calculated residually using Equation (6); this is shown in Exhibit 3-1 (Column 2 minus Column 6 plus Column 7).

For example, for ownership, single-detached completions, the calculation to arrive at completions for mid 1993 to mid 1994 is:

$$10{,}000 - (-2{,}500) + 0 = 12{,}500$$

As discussed earlier, the completions for historical periods (i.e. in Exhibit 3-1, the data for the mid 1991 to mid 1992 period) are actual CMHC recorded completions.

For 1992-1993, estimates of single-detached and "other" completions were made based on starts in calendar year 1992; for apartments, a longer time lag was assumed so that completions in mid 1992 to mid 1993 were estimated by starts in 1991.

The resulting annual completions forecasts are presented on Exhibit 3-1, Column 8.

3.2.2.1.6 Step 6: Translate required completions into starts

Although it is completions that correspond more directly to household growth, local analysts will be required to project housing starts. Therefore, the completions data need to be translated into starts data. This can be done by making broad assumptions about average time from start to completion.

For single-detached and "all other" units, **it was arbitrarily assumed** that starts in a calendar year would be equivalent to completions in the Census year starting mid-way in that calendar year. For example, the forecast of completions for Census year 1993-1994 would be approximated by starts in calendar year 1993. This implies an average five months construction period.[40]

---

[40] Further work on completions lags would be beneficial to analysis. Based on the monthly starts and completions survey, local branches of CMHC may be able to generate average construction lags which are specific to their markets.

For apartment units, it was recognized that the period of construction would be longer, therefore starts in the calendar year were **arbitrarily assumed** to be approximated by completions in the following Census period (i.e. apartment starts in calendar year 1993 were approximated by projected apartment completions in Census year 1994-1995).[41]

The resulting short-term housing starts forecasts - which have been generated using the average annual household growth projections made from within the PHD model as a starting point - are presented on Exhibit 3-1.

3.3 RETENTION OF THE ANNUAL CAPABILITY IN THE PHD MODEL

The foregoing analysis suggested that the structure of the PHD model did not allow it to adequately generate annual projections of household growth, and outlined an alternate approach to generating annual projections of household growth using average annual projections of household growth generated within the PHD model as a starting point.

The question one might ask therefore is: should the annual capability be retained in the PHD model? The analysis undertaken in this report suggests that the annual capability should indeed be retained, but that its focus should be shifted.

For reasons outlined in section 3.1, it was recommended that annual household growth projections not be generated in the PHD model on a regular basis as an input into short-term forecasting exercises. However, **the annual capability is essential** if one wishes to update the base year household estimates in the PHD model (as outlined in Chapter 2) to reflect a non-Census year. If the annual capability were not there, then these base year updates of households could only be undertaken for Census years. While one would not necessarily want to update the base year in the PHD model **every** year, periodic updates, particularly toward the middle and latter years of the intercensal period, are critical to identifying shifts in preferences, etc. since the last recorded Census data.

However, if the annual capability is retained primarily for this updating purpose, users of the model should be cautioned that the annual capability is not intended to be used **by itself** to generate short-term forecasts of housing demand. In particular, users should be cautioned that using a combination of short and longer-term assumptions could distort short-term projections.

For example, some analysts might be "tempted" to incorporate annual short-term fluctuations in net migration (due to factors such as higher immigration) in the PHD model but still continue to use longer term trends in headship rates. Over the longer

---

[41] This method of course does not work for the last year of the starts forecast period (1995), so independent forecasts were made by assuming that the upward trend continued for another year.

term, this is not a problem, since population growth is a good indicator of household growth.

In the short term, however, there is often a lag between changes in the level of population growth and household growth. Persons who have recently moved to an area are more likely to double up in the short-term, until they have established themselves; their relatively lower headship rates in the short-term, therefore, would tend to dampen overall headship rates. Therefore, if an analyst were to apply longer term headship rate trends to the "short-term" change in population growth, short-term household growth would tend to be overstated.

Therefore, although it is desirable that the annual capability be retained in the PHD model, it is recommended that some direction as to how and when this capability can best be used also be provided.

3.4 CONCLUSIONS AND RECOMMENDED FURTHER WORK

This section outlines the conclusions and recommendations resulting from the exercise and areas where further work is indicated.

3.4.1 Conclusions and Recommendations

The following are the key conclusions and recommendations arising from the examination of the use of the PHD model to prepare short-term versus long-term housing demand projections:

- The PHD model is currently being used to generate both longer term (i.e. beyond five years) and short term (annual for up to the next five years) projections of housing demand.

- The demographically-driven PHD model framework lends itself very well to longer-term analyses, since it shows the implications of the changing age structure of the population. However, it is less suited to short term analyses since it cannot adequately take account of short-term factors which impact the cyclical pattern of housing demand, such as the economy and current housing market conditions.

- It is recommended, therefore, that the PHD model be used primarily for generating projections of average annual household growth for five year periods (over which time, most cyclical variation is likely to be "smoothed" out).

- These average annual household growth projections generated within the PHD model for the current five year period can be used as a starting point for the short-term projections. Assumptions about the cyclical pattern of economic growth, etc. can then be used to derive an annual pattern of household growth over the period.

- Deriving this annual pattern is more efficiently done outside the PHD model than from within it. Rather than having to adjust age-specific propensities in each year of the period to reflect these cyclical factors, only the final output - the projections of household growth by tenure and dwelling type - need to be adjusted.

- The household growth assumptions by themselves, however, are inadequate in ultimately preparing housing starts projections. This is because consideration must also be given to net additions to the existing stock and changes in vacant units (and in some areas, the number of mobile homes sold) when determining the number of new units which will need to be built. Allowance for these factors can be readily made within a spreadsheet model as a supplement to the PHD model.

- While it is has been proposed in this report that the structure of the PHD model renders it more useful for generating average annual, rather than annual, household growth projections, this does not mean that the annual capability should be removed from the model. The annual capability is essential if one wishes to update the base year estimates (as outlined in Chapter 2) to reflect a non-Census year. However, if the annual capability is retained primarily for this updating purpose, users of the model should be cautioned that the annual capability not be used **by itself** to generate short-term forecasts of housing demand.

3.4.2 Further Work

The methodology to prepare short-term housing demand forecasts within the PHD model framework would benefit from the following further work:

- As with the methodology to update the base year data in the PHD model, the prime limitation to the outlined methodology in preparing short-term housing projections lies in the generation of assumptions about net replacement. The composition, level and direction (i.e. positive or negative net additions to the existing stock) could vary greatly both between areas and within any area by time period. Further work in this area would enhance the overall reliability of the resulting starts forecasts.

- Work on linking the annual economic forecasts to the disaggregation of average annual household growth by year would also be beneficial in order to have a better understanding of both the magnitude of the impact and time lags between the factors. This type of work could range from simply plotting trends in housing starts against trends in macroeconomic factors to undertaking more involved statistical analyses including regression work.

- The methodology would also benefit from further work on estimated average start to completion lags. Based on the monthly starts and completions survey undertaken by CMHC, average lags which are specific to each major market could likely to generated.