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New Zealand Housing Stock Dynamics

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ABSTRACT

This paper summarises the findings of the writer's PhD thesis on the mortality of New Zealand housing stock and the relationships between average economic life, economic life span, mean age, newbuild construction, and replacement construction. The mortality of New Zealand housing stock has been a function of both age and the expansion rate of the housing stock. Total dwelling losses of all ages have increased and decreased over successive time intervals with each increase and decrease in the expansion rate. The findings on housing stock dynamics illustrate the principles which underlie the trade-offs between maintenance and rehabilitation versus demolition and replacement. The average economic life of dwellings can be extended by maintenance and rehabilitation thus reducing the replacement rate and the mean age of the housing stock and subsequent maintenance and rehabilitation can be reduced by increasing the replacement rate. Further research is required to establish the parameters of optimisation.

GLOSSARY OF TERMS

Mortality: A statistical concept pertaining to probability of loss, survivorship, and life expectation.
Dwelling losses: All possible departures from a housing stock — dwelling related demolition as the result of obsolescence; land use related demolition necessary to allow sub-division to proceed; demolition to allow public works to proceed; change in use from residential to commercial; consolidation of multi-units into single dwellings; and natural disaster such as fire and earthquake.
Dwelling cohort: A group of dwellings which enter a housing stock over the same time interval.
Average economic life: The average number of remaining service years provided by a dwelling cohort.
Economic life span: The age of the longest surviving dwelling in the housing stock still providing housing services.
Stock profile: The distribution of dwelling cohorts by age of construction.
Gross gains: Total newbuild construction, including replacement construction, over a time interval.
Annual gross gains rate: Annual total construction as a percentage of the housing stock.
Annual replacement rate: Annual replacement construction as a percentage of the housing stock.

INTRODUCTION

Empirical research to establish the trade-offs between maintenance and rehabilitation versus demolition and replacement of New Zealand housing stock should be high on the agenda of a housing research programme for the following reasons.

Over the last century New Zealand housing stock has expanded rapidly in response to effective demands to form additional households. An expanding housing stock has enabled the formation of smaller households and the accommodation of a growing population. In recent years the growth rate of New Zealand's natural population has declined and the natural population is aging as the result of a decline in the natural fertility rate. Should net immigration continue at current levels and the effective demand to form smaller households decline, then the mean age of the population and the housing stock would both increase. The result would be an increase in the proportionate costs of maintaining an older housing stock at current standards and an increase in the proportion of replacement construction to total newbuild construction.

In 1990 owner-occupied dwellings formed 23% of New Zealand's total capital stock of buildings, infrastructure, plant, and equipment.[1] Maintenance, additions and alterations, and replacement of New Zealand housing stock cost $1,000 million,[2] $478 million,[3] and $330 million[4] respectively in 1989. A 1% increase or decrease in the total annual costs of maintenance, rehabilitation, and replacement therefore represents about $20 million per year in 1994/1995 prices.

Replacement construction in 1989 formed about 20% of total newbuild construction. It will be shown in this paper that should New Zealand housing stock expand at a constant rate of 1.0% over a prolonged period, an expansion rate which represents the construction of about 21,000 dwellings in 1994, then replacement construction would approach about 40% of total new build construction given that past regimes of mortality continue in the future. When a housing stock expands rapidly, maintenance and rehabilitation versus demolition and replacement is not an issue. However, when the expansion rate declines and the housing stock ages, this issue cannot be ignored.

The total annual costs of maintenance, rehabilitation, and replacement could easily exceed the optimal minimum by as much as 10% or even more when there are changes in the dynamics and age composition of the housing stock. Alternatively, the quality standards of the housing stock could decline as the housing stock ages. There is a need to establish parameters of optimisation and guidelines as to appropriate standards of housing and levels of rehabilitation and replacement. The parameters of optimisation are currently unknown. Estimates of these parameters require a quantification of the mortality and dynamics of the housing stock. This paper summarises the following findings of the writer's PhD thesis on the mortality and dynamics of New Zealand housing stock:[5]

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[1] Philpott, B. *Provisional Estimates of New Zealand Real Capital Stock by SNA Production Groups 1950-1990,* PEP Internal Paper 233a, Victoria University of Wellington, 1992, p. 23.

[2] In an unpublished study of 25 Housing Corporation dwellings, the writer has estimated that the annual costs of maintaining these dwellings over a 40 year period has averaged 1.0% of the replacement costs of the dwellings. The estimate of $1,000 million is based on the cost to replace 1.0% of the housing stock of 1.25 million dwellings at an average cost of $82,000 per dwelling.

[3] New Zealand Department of Statistics, *New Zealand Official 1990 Yearbook*, Department of Statistics, Wellington, p. 523.

[4] The estimate of $330 million is based on the writer's estimate of 4,000 dwelling replacements in 1989 at an average cost of $82,000 per dwelling.

[5] Johnstone, I.M. *The Mortality of New Zealand Housing Stock*, PhD Thesis, University of Auckland, UMI Dissertation Services No. 9322214, 1993.

- The distribution of dwelling losses from New Zealand dwelling cohorts over an economic life span.
- The average economic life of New Zealand housing stock.
- The relationships between average economic life, economic life span, mean age, and annual total and replacement construction rates for New Zealand housing stock.

PREVIOUS RESEARCH INTO HOUSING STOCK DYNAMICS

Needleman's simple mathematical model

In the mid 1960s Needleman developed a simple mathematical model to estimate the 'normal' life of a dwelling under dynamic conditions, the normal life of a dwelling being taken to be the number of years that elapse before half the dwellings built in a particular year has been demolished.[6] Needleman's model was based on the explicit assumption that it is the oldest dwellings in the stock that are demolished each year and the implicit assumption that all dwellings are exposed to the same regime of mortality.

The writer has established that the normal life, average economic life, and economic life span of dwellings in Needleman's model are, for all practical purposes, one and the same.[7] Needleman's model can therefore be tested using data on the economic life span of British dwellings. The model estimates the economic life span [normal life] of British housing stock to be 142 years, given an average expansion rate of 1.3% per annum over the previous 160 years and an average replacement rate of 0.25% per annum between 1881 and 1961.[8]

Needleman's model grossly underestimates the economic life span of British dwellings. A few small dwellings and cottages of traditional construction have remained in use after 400 years and many British dwellings are older than 200 years.[9] The significant lack of precision can be only partially attributed to the roughness of the estimates of the average expansion and replacement rates.

Wyatt's conceptual model

In the late 1970s Wyatt developed a conceptual model of Britain's housing stock.[10] Wyatt's model is based on a multi-deck stack where each stack represents an equal period of time. Dwellings pass down the stack at a rate determined by decay curves. These decay curves are based on a conceptualisation of decay in building components. Decisions are made at each deck as to whether maintenance should take place or not. Dwellings that undergo maintenance return up the stack, the re-entry point being dependent on which upgrading strategy has been adopted. Each dwelling ultimately reaches the bottom of the stack where demolition takes place. Wyatt took the decay characteristics of housing stock to be physically determined in that each construction form has either a long, medium, or short life span. Like Needleman, Wyatt assumed that for each construction form it is the oldest dwellings that are demolished.

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[6] Needleman, L. *The Economics of Housing*. London, Staples Press, 1965, pp. 40-4.
[7] Johnstone, I.M. *Modelling the Annual Replacement rate of Housing Stock*. Fourth Australasian Real Estate Educator' Conference, Auckland University, 26th-28th January, 1994, pp. 3-4.
[8] Needleman, *op cit*, p. 40.
[9] NBA Construction Consultants Limited. *Maintenance Cycles and Life Expectancies of Building Components and Materials: A Guide to Data and Sources*, London, 1985.
[10] Wyatt, D.P. 'Housing Stock Management, Its Performance and Life Cycle', *Housing Science*, v.19, No. 4, 1984, pp. 337-47.

Wyatt's dynamic stack model is more realistic than Needleman's simple mathematical model but simulated dwelling losses have not been validated against field survey data. The precision with which simulated dwelling losses follow the true pattern of dwelling losses from British housing stock is therefore unknown.

The need for empirical studies of housing stock dynamics

The need for empirical studies of housing stock dynamics is demonstrated as follows. When a housing stock is stationary and stable, the replacement rate for any given average economic life is independent of the distribution of dwelling losses over the economic life span of each successive dwelling cohort. But when a housing stock undergoes expansion and the average life expectancy is constant, different distributions of dwelling losses result in different replacement rates. This is because early dwelling losses from more recent, and hence larger, dwelling cohorts tend to predominate. Total dwelling losses of all ages over each time interval are greater when a large proportion of dwelling losses are contributed by more recent dwelling cohorts.

For example, consider two housing stocks of the same size which have different patterns of dwelling losses but the same average economic life of 75 years. Let the distribution of dwelling losses from each dwelling cohort of the first housing stock be constant over the economic life span of each dwelling cohort while the distribution of dwelling losses from each dwelling cohort of the second housing stock follow that of a normal distribution curve. If both housing stocks expand at a constant rate of 2.0% per year over a period sufficiently long enough for each respective housing stock profile to be proportionately stable, then total dwelling losses over each time interval from the first housing stock, compared to the second, are in the ratio of 1.5:1.[11] This ratio increases to 2.8:1 when the expansion rate of each housing stock increases to 4.0% per year. The above example demonstrates that unsubstantiated assumptions as to the distributions of dwelling losses over the economic life span of dwelling cohorts can lead to erroneous estimates of replacement rates.

Gleeson's current life table model

In the early 1980s Gleeson carried out an empirical study of the mortality of a sample of Indianapolis housing stock using a current life table approach.[12] Variations and extensions of the theories and life table models of classical population dynamics have been developed and applied by actuaries, demographers, statisticians, and ecologists over the past 200 years.[13] There are two basic types of life tables, namely the current, or period life table as used by Gleeson, and the generation, or cohort life table.[14]

A current life table is based on age-specific death statistics over a short period so therefore does not represent the mortality experienced by an actual cohort. Instead, it assumes a hypothetical cohort that is subject to age-specific death rates observed over a particular period. The current life table model is also based on the implicit assumption that each successive cohort is subject to the same regime of mortality, an assumption which Gleeson concedes is 'heroic' with respect to housing stock.[15]

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[11] Johnstone, *op cit*, 1993, pp. 214-5.

[12] Gleeson, M.E. 'Estimating Housing Mortality from Loss Records', *Environment and Planning*, v.17, 1985, pp. 647-59

[13] Key modern researchers include N. Keyfitz (demography), H.S. Shryock and J.S. Siegel (demography), A.J. Lokta (ecology), and E.F. Spurgeon (actuarial science).

[14] Keyfitz, N. and J.A. Beekman. *Demography Through Problems*. New York, Springer-Verlag, 1984.

[15] Gleeson, *op cit*, pp. 648-8.

A generation life table is based on the mortality experienced by a particular cohort, and is therefore useful for projections of mortality and studies of mortality trends. It is of note that time series data on age-specific losses and survivorship are unlikely to be available for housing stock.

Gleeson used data on the age and numbers of dwellings demolished over a two year period to estimate the average economic life of a sample of Indianapolis housing stock. Because there was a scarcity of data for very old dwellings, Gleeson extrapolated 57% of the sum total of dwelling losses in his life table and estimated the average life expectancy upon entry, or average economic life, of the sample of Indianapolis housing stock to be 99.6 years. The writer has estimated the true average economic life lies somewhere between 96 and 118 years due to the uncertainty as to the true pattern of dwelling losses which filters throughout the life table.[16] The remaining average economic life at each successive age interval becomes progressively more indeterminate.

Johnstone's indirect mortality model

A current life table approach cannot be used to estimate the mortality of New Zealand housing stock due to the lack of data on the age of dwelling demolitions. The writer has developed an indirect modelling approach which is based on the theoretical framework of classical population dynamics. The indirect mortality model comprises a linking series of generation life table models which simulate dwelling losses from each dwelling cohort over successive age intervals when driven by test regimes of mortality. Dwellings losses over the same time interval combine to form a time series of total dwelling losses of all ages. This time series of total dwelling losses and a corresponding stock profile can be tested against field survey data thus indirectly testing the realism and precision of the mortality regime driving the model.

Although the indirect mortality model approach does not allow the mortality of New Zealand housing stock to be estimated to the same precision that a direct current life table approach could, useful results have been obtained by using the indirect process of search and elimination. Details of the construction of the indirect mortality model, data difficulties, formulation of hypotheses, and validation are set out in the writer's PhD thesis.[17] A summary only of the findings on the mortality and dynamics of New Zealand housing stock is presented in this paper.

FINDINGS ON THE MORTALITY OF NEW ZEALAND HOUSING STOCK

Functions of mortality

- *The mortality of New Zealand housing stock has been a function of both age and the expansion rate of the housing stock.*

- *The probability of loss over each age interval is a function of age which is amplified by a function of the expansion rate.*

- *Successive dwelling cohorts have been exposed to different regimes of mortality as a result of fluctuations in the expansion rate.*

- *The probabilities of loss for each cohort over the same time interval have increased and decreased simultaneously.*

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[16] Johnstone, *op cit*, 1993, pp. 63-5.
[17] Johnstone, *op cit*, 1993.

- *Total dwelling losses of all ages have increased and decreased over successive time intervals with each increase and decrease in the expansion rate of the housing stock.*

Average economic life

The distribution of dwelling losses over the economic life span of a typical New Zealand dwelling cohort is shown in Figure 1.

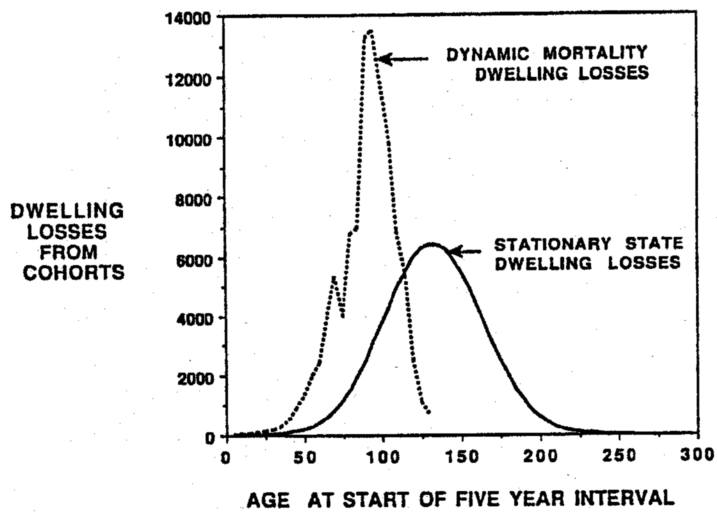

Figure 1 Distribution of dwelling losses from a typical New Zealand dwelling cohort

- *The distribution of dwelling losses from a dwelling cohort over its economic life span follows that of a normal curve skewed to the left.*

- *The average economic life of a typical dwelling cohort is about 90 years.*

The average economic life of a stationary and stable housing stock which is subject to the same function of mortality is about 130 years.

- *The average economic life of a housing stock is limited by the average physical life of the housing stock.*

The physical life of an individual dwelling is ultimately determined by the physical life of its structural system. Although isolated rotting piles, bearers, floor joists, studs, rafters, and the like can be replaced, when the structural system suffers general failure the dwelling is no longer able to provide housing services. A significant proportion of New Zealand's housing stock has been constructed out of light weight timber framing.

- *A minimum upper limit to the physical life of light weight timber framing is indicated by the age of New Zealand's oldest dwelling, Kemp House at Kerikeri, which was constructed in 1821 out of light weight timber framing in the days before use of timber preservatives.*[18]

[18] Salmond, J. *Old New Zealand Houses 1800-1940.* Auckland, Heinemann Reid, 1986, p. 80.

Because Kemp House no longer provides housing services, but is instead open to the public and is protected against demolition under the New Zealand Historic Places Trust Act 1980, this house does not represent the true economic life span of New Zealand housing stock.

Economic life span

- *The economic life span of New Zealand housing stock is greater than 130 years and extrapolation of dwelling losses indicates the economic life span may extend to 150 years.*

Mr John Stacpoole, a historian of New Zealand buildings, estimates there are at least 20, and perhaps as many as 150, pre 1860 dwellings still standing and providing housing services as at December 1992.[19]

The economic life span of a stationary and stable housing stock subject to the same function of mortality is estimated to be 260 years.

Mean age

- *The current mean age of New Zealand housing stock is approximately 35 years.*

This estimate is based on Valuation New Zealand's computerised database of land use records, as at December 1991.[20]

FINDINGS ON NEW ZEALAND HOUSING STOCK DYNAMICS

Scenarios of housing stock

The indirect mortality model has been used to simulate scenarios of housing stocks undergoing different constant rates of expansion, including zero expansion. Successive dwelling cohorts are exposed to the same mortality regime in each scenario. The mortality regimes of the expanding housing stock set of scenarios are based on the same mortality function experienced by New Zealand housing stock between 1860 to 1980. The mortality regimes of the stationary housing stock set of scenarios are based on the same family of mortality functions. Results of each set of scenarios are tabulated in Tables A and B located in the Appendix at the end of this paper

The housing stock profiles in each scenario remain proportionately stable whereas the stock profile of New Zealand's housing stock is proportionately unstable due to past fluctuations in the expansion rate. Under conditions of a constant expansion rate it takes at least one economic life span for a housing stock profile to stabilise. The extent of differences between the dynamics of a stable and unstable housing stock profile is illustrated by the following example. Over the 1985-1989 five year interval the average annual expansion rate of New Zealand housing stock was 1.70% and the annual replacement rate was 0.37%. The annual replacement rate of a constantly expanding and proportionately stable housing stock with the same expansion rate is about 0.47% , a difference of 21%.

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[19] Private communication, December 1992.
[20] Private correspondence from Valuation New Zealand, December 1991.

Replacement to gross gains ratio versus annual expansion rate

The replacement to gross gains ratio versus the annual expansion rate is graphed in Figure 2.

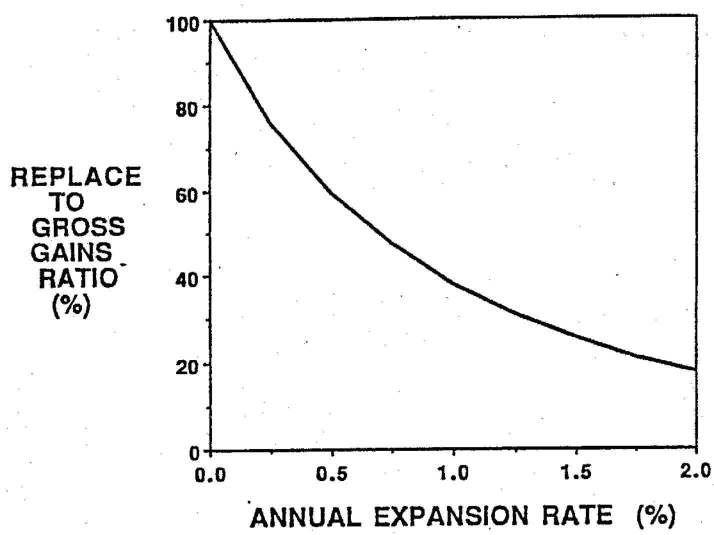

Figure 2 Replacement to gross gains ratio versus annual expansion rate

- *The replacement to gross gains ratio of a housing stock increases as the expansion rate of the housing stock decreases.*

Replacement construction forms 17% and 38% of total newbuild construction at an expansion rate of 2.0%. and 1.0% respectively.

- *All newbuild construction is replacement construction when the expansion rate of a housing stock is zero.*

At an expansion rate of zero, the annual replacement rate of a housing stock subject to the same function of mortality as experienced by New Zealand housing stock is 0.77%. This replacement rate represents 10,000 replacement dwellings per year for a stationary housing stock the same size as New Zealand's current housing stock of 1.3 million dwellings. An increase or decrease in the annual replacement rate of 0.77%, while retaining an expansion rate of zero, would result in a corresponding decrease or increase in the average economic life of the stationary housing stock.

Average economic life versus mean age

The average economic life versus mean age for each set of scenarios are graphed in Figure 3.

- *The average economic life of a stationary and stable housing stock is directly proportional to the mean age of the housing stock.*

- *Each unit decrease in the average economic life of an expanding housing stock corresponds to a progressively larger unit decrease in the mean age of the housing stock.*

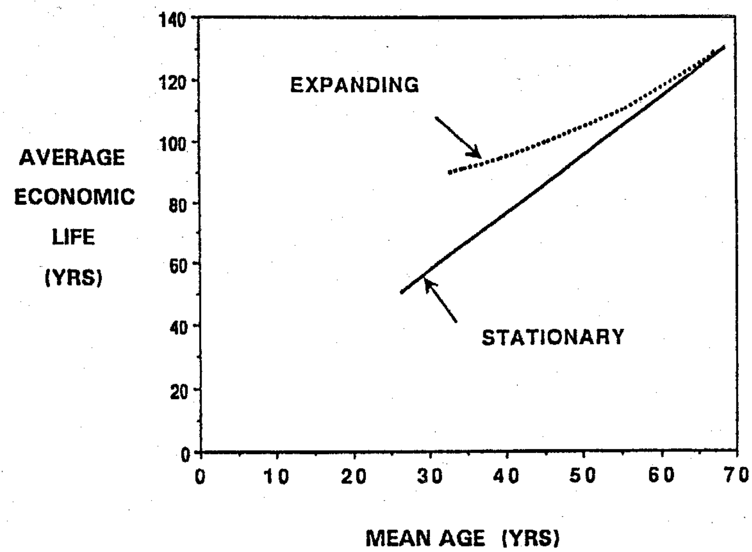

Figure 3 Average economic life versus mean age

Annual gross gains rate versus average economic life

The annual gross gains rate versus average economic life for each set of scenarios are graphed in Figure 4.

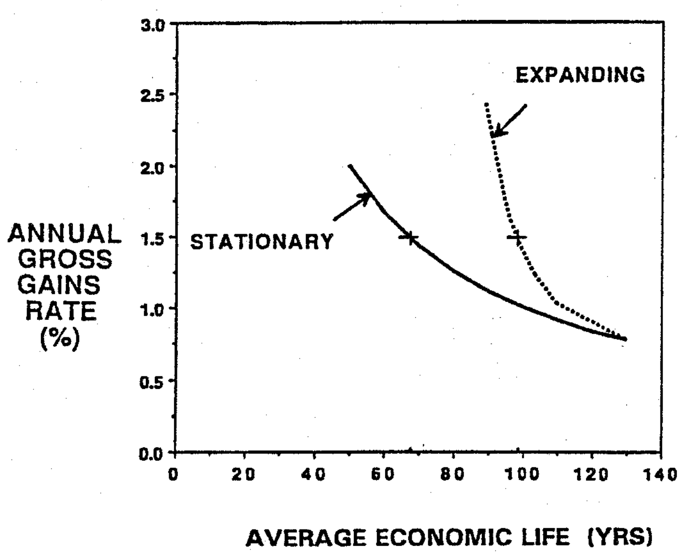

Figure 4 Annual gross gains rate versus average economic life

- *The average economic life of a stationary and stable housing stock is inversely proportional to the annual gross gains and is independent of the distribution of dwelling losses over the economic life span of each dwelling cohort.*

The average economic life of a stationary housing stock can be maintained at 50 years by annual gross gains of 2.0% of the housing stock or at 100 years by annual gross gains of 1.0% of the housing stock.

- *A stationary and stable housing stock of the same size as New Zealand's current housing stock of 1.3 million dwellings can be sustained at an average economic life of 100 years by 13,000 replacement dwellings per year.*

- *The average economic life of an expanding housing stock is dependent on the mortality regime of the housing stock.*

An expanding housing stock subject to New Zealand's housing stock mortality regime requires annual gross gains entries of 1.4% to sustain an average economic life of 100 years. In the year when the size of that housing stock numbers 1.3 million dwellings, a total of 18,200 dwellings are required to sustain an average economic life of 100 years. The corresponding annual expansion rate of the housing stock is 0.75%. This expansion rate represents the formation of 9,750 additional households in that year.

- *Fluctuations in the annual expansion rate have less impact on the average economic life of dwelling cohorts as the expansion rate increases.*

At a zero expansion rate the average economic life increases to 130 years whereas at an annual expansion rate of 2.0% the average economic life of the housing stock declines to 90 years.

Annual gross gains rate versus mean age

The annual gross gains rate versus mean age for each set of scenarios are graphed in Figure 5.

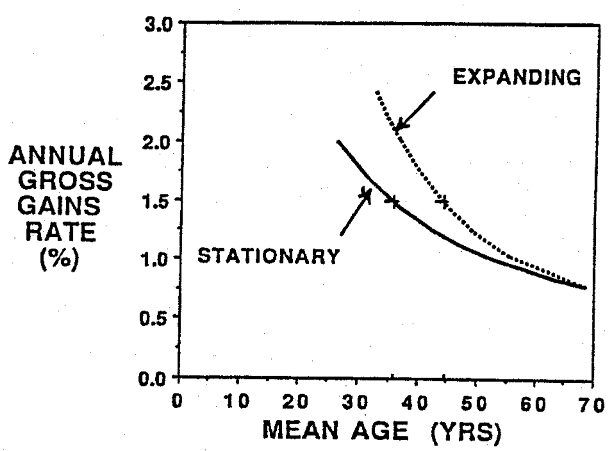

Figure 5 Annual gross gains rate versus mean age

- *Fluctuations in the expansion rate have a greater impact on the mean age of a housing stock as the expansion rate increases.*

When the annual gross gains rate of a stationary and a expanding housing stock is 1.0% (an annual expansion rate of 0.25%), the mean age of each housing stock is 53 years and 56 years respectively. These mean ages are significantly greater than the estimated mean age of 35 years for New Zealand housing stock. This is because the average annual expansion rate of New Zealand housing stock over the last 100 years has exceeded 2.0% and higher expansion rates have greater impact on the mean life of the housing stock.

- *The annual gross gains rate required to maintain the mean age of a stationary housing stock is less than that required to maintain the same mean age of an expanding housing stock.*

- *For a housing stock to retain its mean age as the expansion rate declines, the annual replacement rate of the housing stock would need to be progressively increased to a higher rate than would occur otherwise and the average economic life of the housing stock would correspondingly decline.*

The mean age of a stationary housing stock can be sustained at 35 years by an annual gross gains rate (annual replacement rate) of 1.5%. For a stationary housing stock of 1.3 million dwellings this represents the construction of 19,500 replacement dwellings per year.

- *When the size of a stationary or expanding housing stock exceeds 1.3 million dwellings, the mean age of the housing stock increases if the level of total newbuild construction falls below 19,500 dwellings per year.*

Annual gross gains rate versus economic life span

The annual gross gains rate versus economic life span for each set of scenarios are graphed in Figure 6.

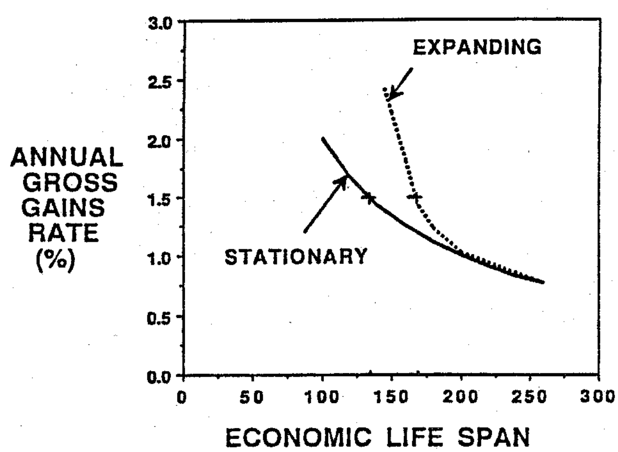

Figure 6 Annual gross gains rate versus economic life span

- *For each unit increase in the gross gains rate over and above 1.25%, there is a progressively greater decrease in the economic life span of a stationary housing stock compared to an expanding housing stock..*

Comparison of a stationary and an expanding housing stock with the same annual gross gains rate

Table 1 compares a stationary and stable housing stock against a constantly expanding and proportionately stable housing stock. Both housing stocks have the same annul gross gains rate of 2.0%. This annual gross gains rate represents the construction of 26,000 dwellings in the year that the housing stocks are the same size as that of New Zealand's current housing stock of 1.3 million dwellings.

Table 1 Comparison of a stationary and an expanding housing stock with a gross gains rate of 2.0%.

	Expansion rate %	Average Economic Life years	Mean Age year	Economic Life Span years
Stationary	0	50	26	100
Expanding	1.5	92	37	155

- *When the annual gross gains rates of a stationary and an expanding housing stock are the same, the stationary housing stock is younger and the proportionate costs of maintaining the stationary housing stock are less.*

CONCLUSIONS AND RECOMMENDATIONS

Findings on the mortality and dynamics of New Zealand housing stock have been quantified and summarised in this paper. The findings illustrate the principles of housing stock dynamics which underlie the trade-offs between maintenance and rehabilitation versus demolition and replacement. The remaining average economic life of dwellings can be extended by maintenance and rehabilitation thus reducing the replacement rate and the mean age of the housing stock and subsequent maintenance and rehabilitation can be reduced by increasing the replacement rate.

Estimates of the optimal parameters of maintenance and rehabilitation versus demolition and replacement entail forecasting the dynamics of the housing stock. An implicit assumption of any forecast is that past patterns will continue in the future. The realism of a forecast of the dwelling losses from New Zealand housing stock will be partially dependent on the realism of estimates of future expansion rates of the housing stock because the mortality of the housing stock has been a function not only of age but also the expansion rate.

The precision of a short-term forecast is dependent on the precision and currency of the housing stock profile which forms the initial state variables. That precision is currently limited by the extent of uncertainty in the Valuation New Zealand (VNZ) database on the distribution of New Zealand housing stock by age of construction. The age each urban dwelling has been recorded in an age field in the VNZ database by category of the decade within which the dwelling was constructed. The original age of each dwelling, however, has not been preserved. Each time there has been a valuation update, the age of a dwelling which has undergone a major renovation or addition has been recorded as a "mixed age" category for reasons '...the original erection date ceases to describe the structural quality'.[21] In August 1978 the percentage of pre 1960 dwellings of uncertain age was 13%. By December 1991 this percentage had almost doubled to 25%.[22] In another decade the VNZ database

[21] Nana, N. *Urban Housing Stock in New Zealand, Volume 10: New Zealand Totals*. National Housing Commission Research Paper 81/6, Wellington, 1981, p. 13.

[22] Johnstone, *op cit*, 1993, pp. 119-23.

will be of limited value for future research on housing stock dynamics. To remedy this situation, the writer makes the following recommendations:

- That all completion certificates and demolition permits for dwellings be subject to registration only with an existing central government agency *prior* to issue by local authorities and that each registration be recorded in the Valuation New Zealand database of land use records.

- That the Valuation New Zealand database of land use records be modified to retain a record of the date of completion of dwellings and to include the date of demolition of dwellings for each site.

APPENDIX

Table A Dynamics of an expanding housing stock

CONSTANTLY EXPANDING AND PROPORTIONATELY STABLE HOUSING STOCK									
	ANNUAL EXPANSION RATE								
	0	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
Annual replacement rate (%)	0.77	0.78	0.73	0.67	0.61	0.56	0.51	0.46	0.42
Annual gross gains rate (%)	0.77	1.03	1.23	1.42	1.61	1.81	2.01	2.21	2.42
Replacement: Gross gains ratio	100.0	75.7	59.3	47.2	37.9	30.9	25.4	20.8	17.4
Average economic life (yrs)	130.0	109.7	103.3	99.3	96.4	94.1	92.3	90.7	89.3
Mean age (yrs)	68.7	55.5	49.6	45.4	42.1	39.2	36.8	34.6	32.6
Economic life span (yrs)	260	200	180	170	165	160	155	150	145

Table B Dynamics of a stationary housing stock

STATIONARY AND STABLE HOUSING STOCK									
	AVERAGE ECONOMIC LIFE								
	130	120	110	100	90	80	70	60	50
Annual replacement rate (%)	0.77	0.83	0.91	1.00	1.11	1.25	1.43	1.67	2.00
Mean age (yrs)	68.7	63.4	58.1	52.8	47.5	42.2	36.9	31.6	26.3
Economic life span (yrs)	260	240	220	200	180	160	140	120	100