TECHNICAL RESERVES WORKING PARTY

REPORT 1 - IBNR RESERVES

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Section 1

1.   <u>Introduction</u>

1.1   This paper is the first of a series of papers to be produced by the technical reserves working party. The main object of these papers is to describe methods which can be used to estimate technical reserves in general insurance having made due allowance for the various circumstances experienced in practice. Explanatory comments will be provided to assist the user in selecting and applying the different methods described.

1.2   At the request of members of the general insurance study group the first paper has been restricted to the subject of estimating reserves for claims which have been incurred but have not been reported (IBNR).

It can be argued that a logical sequence of papers produced by the reserves working party would have covered, in sequence:

1.2.1   The nature of technical reserves; their use in solvency, premium and profit calculations; views on whether or not reserves can be aggregated to prove sufficiency; discounting techniques (if any) and asset matching.

1.2.2   Reserves for known outstanding claims.

1.2.3   IBNR

1.2.4   Other reserves and provisions.

It is pointless to strive for greater precision in the estimation of IBNR reserves than can be achieved for the reserves for reported claims. In practice both these reserves should be considered as one when deciding on the overall adequacy of the reserves for an individual class of business.

1.3   A U.K. company must:

1.3.1   Put up an outstanding claim reserve in its Company Act Consolidated accounts which is sufficient to cover all claims, including IBNR claims, for the worldwide business of the company and its subsidiaries. A separate IBNR reserve is not shown.

1.3.2   Show in the notes to the balance sheet produced for the DOT a statement of the amount of that part of the outstanding claim reserve relating to IBNR, again on a worldwide net basis. The claim frequency analysis covers the number of IBNR claims for the direct business of major territories by risk class. The current claim settlement analysis includes but does not separately identify IBNR claim amounts. New regulations currently being drafted will produce a more detailed analysis of IBNR claims for all business.

1.3.3   Agree with the Inland Revenue as to whether an IBNR claim provision can be charged in the tax computation. Some U.K. companies have experienced difficulties, but the Inland Revenue will now allow the provision as long as there is statistical evidence to support it. Companies will generally agree their statistical bases individually with their District Inspector.

1.4   It is not the intention of this paper to suggest ideal solutions to the problem. The purpose is to highlight the considerations which must be taken into account by the statistical investigator in general insurance and to indicate possible practical approaches. Some tables indicating the level of the figures involved are provided for different classes of business; they are intended only as a broad guide and should not be used without checking their validity against the data of the particular company under consideration.

1.5   It is necessary to have close contact with both underwriting and claims staff so that the projected estimates of IBNR reserves will reflect changes in standards of underwriting or administration.

1.6   The adequacy of the methods will depend on both the size of the portfolio and on the assumptions made as to the future especially with regard to the rate of inflation.

1.7   This paper has been divided into two distinct sections.

1.7.1   Section II Direct business

1.7.2   Section III Reinsurance business

Whilst the theorectical framework underlying these two sections are similar the practical considerations differ sufficiently to make it advisable to separate them even though there will be a certain amount of repeated information. The Reinsurance section is mainly concerned with excess-of-loss business but offers some thoughts on proportional Reinsurance.

1.8   The above two sections have each been broadly sub-divided into four parts:-

1.8.1   the definitions

1.8.2   a description of theoretical foundations underlying the practical methods

1.8.3   considerations in the selection of practical methods

1.8.4   a discussion of practical application

1. Definitions

1.1. The compilation of a company's trading results will normally relate
     to a specified period ending on a defined date; and will include a
     statement of assets and liabilities as at that date.
     We therefore refer to the 'accounting period' ending on the 'accounting
     date'; in this context it is customary to publish results for an
     accounting period of 12 months ending on 31st December.

1.2. For practical convenience each company will have a set of rules
     which, having regard to its particular system of debiting and recording,
     determine the movements which are to be included in each accounting
     period.   Such a set of rules will involve a date which we term the
     'closing-date' which effectively terminates the accounting period in
     question.   In some cases the closing-date will coincide with the
     accounting date; but more often than not the two dates will differ in
     order to allow 'pipe-line' movements to be processed.

1.3. With regard to claims the rules will customarily specify that all
     claims 'notified' before the closing-date will be included in the
     known liabilities.   In this context the meaning of 'notification'
     will vary according to company practice; for example, it may mean
     the reporting of the claim to a branch office; on the other hand it
     may be interpreted as the recording of the claim on the computer file.

1.4. Strictly speaking, IBNR should refer to claims which have been
     incurred but not reported before the accounting date (as defined in
     1.1. above).   However, in view of the convention of using a closing-
     date which may differ from the accounting date it is convenient to
     define IBNR claims for the present purpose as those which are incurred
     before the accounting date but not notified by the closing-date.

1.5. Under direct business the incurment of a claim is generally determined
     by its occurrence, an event which is usually clearly defined.   There
     are, however, some exceptions which are exemplified below.

     (a)   Industrial injuries or diseases may sometimes not become
            manifest as potential employers liabilities claims until a
            lapse of time after the incident, accident or situation which
            gave rise to the condition.   Company practice may vary in
            regarding the claim as having been 'incurred' at the time of
            the original incident or at the time when the resulting
            condition first becomes apparent; and this will affect its
            attitude towards the setting-up of IBNR reserves.   The
            practice in some companies is to ignore such random late-
            developing claims for IBNR purposes and to provide against them
            by means of general free (e.g. contingency) reserves.
            For the purpose of this paper we assume that the relevant
            company statistics will have been based upon the chosen
            definition of 'incurred' and the IBNR provision developed
            appropriately.

     (b)   A similar problem arises in connection with claims under
            mortgage guarantee and professional indemnity types of
            policies.   Company practice will determine the appropriate
            treatment for IBNR purposes.   It is usual to provide for
            claims notified after the accounting date within the UPR
            reserve; this would include claims which could more strictly
            be considered as IBNR.

1.6. Any special reserve which might be required at the closing-date against adverse movements in the estimated liabilities under claims already reported is not usually regarded as IBNR; and we therefore exclude it from the definition of IBNR.

1.7. Company practice varies as to the circumstances in which a claim may be regarded as 'settled' (implying that the Company has no further liability thereunder). Whatever the practice it is to be expected that some proportion of such 'settled' claims will subsequently be re-opened and further payments made. As a matter of prudence it is customary to reserve against such additional liabilities; either by means of a specific reserve or implicitly by means of margins in the estimated liabilities under outstanding claims generally. The practice of some companies is to treat any specific 're-opening' reserve as part of the IBNR provision. However, for the purpose of this paper we exclude the re-opening aspect from our definition of IBNR because the statistical bases are quite different.

1.8. It is assumed that the IBNR provision would be assessed initially on a gross basis and that any allowance for outward reinsurance if appropriate would be as a final adjustment determined by the type and nature of the reinsurance arrangements.

1.9. Published company results may present IBNR and other claims reserves as including both the basic claims liabilities and the claims-handling expenses.
However, this paper is confined to a consideration of claims liabilities only and excludes claims-handling expenses which it is assumed would be assessed as a separate provision. In this connection a distinction should be drawn between specific fees attributable to particular claims and general office administration costs; the former which would include such items as legal charges, medical fees and engineers' (consultative or employed) fees, would usually be regarded as part of the individual claims liabilities.

1.10. Employers liability policies are commonly subject to retrospective additional premium adjustments. Depending upon the accounting methods used by different companies it is sometimes the practice to modify the claims liabilities by means of an adjustment to the IBNR reserve. For the purpose of this paper such adjustments are excluded from the definition of IBNR.

2. Theoretical foundations

2.1. Although the main purpose of this paper is to provide guidance on practical methods of estimating IBNR provisions it seems appropriate to introduce such methods with a brief outline of the theoretical basis which underlies them.

2.2. Dealing first with numbers of claims and taking a unit interval of time as one month we may denote the number of claims which are incurred in month i and reported in month r by n_r^i

It follows that the total number of claims incurred in month i is

$$\sum_{r=i}^{i+t} n_r^i$$

where $t + 1$ is the total number of months over which the delay distribution is spread, i.e. all claims incurred in month i will have been reported by month $(i + t)$.

2.3. Generally the value of t will vary but if for the purpose of illustration we assume t to be constant the situation may be portrayed by the following scheme of arrays:-

Month of incurment	Month of Notification									Total number incurred
	1	2	3	4	----	t + 1	t + 2	t + 3	t + 4	
1	n_1^1	n_2^1	n_3^1	n_4^1		n_{t+1}^1				$\sum_{r=1}^{t+1} n_r^1$
2		n_2^2	n_3^2	n_4^2		n_{t+1}^2	n_{t+2}^2			$\sum_{r=2}^{t+2} n_r^2$
3			n_3^3	n_4^3		n_{t+1}^3	n_{t+2}^3	n_{t+3}^3		$\sum_{r=3}^{t+3} n_r^3$
4				n_4^4		n_{t+1}^4	n_{t+2}^4	n_{t+3}^4	n_{t+4}^4	$\sum_{r=4}^{t+4} n_r^4$
⋮										

2.4. Alternatively we may represent the above situation in terms of the proportions of the total number incurred which have been notified at the end of various delay periods. Thus we define:-

$$U_d^i = 100 \times \frac{\sum_{k=i}^{i+d} m_k^i}{\sum_{k=i}^{i+t} m_k^i}$$

where d is the delay, in months, varying between o and t.

This leads to the following scheme:-

Month of incurment	Month of delay						
	0	1	2	3	----	t - 1	t
1	U_0^1	U_1^1	U_2^1	U_3^1		U_{t-1}^1	100
2	U_0^2	U_1^2	U_2^2	U_3^2		U_{t-1}^2	100
3	U_0^3	U_1^3	U_2^3	U_3^3		U_{t-1}^3	100
4	U_0^4	U_1^4	U_2^4	U_3^4		U_{t-1}^4	100

2.5. The development of practical estimating methods rests on the hypothesis that the observed delay distributions conform to a stable pattern; and that the underlying 'population' distribution can be estimated from the observed values.

It is assumed that it is possible to construct a smooth experience table of factors $\bar{U}_d$ $(d = o$ to $t)$ from the observed data.

$\bar{U}_d$ represents the cumulative proportion of the total number incurred which have been notified to the end of delay month d.

2.6. Reverting to the type of tabulation of paragraph 2.3. above in which numbers of incurred claims are analysed into the months of notification the closing-date of an accounting period may be represented by a vertical line dividing the scheme of arrays into two portions. The area to the left of the line is the notified or 'known' segment; i.e. it represents the actual record of notified claims as known at the closing-date. To the right of the line is the 'unknown' triangle of IBNR claims.

The basic problem is to estimate the IBNR triangle.

2.7. Assume that the closing-date occurs at the end of month c.

For month of incurment i the available data are the number of claims notified n_r^i for values of r = i to c. The IBNR component is estimated as

$$\sum_{r=i}^{c} n_r^i \left(\frac{100}{\overline{U}_d} - 1 \right) \text{ where } d = c-i$$

Hence, the complete IBNR triangle is given by summing the above expression over all the relevant values of i ; thus –

$$\sum_{i=c-t+1}^{c} \sum_{r=i}^{c} n_r^i \left(\frac{100}{\overline{U}_d} - 1 \right) \text{ where } d = c-i$$

2.8. The above analysis of the underlying structure of numbers of IBNR claims forms the foundation of most of the practical methods of estimation currently in use.

The particular choice of method will depend inter alia upon the degree of detail in which the statistical information is available, and the size of the portfolio in question.

2.9. The analysis of numbers of claims could be paralleled by a similar portrayal of claim costs.
In practice it may be difficult to construct the necessary scheme of costs; and there are further problems connected with the estimation of the cost of known claims which are outstanding. For these reasons the methods used in practice usually involve a different approach.

Theoretically it is possible to envisage a matrix scheme similar to that in paragraph 2.3. above in which claim amounts S_r^i are substituted for numbers of claims. Given such a scheme, the development of an experience table of factors corresponding to $\overline{U}_d$ and the consequent formulas for projecting future reserves would be a straightforward matter.

However, there are practical difficulties in constructing the necessary matrix.

(a) General insurance claims may take a considerable time to settle (sometimes many years). Only when the claim is finally settled is its cost known for certain; until then it can only be estimated. Thus, in constructing the matrix of costs the choice varies from using: up-to-date data involving estimated costs which may contain a significant error element: to using mature settled data which may be several years out-of-date and therefore inappropriate for current conditions.

(b) The patterns exhibited by the factors U_d^i relating to numbers of claims are usually sufficiently stable to enable the smooth experience factors $\overline{U}_d$ to be determined with some confidence. However, the random incidence of large claims may produce very wide statistical fluctuations in amounts so that the patterns of costs in the matrix of claim amounts are less readily identifiable and the derivation of a reliable experience table of costs is conjectural.

(c)   The arrays of historical costs will reflect the
       varying incidence of past inflation or assumed future
       inflation implicit in estimates of outstanding claims;
       strictly speaking an attempt should therefore be made to
       'de-inflate' the amounts to a common price level before
       developing the experience table.   In using the experience
       table to estimate the costs of IBNR claims it would be
       necessary to build in adjustments for anticipated future
       inflation.

Because of these aspects it may be necessary to develop
different methods for dealing with the costs of IBNR claims
depending upon the class of business and its size.
These are discussed in parts 3 and 4.

3. **Practical methods -**
   considerations affecting the selection of method

3.1. The aim is to calculate the estimated number and cost of claims which may have occurred before the end of the accounting period but have not been notified to the company by the closing date.

3.2. The investigator may be faced with the task of estimating IBNR claims from a statistical basis which provides only very limited historical data. In such circumstances it might be necessary as a temporary expedient to develop special methods for estimating IBNR claims.

   The methods discussed in this paper assume that an adequate system of data collection and statistical tabulations has been established on an ongoing basis; and that the appropriate historical information is available. The exact format of the tabulations, their extent and scope, and the degree of detail will obviously be a matter of choice depending upon the circumstances of each company. However, the scheme of arrays used in Part 2 above would be typical of the type of statistical information available; generally speaking any other systems in use may be regarded as variants of this basic format.

3.3. It is evident that the choice of practical methods to be employed in estimating the IBNR triangle will involve inter alia the following considerations:

   (a) The unit interval of time (taken as one month in Part 2) may be dictated by the availability of statistics; thus there may be circumstances where the statistics cannot be analysed into shorter periods than say one year. In such a case the 'IBNR: reported' relationship may perforce be expressed in relatively crude terms.

   (b) In the absence of constraints on the selection of a suitable unit time interval the choice in practical terms ranges between year, quarter-year, month or week. The shorter the interval the greater may be the effectiveness with which the system copes with such features as growth, seasonal movements and variations in the closing dates of accounting periods. Against this, the margins of error inherent in the statistical variability of the system may render spurious the supposed precision of a short unit time interval. Thus the size of the portfolio/class under consideration will tend to determine the choice of interval; in practice it is probably unrealistic to use a shorter period than one month for statistically stable portfolios; for smaller portfolios a longer interval would be appropriate.

   (c) Generally speaking the estimation of the IBNR triangle of <u>numbers</u> of claims poses fewer problems than the assessment of the corresponding <u>amounts</u>. The relatively stable statistical patterns of numbers of claims should in most instances enable methods to be devised which lead to reliable estimates of the numbers of IBNR claims. The same cannot necessarily be said for the estimating of claim amounts where the marked skewness of the claim-size distribution (which manifests itself in the fluctuating incidence of large claims) may produce awkward statistical instability.

There is a choice of two basic methods in dealing with claim amounts -

(i) To estimate direct from a matrix scheme of claim amounts

(ii) To first estimate the claim numbers and then to apply suitable average costs thereto in order to arrive at the corresponding amounts.

The latter approach is probably to be preferred (given a suitable statistical basis) since it should be possible to develop a series of average costs (smoothed of statistical fluctuations) applicable to IBNR claims and to introduce a specific adjustment for future trends (such as inflation, changes in underwriting conditions, changes in product-mix within a class). This approach preserves a proper and consistent relationship between numbers and amounts; and tends to produce a regular development in the IBNR reserve from one point of time to another.

(d) It is pertinent to bear in mind that the estimates of IBNR amounts should be viewed in broad terms as far as accuracy is concerned. The underlying statistics of claims costs will usually involve the customary estimating aspects associated with outstanding claims; so that in effect there may be a 2-level estimating process involved. Add to this the effects of statistical fluctuations in claims costs and it is not difficult to see that, except for the largest and most stable portfolios in fairly stable economic conditions, the resulting IBNR reserve may lie within quite wide margins of error. This must naturally condition the degree of complexity and sophistication to be built into any practical approach since the supposed precision of the method may be rendered spurious by the limitations of the statistics.

The over-riding consideration may be to produce IBNR reserves which fulfil the criteria of (i) adequacy on the basis of a given set of assumptions and (ii) sensible and steady progression from one point of time to another. Subject to these criteria the choice of method will depend upon the size and stability of the portfolio under examination; and the frequency with which it is required to produce the reserves. The discussion of the following particular aspects needs to be viewed in the context of these broader considerations.

(e) In estimating the content of the IBNR 'triangle' it may be possible in some circumstances to proceed by establishing a simple relationship between the triangle and the 'reported' segment (or some portion thereof). Otherwise, it may prove necessary to accumulate the content of the triangle from the separate projection of each of the individual horizontal arrays according to the type of approach set down in Part 2.

(f) In a fast-growing portfolio the total numbers of claims incurred in successive intervals will change rapidly. Consequently the relationship between the IBNR triangle and the reported segment will not be stable. This indicates that the simple approach suggested in (e) above may be inappropriate except in a stable portfolio. Likewise the choice of unit time interval (see (b) above) may be influenced by the growth of the portfolio.

3.4. For the reasons stated in Part 2.9 there are likely to be few circumstances in which it would be feasible to project IBNR costs direct from a matrix of historical costs.

We may therefore think in terms of calculating the IBNR reserve as the product of -

(a)   the projected number of IBNR claims

(b)   a suitable average cost per claim.

As a first approximation the average cost per IBNR claim could be taken as being the same as the expected average cost of currently reported claims with some adjustment for inflation.   This, however, is not always a justifiable assumption and it would be appropriate to develop a ratio -

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Average cost of IBNR claims

Average cost of reported claims

</div>

For this purpose it would be necessary to investigate the relationship between the cost and the delay between occurrence and notification; and in particular the differences in the delay patterns of claims of different size.   The value of the ratio varies according to class of business; and there are differences between companies depending upon their claims-recording procedures.   For example, the ratio tends to be greater than unity for claims under employers liability, i.e. the longer the delay the more expensive the average claim; the opposite holds for Motor claims.

3.5.   The random incidence of large claims presents a problem in several different contexts.   Thus average claims costs may fluctuate considerably from year to year and it will be necessary to adopt some sort of smoothing process.

The problem is alleviated to some extent by the fact that as a general rule exceptionally large claims tend to have their existence brought to the company's attention very promptly and therefore hardly ever feature in the IBNR segment (for example, the 'Flixborough' incident would have been known to insurers almost as soon as it occurred).   On the other hand if the cost of such claims is allowed to enter into the average cost of reported claims to which the ratio mentioned in paragraph 3.4. is applied the consequence might be an unwarranted escalation in the resulting projected cost of IBNR claims.

3.6.   The standard experience factors developed in Part 2 imply that the underlying delay pattern is unchanged from month to month.   In practice this assumption is not valid -

(a)   For many classes of business there are marked seasonal variations in claims frequency which may affect the delay pattern from month to month.

(b)   At the end of the year the feature of Christmas/New Year holidays usually has a marked effect on the number of claims being notified before the closing date.   The effect may vary from year to year according to the incidence of weekends in relation to the holiday periods.

(c)   The company's rules may lead to differences in the closing date from one year to another depending upon the incidence of working days.

It may therefore be necessary to modify the standard experience factors to reflect the atypical characteristics of the year-end.

There may also be some seasonal variation with regard to claim amounts. For example, there is evidence to suggest that motor claims arising in the winter months tend to be more serious than summer claims.

4. Practical methods
- application

4.1. It will be apparent from the preceding Section that the choice of method of calculation is dependent upon the nature and size of the class of business under consideration and the statistical data available. In practice the investigator will probably test several alternatives before selecting the particular method to use in the light of their results.

4.2. In the preceding Part we have dealt with some of the considerations involved in making the choice of method. In the present section we seek to illustrate some of those points with a hypothetical example.

4.3. Appendix A provides a scheme of numbers of claims analysed by month of incurment and by month of notification. For reasons of space the illustration is limited to a span of 2 years' claims; in practice the investigator would make use of more extensive data if available.

The information in Appendix A may be summarised as follows -

INCURRED in year -	NOTIFIED in year -		Total
	1973	1974	
1971	9	-	9
1972	1213	-	1,213
1973	5834	1540	7,374
1974	-	7668	7,668
Total	7056	9208	

The problem is to estimate the unreported part of the claims incurred in 1974.

(a) An intuitively simple approach might be to assume that the horizontal distribution of claims incurred in 1974 was the same as that in 1973; i.e. the unreported component of 1974 would be

$$7668 \times \frac{1540}{5834} = \underline{2024}$$

(b) A similar method would be to assume that there is a constant relationship between the number of IBNR claims at the end of the year and the number of claims notified during the year.

Thus,
(i) Actual number of IBNR claims at end-1973 = 1540
(ii) Number of claims notified during 1973 = 7056

    Percentage of (i) to (ii) = 21.8%

Hence,
Estimated IBNR at end-1974 = 21.8% of 9,208 = $\underline{2007}$

(c) A complete month-by-month calculation using the detailed data of Appendix A is provided in Appendix B (Table of u_d^t) and Appendix C (1).

It is noteworthy that the answer produced by this method, $\underline{1880}$, is distinctly lower than the other simpler methods.

Appendix C(1) highlights the feature that where there is a fairly elongated delay distribution the computation is dominated by the multiplier for d = o so that the result tends to be unduly influenced by the number of claims incurred in the most recent month.

(d) In certain circumstances the most recent numbers of claims may accurately reflect the current trend in the occurrence of claims in which case the method of Appendix C(1) is to be preferred.

In other instances the most recent number of claims may be temporarily distorted (or simply a random fluctuation) in which case the method of Appendix C(1) may tend to aggravate the distortion; so that one of the other methods may be preferred.

(e) Alternatively, if circumstances permit, it may be advantageous to defer the calculation until a further month's data have come to hand; and then to use a modified version of the method of Appendix C(1). This is illustrated in Appendix C(2).

This approach has the effect of smoothing out to a large extent any aberrations in the distribution of one month's claims by eliminating the largest multiplier; and it will be seen that the result of Appendix C(2) lies closer to those of the simpler methods of (a) and (b) above.

(f) The following table gives for 3 types of policy some typical percentage distributions of cumulative percentages notified according to months of delay.

Delay period (months)	Employers Liability	Private Car	
		Comprehensive	Non-Comprehensive
0	23	60	48
1	58	90	85
2	71	95	92
3	78	97	95
4	82	98	96
5	87	99	97
6	91	100	98
7	94		99
8	97		100
9	99		
10	100		

It must be stressed that the distributions of individual companies may differ significantly from the above table and the percentages should not be used without first testing their validity against the company data.

4.4. Appendix D sets out an example of the type of information which might be available regarding claims costs. Several different approaches to estimating the IBNR reserve may be explored.

(a) In parallel with 4.3(a) above we have –

$$5,828,000 \times \frac{1,163,000}{3,220,000} = £2,105,000$$

N.B. This implies an average cost of £1,040 for each of the 2024 claims.

(b) Corresponding to 4.3(b) -

    (i)   IBNR cost at end-1973   = £1,163,000

    (ii) Notified losses for year 1973 = £4,108,000

        (= £888,000 + £3,220,000)

        Percentage of (i) to (ii)   28.3%

Whence, IBNR reserve

$$= 28.3\% \text{ of } (£1,163,000 + £5,828,000) = £1,978,000$$

N.B. This implies an average cost of £986 per claim.

(c)   The ratio

$$\frac{\text{Average cost of claims notified after year of incurment}}{\text{Average cost of } \quad " \quad " \quad \text{during } \quad " \quad " \quad "}$$

has the following values -

1970	1.556
1971	1.665
1972	1.450
1973	1.368
1970 - 1973	1.486

The average cost of 1974 IBNR claims may thus be taken as

$$£760 \times 1.486 = £1,129$$

(d)   In using the above three approaches it is important to bear
in mind that the costs set out in Appendix D will comprise
a combination of actual payments and estimates of future
payments. The impact of the estimates, which may be biassed,
on the claims incurred in recent years may be considerable;
in contrast to the earlier years where the cost consists
predominately of known payments. Thus the apparent progression
of costs from year to year may not be strictly reliable.

(e)   The progression of 'same-year' average costs is -

	(% change)
£369	
£474	28.4%
£505	6.5%
£552	9.3%
£760	37.7%

The uneven rates of increase may reflect the feature
mentioned in (d) and the random incidence of large claims
and it may be appropriate to smooth these costs before
deriving the corresponding IBNR costs.

Alternatively it may be decided to work exclusively on the
IBNR costs and to derive the 1974 average by reference to
the known sequence -

£574
£789
£732
£755

by applying a smoothing process and adjusting for inflation.

(f) The scope for producing different results by different methods
is considerable and the choice of method must rest upon the
investigator's appraisal of the validity of the various approaches.

(g) The following typical percentage distributions of IBNR liabilities
corresponds to those given in 4.3.(f) for numbers of claims. The
table is subject to similar qualifications as to its use.

Cumulative percentage of IBNR liability
according to delay from incurment to notification.

Delay period (months)	Employers liability	Private Car Comprehensive	Private Car Non-Comprehensive
0	24.0	72.0	54.0
1	43.0	96.0	89.0
2	59.0	98.0	94.0
3	69.0	98.5	96.0
4	75.0	99.0	98.0
5	81.0	99.5	98.5
6	86.0	100.0	99.0
7	91.0		99.5
8	95.0		100.0
9	98.0		
10	100.0		

Month in which calving was reported

1974

	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
	1	2	7	1	5	3	3	3	4	1	3	1	1	2	2	6	2
	1	1	6	12	7	4	3	9	9	5	7	4	2	6	1	8	1
	4	1	8	5	10	10	5	8	17	19	8	4	12	3	2	3	5
	5	2	17	10	10	18	3	16	27	8	17	9	4	7	17	17	3
	15	11	27	16	11	18	14	21	5	21	22	24	25	9	12	34	17
	21	17	32	29	19	16	14	35	47	23	17	13	29	30	27	45	25
	26	30	54	30	51	41	32	45	61	23	48	33	36	19	47	90	50
	46	42	63	69	63	39	34	50	55	70	59	53	64	43	64	33	
	59	71	89	57	98	77	53	91	117	74	73	47	100	74	94		
	70	81	263	124	229	127	75	224	140	111	105	96	141	111	246	277	
	186	235	131	262	78	196	76	66	259	280	285	147	233	168	114	148	114
	78	112		118		100	294		110	115	122	297	102	263			
							133					148		122			
															756	842	927

Table of U_d^i

Month of incurment	Month of delay													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
1973 1	14.9	49.1	66.2	75.3	80.6	85.4	89.9	92.6	94.6	95.8	98.0	98.9	99.4	100.0
2	18.2	55.9	69.4	81.6	87.6	91.6	95.9	97.3	99.0	100.0	100.0	100.0	100.0	100.0
3	16.2	52.8	70.4	78.2	83.1	87.6	92.9	95.8	97.6	98.8	99.5	100.0	100.0	100.0
4	9.9	48.8	63.2	72.9	80.9	88.2	92.9	95.7	97.4	99.1	100.0	100.0	100.0	100.0
5	18.2	51.8	64.9	74.0	84.8	89.7	94.2	98.5	98.9	99.4	100.0	100.0	100.0	100.0
6	14.7	48.8	60.9	74.8	84.1	89.3	91.2	94.3	96.7	98.3	99.8	100.0	100.0	100.0
7	14.6	44.5	65.5	75.6	86.7	89.7	92.3	94.5	95.8	98.6	99.4	99.8	100.0	100.0
8	12.3	49.3	63.1	72.1	77.0	83.5	88.5	91.0	95.3	98.3	99.4	100.0	100.0	100.0
9	16.4	54.8	73.0	82.2	87.9	92.8	95.9	96.6	97.8	99.0	99.6	99.7	100.0	100.0
10	17.3	52.0	64.9	75.1	82.1	86.5	92.7	95.5	97.8	98.9	99.2	100.0	100.0	100.0
11	15.9	46.8	64.0	74.1	80.2	88.4	91.5	94.5	97.7	99.3	99.7	100.0	100.0	100.0
12	15.0	52.7	67.3	76.9	87.5	91.9	95.2	97.7	98.5	99.8	100.0	100.0	100.0	100.0
$\vec{U}_d$	15.4	50.5	66.0	76.0	83.4	88.7	92.7	95.1	97.2	98.7	99.5	99.9	100.0	100.0

Month of incurrment		Total number of claims notified up to end of 1974	d	Multiplier $\frac{100}{d} - 1$	Estimated number of IBNR
1973	12	520	12	0	0
1974	1	797	11	.001	1
	2	768	10	.005	4
	3	641	9	.013	8
	4	750	8	.029	22
	5	819	7	.051	42
	6	805	6	.079	63
	7	799	5	.127	102
	8	596	4	.199	119
	9	623	3	.316	197
	10	498	2	.515	257
	11	458	1	.980	449
	12	114	0	5.493	626

Total IBNR   1890

Month of incurment		Total number of claims notified up to end of 1974	Claims notified in January 1975	(2) + (3)	Multiplier	Estimated number of claims to be notified after January 1975
(1)		(2)	(3)	(4)	(5)	(6)
1973	12	520	2	522	0	0
1974	1	797	0	797	0	0
	2	768	1	769	.001	1
	3	641	1	642	.005	3
	4	750	2	752	.013	10
	5	819	13	832	.029	24
	6	805	8	813	.051	41
	7	799	35	834	.079	66
	8	596	49	645	.127	82
	9	623	83	706	.199	140
	10	498	94	592	.316	187
	11	458	152	610	.515	314
	12	114	273	387	.980	379
			713			1247

Total number of IBNR claims at end of 1974 = 713 + 1247 = __1960__

Claims INCURRED in the year -	Claims notified in the SAME YEAR in which they were incurred			Claims notified AFTER the year in which they were incurred		
	Number	Total estimated cost	Average cost	Number	Total estimated cost	Average cost
1970	4173	1,540,000	369	1,090	626,000	574
1971	4280	2,029,000	474	1,095	864,000	739
1972	4627	2,337,000	505	1,213	888,000	732
1973	5834	3,220,000	552	1,540	1,163,000	755
1974	7668	5,828,000	760			

I.B.N.R. - Non-proportional reinsurance

1. Definitions

    1.1   Non-proportional reinsurance emanates from a direct insurer or another reinsurer where insurance cover is required in excess of a chosen sum.

    1.2   The ceding office will choose an excess or retention level which will reduce the potential fluctuations in its profitability as a result of large claims or catastrophes. In recent years excess levels have often been linked to an index of costs in the territory involved. This ensures that the reinsurer and the ceding company bear their own proportion of the deterioration in claim amounts resulting from inflation.

    1.3   The definitions set out for 'Direct Business' under (1.1, (1.2), (1.3, (1.4), (1.5) (a) and (1.9) apply equally to reinsurance, since in many areas the reinsurer just follows the practice of the ceding company.

    1.4   The period of insurance is known as the underwriting year. Claims occuring during this underwriting year may still remain to be settled twenty years later. The years of experience through which an individual underwriting year moves are known as years of development. The first development year is the underwriting year itself.

    1.5   Information will be assumed to be distinguishable by underwriting year and year of development in the form of Tables I and II.

    1.6   Most of this business is transacted on a burning cost basis. This basis of premium rating provides for a reviewable premium rate with an upper and lower limit. At the commencement of the underwriting year usually the 1st January a premium known as the 'deposit premium' is payable based on the lower rate. As claims are paid and notified the ratio of total claims paid and outstanding to premium together with a loading for expenses is compared with the lower premium rate. If and when that ratio exceeds this rate an additional premium is charged. Additional charges will be made on further claim advices until the burning cost equals the upper premium rate and thereafter for that underwriting year no further premiums are chargeable.

    1.7   As can be seen from the above, claim payments and the consequent adjustment premiums may take some years to be complete. It is normal practice to allow the account for an individual underwriting year to remain 'open' for a period of two or three years since only by this time will the reinsurer have been notified of a substantial proportion of the claims. Earlier than this it would normally be impossible to predict the outcome of the underwriting year with any degree of certainty. At the end of this period the underwriting year is considered closed, and it is necessary to estimate the sum of money, reserve, to be set aside in order to settle all future claims relating to that underwriting year.

1.8   The reserve required for a particular underwriting year must allow for known outstanding claims, incurred but not reported claims and movement in known outstanding claims. For the purpose of this note I.B.N.R. will include the last two of these factors. This definition does not include a provision for anticipated future income resulting from the operation of the burning cost formula.

1.9   In all methods of estimation of I.B.N.R. claims it is necessary to estimate the total reserve or fund required to be set aside for the payment of all future claim settlements. The I.B.N.R. provision is then the total reserve less any outstanding claims.

2. Theoretical Foundations

2.1 Under non-proportional reinsurance since the information available to the reinsurer is restricted at most to the number and amount of claims and claims outstanding, and the amount of premium, the theoretical foundation underlying all methods of estimation of I.B.N.R. is that the observed pattern of notifications and settlements is sufficiently stable to enable one to assume that the underlying 'population' of notifications and settlements may be estimated from these observed values.

2.2 In view of the paucity of data available on which to base one's estimates, it is advisable to produce estimates by as many methods as possible and then to exercise caution in the selection of the final result having regard to the relative stability of the estimates for each underwriting year.

2.3 Under non-proportional reinsurance there are four categories:-

> Short Tail
> Long Tail
> Marine
> Aviation

2.4 **Short Tail**

No I.B.N.R. provision is made for short tail business since the account for an individual underwriting year remains 'open' for a period of two years by which time the I.B.N.R. problem has disappeared.

2.5 **Long Tail**

Accident non-proportional business has a settlement pattern which lasts for up to twenty years and in some cases considerably longer. During that period claims are notified as and when they exceed the excess level and an estimate made of the potential liability. However, the period before notification of the claim to the reinsurer may be several years as a result of an under estimation of the size of the claim at the time of original notification or subsequent deterioration produced by unforseen levels of inflation.

2.6 For the purpose of estimation, therefore, it is assumed that for an individual underwriting year the total of claims paid to the end of a particular year of development plus the outstanding claims at the end of that year approach an ultimate value at some point around ten years, since by that time there are likely to be relatively few claims outstanding, and for those, the estimate of the potential liability should have a relatively high degree of confidence. The I.B.N.R. provision at this stage principally relates to deterioration in claim amounts.

2.7 A further method assumes that for an individual development year the proportion of claims paid to the ultimate value, estimated by the first method, is stable for all underwriting years. This method is dependent on the first and indicates whether there has been a change in the development of claims paid compared with claims paid plus outstanding claims.

2.8 Another method assumes that an underwriter writes business with the intention of breaking even, making neither profit nor loss. This method is more suitable for recent years where there has been little claims development. The breakeven point may be regarded as 100% of premiums or as a factor of the premium which takes into account interest and expenses and the incidence of settlement as derived in the second method.

2.9 A final method is based on numbers of claim notifications and their distribution. The ultimate number of claims is estimated and an average claim figure applied to that estimate.

2.10 **Marine and Aviation**

The settlement pattern of this business extends to around ten years and since information is available only for claim and premium amounts and then only at settlement, one is left with two methods of estimation.

2.11 The first based on claim settlements is similar to the second method of the long tail section, but since there is no separately determined ultimate claim estimate, one has to assume that the total of claim settlements approaches an ultimate value at around ten years.

2.12 The second method based on premiums is similar to the third method of the long tail section, making use of the settlement pattern derived by the above method.

3. Practical Methods

Consideration affecting the selection of method

3.1 Since all the methods are somewhat crude it is essential to produce estimates on as many bases as the availability of data allows.

3.2 Having produced the estimates on all bases where the estimates produce consistent values, this will point to acceptance of any of the methods. Where, on the contrary, the estimates differ widely, it is then necessary to understand the reason for this divergence in order that the most appropriate method may be chosen.

Application

3.3 Long Tail:

Data for this class of business is usually limited to numbers and amounts of claims paid and outstanding, and premium amount. This data is required to be summarised in the form of Tables I and II. It may not be possible in all cases to have numbers since the data for past years may have been collected purely for accounting and underwriting purposes.

3.4 The data available for this class of business may cover many territories involving different rates of exchange and rates of inflation.

Method I

3.5 In Table I the figures appearing in the later development years increase only slightly from year to year and hence may be regarded as approaching the ultimate cost of claims for that particular underwriting year.

3.6 In order to produce factors which can be applied to the most recent cumulative claims paid plus outstanding claims to determine the ultimate claim value it is necessary to calculate factors for development year 't + 1' to development year 't'.

3.7 For example in Table I the factor for development year 6 equals the total claims and outstanding for development year 6 divided by the total for development year 5 excluding the entry for underwriting year 1970.

3.8 To convert this series of factors into a meaningful set of factors for application to the cumulative claims paid to date plus outstanding claims it is necessary to assume a factor for over ten years say 1.005 and then multiply by the development factor for year 9 to obtain a product factor for the end of that development year.

3.9 In this way factors for the end of each development year may be obtained as below.

Development Year

	1	2	3	4	5	6	7	8	9	10
Development Factors	-	1.831	1.239	1.157	1.111	1.044	1.056	1.061	1.033	1.015
Product of Factors	3.594	1.963	1.584	1.369	1.232	1.181	1.118	1.054	1.020	1.005

3.10 Applying these factors to the most recent cumulative claims paid plus outstanding claims for each underwriting year produces the following results:

Underwriting Year	Claim Paid Plus Outstanding Claims	Product Factor	Ultimate Claim Estimate
1965	1434	1.005	1441
1966	1419	1.020	1447
1967	1023	1.054	1078
1968	1017	1.118	1137
1969	811	1.181	958
1970	1077	1.232	1327
1971	635	1.369	869
1972	672	1.584	1064
1973	483	1.963	948
1974	332	3.594	1193

Method II

3.11 Firstly it is necessary to determine the settlement pattern. The ultimate claim estimates are as determined by Method I. The proportion settled equals the total claims paid for a given development year divided by the ultimate claim estimates for those underwriting years included in the numerator.

Underwriting Year	Ultimate Claim Estimate	Development Year	Cumulative Claims Paid	Percentage Settled
1965 to 1974	11462	1	318	2.8
1965 to 1973	10269	2	953	9.3
1965 to 1972	9321	3	1738	18.6
1965 to 1971	8257	4	2488	30.1
1965 to 1970	7388	5	3171	42.9
1965 to 1969	6061	6	3257	53.7
1965 to 1968	5103	7	3194	62.6
1965 to 1967	3966	8	2784	70.2
1965 to 1966	2888	9	2236	77.4
1965	1441	10	1208	83.8

3.12 The product of the most recent cumulative claims paid for each underwriting year and the reciprocal of the proportion settled gives the total claim estimate for each underwriting year as follows:

Underwriting Year	Cumulative Claims Paid to December 1974	Development Year	Reciprocal of Settlement Pattern	Product
1965	1208	10	1.19	1438
1966	1084	9	1.29	1398
1967	713	8	1.42	1012
1968	690	7	1.60	1104
1969	459	6	1.86	854
1970	419	5	2.33	976
1971	207	4	3.32	687
1972	183	3	5.38	985
1973	88	2	10.75	946
1974	75	1	35.71	2678

3.13 If we extrapolate the settlement pattern to say twenty years it is possible to apply this method to claims paid data for those underwriting years prior to 1965 where data may only be available for the last ten years.

3.14 Extrapolating the above figures we obtain the following results:

Development Year	Percentage Settled
11	88.5
12	91.9
13	94.3
14	96.0
15	97.3
16	98.3
17	99.0
18	99.5
19	99.8
20	100.0

3.15 To produce a total claim estimate for 1962, for example, from claims paid data available for the years 1965 to 1974, development years 4 to 13, one can estimate what proportion of claims one expects to settle within these years. This is the difference between the factor for development year 13, 94.3% and development year 3, 18.6%. The reciprocal of this may then be multiplied by the cumulative claims paid for the period 1965 to 1974.

3.16 If the financial data includes special situations such as the settlements of a portfolio of outstanding claims with a particular ceding office, then the final claim estimate is better based on the average of estimates derived from the most recently completed development year and the two immediately prior to that. Even if one does not suspect any significant irregularities in the data, this method does produce more stable results.

Method III

3.17 The breakeven point may be considered to be 100% of the premiums but since claim settlements occur for up to twenty years, and the vast majority of premium income is received in the first two or three years, there is an investment situation.

3.18 Therefore, a true breakeven point will allow for interest and expenses, The pattern of settlements can be assumed to be as for Method II and from an equation of value a result of anything between 110 and 130 may be obtained depending on the mean duration of the liability and the investment returns available.

3.19 Assuming a rate of interest of say 5% and expenses at 4% of settlements and 10% of premium, the breakeven point is approximately 125% of premiums.

3.20 This method produces the following results compared with the previous two methods:

Underwriting Year	Total Premium Recorded	Final Claim Estimate
	(to December 1974)	
1965	954	1193
1966	940	1175
1967	681	851
1968	824	1030
1969	947	1184
1970	1112	1390
1971	885	1106
1972	976	1220

3.21 No calculation has been performed for 1973 and 1974 since it is normal practice to hold these years 'open' and just carry forward the balance of premium less claims and commission until the end of the second or third year by which time virtually all the premiums will have been received.

Method IV

3.22 If numbers of claims paid and notified have been recorded in the same format as for claim amounts then it has been discovered that analysis will produce a table of the following form:

Table A

Development Year	Percentage of claims by number reported in year	Cumulative total
		$100 \ P_t$
1	25	25
2	29	54
3	13	67
4	9	76
5	7	83
6	4	87
7 & later	13	100
TOTAL	100	

It is first necessary to estimate the ultimate number of claims, using the above table.

3.23 For 1974 a first estimate would be 81 divided by 0.25, namely 324. Since the purpose of the exercise is to calculate reserves, prudence would suggest that some higher figure would be desirable. Using the percentages in Table A as binomial variables it is possible to calculate the 1‰ significance level for the ultimate number of claims as follows:

Let: (1) A be the number of claims reported up to the end of development year t.

(2) $100p_t$ the cumulative percentage reported up to the end of development year t, from Table A.

(3) n the unknown number of ultimate claims.

Then:
$$\frac{np_t - A}{\sqrt{np_t (1-p_t)}} = 3.090 \qquad (1)$$

As an example from Table I underwriting year 1974, A is 81, and P_t is 0.25. Substituting these in equation,(1) we have n = 324.

3.24 The complete table for those years for which there is information on claims is as follows.

Table B

Underwriting Year	Expected ultimate number of claims from Table A	Upper 1‰ limit to number of claims
1969	483	510
1970	613	649
1971	324	356
1972	437	485
1973	294	347
1974	324	436

3.25 It is then necessary to calculate from Table I the average claim paid and outstanding in each development year. This is shown at the bottom of Table I and is reproduced in Table C below.

Table C

Development Year	Average claim paid and outstanding £000's	Modification factor 2.000 ÷ column 2
1	3.172	.631
2	2.625	.762
3	2.315	.864
4	2.155	.928
5	2.020	.990
6	1.926	1.000 say

3.26 If this average may be assumed to be tending ultimately to £2,000 we can calculate a set of modification factors as shown in column 3 above, which can be applied to the average for the latest development year for each underwriting year. These averages are shown in Table D.

Table D

Claims paid and outstanding
for the latest development year

Underwriting Year	number	amounts £000's	average £000's
1969	421	811	1.926
1970	509	1077	2.115
1971	246	635	2.585
1972	293	672	2.295
1973	159	483	3.039
1974	81	322	4.105

3.27 Finally in Table E these upper limits may be applied to the ultimate number of claims (Table B to the averages in Table D modified by the factors in Table C).

Table E

Underwriting Year	Ultimate no. of claims	Current average claim	Modified factors	Product
1969	510	1.926	1.000	982
1970	649	2.115	0.990	1359
1971	356	2.585	0.928	854
1972	485	2.295	0.864	962
1973	347	3.039	0.762	804
1974	436	4.105	0.631	1129

Comparison of results

3.28 The results of the four methods are presented below:

Underwriting Year	I	II	III	IV
1965	1441	1438	1193	
1966	1447	1398	1175	
1967	1078	1012	851	
1968	1137	1104	1030	
1969	958	854	1184	982
1970	1327	976	1390	1359
1971	869	687	1106	854
1972	1064	985	1220	962
1973	948	946	-	804
1974	1193	2678	-	1129

3.29 The results of Method I and II are broadly similar for the years 1965 to 1968 inclusive differing by only 3%. This is to be expected since the settlement pattern in the later years of development was based exclusively on these underwriting years. However, one would expect the first method to produce reasonable results in view of the lengthy period of development already experienced. Coupled with the fact that they are all known to have resulted in loss situations Method III is of no value here.

3.30 The underwriting years 1969 to 1972 inclusive produce a much less consistent set of estimates.

3.31 Since Method III, the breakeven method, is consistently higher, the acceptance of an alternative method involves the release of surplus. One must therefore be sure that if an alternative method is chosen that it is confidently expected that the underwriting year will prove profitable.

3.32 For these underwriting years Methods I and IV differ in total only by a little over 1%.

3.33 However, the method based on cumulative claims is around 15% less, a substantial difference. It would, therefore, appears that the rate of claim settlement is lower than the average of all the underwriting years or the final claim estimate produced by the first method is too high.

3.34 To understand the results one must examine the background to the data. In 1969 the use of indexed excess levels became common. This, of course always affected the claims actually settled but not in all cases the outstanding claims since this depended on how frequently the estimate was revised.

3.35 With this background to the results and the possibility that the settlement pattern will in time prove a slightly different shape to that of unindexed excess levels, since it is necessary to establish prudent reserves, one must have regard to the breakeven basis Method III.

3.36 As already mentioned years 1973 and 1974 are 'open' years and in view of the length of settlement pattern of this class of business and the delay in receiving information, unless claims paid plus outstanding as a proportion of premium received has risen more sharply than earlier years, it is normal to carry forward a fund equivalent to premiums less claims.

3.37 In the determination of the reserve required for outstanding claims whether known or I.B.N.R. no consideration has been given to inflation, exchange movements or interest. The figures used for this exercise had an implicit allowance for inflation and exchange movements inherent in the development of the results.

3.38 No attempt has been made to extricate the effect of these factors and make alternative assumptions. The results may be regarded as having an implicit margin for such movements and if this is considered sufficient for future purposes discounting may be considered

3.39 Alternatively, the interest factor may be left as an implicit margin against future inflation allowing it to emerge as surplus later.

TABLE I

ACCIDENT NON-PROPORTIONAL

December 1974

£000s Sterling

Cumulative Claims Paid Plus
Outstanding Claims

Development Year

Underwriting Year	1 No.	1 Amt	2 No.	2 Amt	3 No.	3 Amt	4 No.	4 Amt	5 No.	5 Amt	6 Amt	7 Amt	8 Amt	9 Amt	10 Amt
1965	N/A	477	N/A	722	N/A	982	N/A	1132	N/A	1258	1269	1305	1348	1413	1434
1966	N/A	454	N/A	826	N/A	909	N/A	1025	N/A	1140	1193	1283	1394	1419	
1967	N/A	365	N/A	593	N/A	703	N/A	812	N/A	845	900	962	1023		
1968	N/A	363	N/A	578	N/A	684	N/A	765	N/A	876	963	1017			
1969	103	300	222	513	305	633	420	694	421	800	811				
1970	124	328	242	637	324	743	509	967		1077					
1971	53	195	134	382	203	557		635							
1972	71	188	200	497	293	672									
1973	50	187	159	483											
1974	81	332													

Average Claim

Amounts / Numbers	3.172		2.625		2.315		2.155		2.020		1.926				

Proportional Reinsurance

1.1   It is not conventional to associate an IBNR reserve with
       proportional reinsurance business. This arises from the way a
       pro-rata treaty is set up and from the way in which accounts are
       presented.

1.2   In return for a proportion of the premium on the original risk
       (which would vary according to the risk for a surplus treaty), a
       reinsurer pays claims on that risk in the same proportion and
       also pays commission on terms subject to negotiation.

1.3   The accounts presented, normally on a quarterly basis, by the
       ceding companies to their reinsurers itemise:

         (i)   premiums ceded
        (ii)   recoveries on claim payments
       (iii)   commission due
        (iv)   movement on premium reserve
         (v)   movement on recoveries outstanding

       The first three quarterly accounts presented more of ten than not
       just cover the first three items, the cash items. The last two
       items, the reserve movements, may only be shown on the fourth
       quarter account or even a "fifth" quarter account.

1.4   There is a substantial delay in the receipt of an account statement
       by a reinsurer from the ceding company. This delay should be no
       more than six months according to standard contract wording. However
       in practice a delay of up to a year is quite common. An interpretation
       of the IBNR definition could cover all such outstanding accounts at
       the end of each year. Companies have experienced such difficulties
       in estimating these claim recoveries outstanding that they have
       brought in an accounting device which has effectively removed the
       problem. This device is essentially reporting 12 months in arrears.

1.5   Reporting in arrears can be achieved either:

         (i)   by recording all entries relating to the previous year
               in the current years account,

       or (ii) by putting all accounts presented relating to the current
               year in an 'Open Year' account, the accumulated balance
               is the Fund carried forward. The remaining accounts will
               be entered the following year, in the Closed Year account,
               and the profit or loss released twelve months after the
               year in which it has been incurred.

1.6   It is considered desirable to build up the Fund carried forward from
       the open year if it is expected to make a loss on the relevant
       Treaty Year. This is a re-statement of the IBNR problem. Solutions
       are probably limited to a study of the relationship between the ratio
       of premium to the Open Year Fund carried forward and the eventual
       profit released. Knowledge of the various underwriting trends in
       the area of a ceding company's operations may also help.

TABLE II

ACCIDENT NON-PROPORTIONAL

£000s Sterling

Cumulative Claims Paid

Development Year

Underwriting Year	1 Amt	2 Amt	3 Amt	4 Amt	5 Amt	6 Amt	7 Amt	8 Amt	9 Amt	10 Amt
1965	43	131	306	515	691	849	976	1060	1152	1208
1966	39	142	277	456	671	824	918	1011	1084	
1967	23	115	235	374	473	524	610	713		
1968	51	137	242	376	527	601	690			
1969	27	110	178	271	390	459				
1970	21	86	181	289	419					
1971	23	80	136	207						
1972	4	64	183							
1973	12	88								
1974	75									
TOTAL	318	953	1738	2488	3171	3257	3194	2784	2236	1208

1.7   Given a resolution of this problem, it can be argued that either:

   (i)   the IBNR associated with proportional business is the
         the IBNR element in the ceding companies reserves.
         The reinsurer does not know what this element is and for
         surplus reinsurance it would be unusual for a ceding
         company to have estimated IBNR recoveries

   or (ii) there is no IBNR element, because the contract wording
            of the treaty gives the reinsurer the option to pay a
            'portfolio claim' releasing it from the liability on all
            outstanding claims.

1.8   The outstanding claim reserve is normally taken as the 'portfolio
       claim' amount, which is typically 90% of the appropriate proportion
       of the ceding company's outstanding claims. On a "break-up value"
       reserving basis this may be satisfactory. On a going concern basis
       it may postpone losses emerging when the ceding company under-
       estimates its outstanding claim (including IBNR).