AUTOMOBILE COLLISION DEDUCTIBLES AND REPAIR COST GROUPS:

THE LOGNORMAL MODEL

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Background

Ratemaking methodology in the field of auto physical damage insurance is still in the Stone Age. The peculiarities involved in auto physical damage have really never received the same rigorous scrutiny in actuarial literature that has been given liability ratemaking techniques. The use of driver classification plans, territorial differentials, and other rating factors has been advanced to a remarkable level for physical damage coverages as well as liability. But the real *sine qua non* of a complete physical damage ratemaking procedure—the consideration of the physical characteristics of the vehicle itself—has always been shrouded in actuarial mystery, characterized by ritualistic rules of thumb, crude groupings of cars by left rear-window price stickers, and the absence of an earnest attempt to examine one of the most significant aspects of all physical damage ratemaking: the deductible.

But the absence of significant contributions which get to the real heart of the physical damage problem is not necessarily due to neglect. The simple truth is that at the physical damage table we have been forced to play with less than a full deck of cards. It is probably no secret that the effect of a particular deductible on net loss cost cannot be expected to be the same for automobiles whose expected mean repair costs are different. Unfortunately, an actuarial student's first exposure to the study of deductibles is usually restricted to situations where the underlying expected distribution by size of loss for the particular line is assumed to be identical for all risks and, consequently, the computation of the effect of a deductible (sometimes referred to as "loss elimination ratio") is based on all risks combined. In order to develop the effect of a particular deductible in the case of automobile collision there is the important stipulation that as the

NOTE: The author would like to thank his associates Mr, Thomas J. Patterson, Jr. and Mr. LeRoy P. Kuriger for their assistance in the compilation of the original data and in certain stages of the program used to tabulate net loss cost based on our model.

mean repair cost and underlying distribution by size of loss change from one group of cars to another, then the percentage effect (loss elimination ratio) of the deductible changes as well.

The Lost Card

The distribution by size of loss to which we refer might be defined as the distribution of gross repair costs which would be incurred for a particular automobile when subjected to the full spectrum of possible collisions, weighted by the relative incidence of the particular types of collisions. There is no doubt that mean repair cost by model, together with its underlying size of loss distribution, either measured from actual repair data, or estimated through another measure which is highly correlated to it, is the single most important statistic in physical damage ratemaking. It also happens to be that big trump card which is missing from our deck.

There have been many vain attempts in the past on the part of some companies to compile cost statistics by make and model of vehicle. Of the many reasons such attempts were abortive, the most important one is that, even if the necessary coding quagmire had yielded spotlessly accurate data, it would probably have taken two or three years before any cost studies could have been completely compiled. The value of such knowledge of two year old models would then have been very questionable in estimating the damageability of the corresponding current year models. The physical changes incorporated into the same model from one year to the next are sometimes quite significant. The only answer to this dilemma would be to find a means of estimating the expected average repair costs of a particular model on an *a priori* basis, perhaps even before it leaves the dealer's showroom. Such an exercise would be strictly an engineering probem and well beyond the province of the actuary, so we, along with the industry as a whole, have ignored this problem and have satisfied ourselves that it was necessary to make do with the remaining fifty-one cards.

The Repairability/Damageability Crusades

The only way in which insurers at present distinguish the physical characteristics of insured automobiles is the customary broad list price groups which number from 7 to 10 or so, depending on the company. This grouping assumes, implicitly, that all automobiles falling within a given list price bracket develop about the same average repair costs for both total losses and less than total losses. Recent studies in the last two years which have been given quite widespread publicity have shown that there is a wide disparity in the average repair cost of automobiles which have been placed in the same group by list prices new.[1] Based on the results of these studies, there have been many suggestions by both the automobile manufacturers and the insurance companies in the last two years that physical damage ratemaking formulas be revamped to group cars in some manner by relative repairability and damageability. While these two concepts might be treated as one in some contexts, it might be well to point out that two distinct definitions of the terms are now in the process of evolution. For purposes of this paper, "damageability" will refer to the relative susceptibility to damage given a certain collision situation and "repairability" will refer to the cost of repair parts and labor given a certain degree of damage. As will be brought out later, there are times when the two concepts can be treated as one, but other situations require separate treatment.

Although not all of the repairability/damageability studies which have been completed or are in progress can be thoroughly described in this paper, it might be useful to outline the objectives of these studies and summarize their findings. For a starting point, one industry association undertook a study in 1971 to measure the difference in repair costs of several hundred models from labor and parts prices found in claims adjusters' "flat rate manuals"—basing the "average" repair bill for each model on a predetermined weighted average of parts typically replaced in collision claims.[2] The differences between cars of the same list price group were substantial, ranging towards 80 per cent. Moreover, there was a high degree of overlap in the weighted average repair bill between list price groups. Since the study made no allowance for relative damageability between models, these repairability relativities would not, by themselves, be a completely appropriate "repairability/damageability index"; nevertheless, the study quite graphically illustrated how inequitable the present list price groupings are.

The engineers have decided to take it a step further. Several groups have begun a series of very elaborate tests to determine the relative dam-

[1]See, for example, "Status Report," Insurance Institute for Highway Safety, November 19, 1971, wherein low-speed crash tests of several 1972 models are described and the results outlined.

[2]Mutual Insurance Advisory Association, "Methods of Reflecting Damageability and Repairability Difference in Rating Private Passenger Automobiles", unpublished memorandum of August 25, 1971.

ageability of various models by crashing them into poles and barriers under controlled conditions and then determining the relative damage suffered. These tests have been focused chiefly on the efficiency of various bumper systems. Certainly the most sensational "Naderizing" finding to date was the fact that none of the bumpers tested was able to prevent damage in even a 5 MPH barrier crash. These crashes also showed significant variation between models in susceptibility to damage at many impact speeds.

Even though much useful information has already been derived from these studies and tests, we think it should be safe to assume that the insurance industry will not allow this renaissance movement to come to a close. A completely feasible means to determine a reasonably accurate expected average repair cost which would take into consideration the parts/labor costs and the damageability over the full spectrum of possible collisions for each new automobile model must be developed. The ideas in this paper are predicated on that assumption.

The Need For a Working Mathematical Model of Size-of-Loss Distributions

With the prospect that automobiles can be grouped by expected average repair costs, it follows that half of the basic ratemaking equation will have been supplied to us. For, just as my old physics professor reminded that almost all physics problems can be attacked with the formula F=MA, the pure premium = severity x frequency formula remains equally inviolate. I have inferred from some things I have read concerning the recent repairability/damageability studies that the general feeling is that once there are feasible means of grouping cars by expected severity, the battle will be over and all will be right in the world of physical damage ratemaking. The proper analysis of deductibles, however, requires going a little further.

If the distribution by size of loss for each average repair cost group were available, as well as simply the mean cost itself, then the effect of a particular deductible on loss cost could be analyzed correctly—for the first time. The natural choice would be to find a theoretical distribution function to use as a model for all repair cost groups and to determine the effect of a given deductible based on that model distribution function.

A Likely Candidate—The Lognormal

The usefulness of the Lognormal distribution in representing many kinds of natural phenomena with skewed distributions has been well established. This model has been shown to accurately depict distributions of such things as the number of plankton caught in hauls of a fisherman's net, the distribution of family incomes, the amount of electricity used in middle class American homes, sentence length of various authors, the survival time of insects treated with disinfectant, and the age upon marriage of American spinsters. The use of the lognormal has also been demonstrated in papers in the *Proceedings* of the CAS. Most recently, Hewitt observed that, although a compound form of the lognormal and gamma functions might improve to some degree the closeness of fit, the simple lognormal distribution provided a good working model to represent the distribution by size of loss of auto property damage claims.[3]

Thus, the lognormal is a natural choice as a model for the distribution by size of auto collision claims. It should be emphasized at this point that the distribution we wish to concern ourselves with is the gross cost of claims before the application of a deductible (including those eliminated completely by the deductible), but the only collision data available to us is that from net claim cost, after the deductible. This presents a special problem in estimating the parameters of the lognormal to be fitted to our actual data. How this problem is handled is covered later. First, a brief review of the lognormal mathematics:

Rudiments of the Lognormal Distribution[4]

If $Y = \log X$ is normally distributed with mean μ and variance σ^2, X is said to be lognormally distributed. The probability density function for the lognormal distribution is

$$f(x) = (x \sigma \sqrt{2\pi})^{-1} \exp \left[-\frac{1}{2\sigma^2} (\log_e x - \mu)^2 \right]$$

The standard nomenclature for the lognormal distribution function is

$$\Lambda(x | \mu, \sigma^2) = \int_0^x f(u) du = P [X \leq x]$$

[3]Charles C. Hewitt, Jr., "Credibility for Severity," PCAS, LVII (1970), p. 148.

Most of this brief exposition is adapted from J. Aitchison and J. A. C. Brown, *The Lognormal Distribution,* Cambridge University Press, 1969, Chapter 2. For readers who might have the appetite for a thorough, exhaustive treatment of the lognormal distribution, this book is highly recommended.

and

$$\frac{d}{d_x} \Lambda(x) = f(x).$$

The jth moment about the origin $= \int_0^\infty x^j \, d\, \Lambda\,(x)$

$$= e^{j\mu + \frac{1}{2} j^2 \sigma^2}.$$

The mean α and variance β^2 of the distribution, then, are:

$$\alpha = e^{\mu + \frac{1}{2}\sigma^2}$$

$$\beta^2 = e^{2\mu + 2\sigma^2} - e^{2\mu + \sigma^2} = e^{2\mu + \sigma^2}\,(e^{\sigma^2} - 1)$$

$$= \alpha^2(e^{\sigma^2} - 1) = \alpha^2 \eta^2$$

where $\eta^2 = e^{\sigma^2} - 1$

The quantity η is, therefore, the coefficient of variation of the distribution and the quantity is very useful in our application of the lognormal distribution. Of particular importance is the fact that, as can be seen, if the members of a family of lognormal curves have equal coefficients of variation, they have equal values of the parameter σ^2.

Moment Distributions

A very important theorem concerning the lognormal distribution concerns the concepts of moment distributions. The jth moment distribution function of $\Lambda(x \mid \mu, \sigma^2)$ is defined as

$$\Lambda_j(x \mid \mu, \sigma^2) = \frac{\int_0^x u^j \, d\, \Lambda\,(u \mid \mu, \sigma^2)}{e^{j\mu + \frac{1}{2} j^2 \sigma^2}}$$

The theorem states that the jth moment distribution of a lognormal distribution with parameters μ and σ^2 is also a lognormal distribution with parameters $\mu + j\sigma^2$ *and* σ^2, respectively.[5] The first moment distribution Λ_1 would, therefore, be a lognormal distribution with parameters $\mu + \sigma^2$ and σ^2.

[5] Proof in Aitchison and Brown, *op. cit.*, p. 12.

The lognormal distribution and its first moment distribution are the two basic models of this study of distribution of collision losses by size of loss. In studying the effect of a deductible on loss costs in any coverage, two quantities are needed:

1. The ratio of the expected number of claims which exceed the amount of the deductible to the total expected number of claims. Each of these claims would be reduced by the amount of the deductible.

2. The ratio of the aggregate amount of those claims less than the deductible to the total amount of claims over the entire distribution. These claims are eliminated entirely by the application of the deductible.

The reduction in loss costs brought about by the use of a deductible is a combined result of the two quantities above. Using the lognormal model, the first quantity is derived from the lognormal distribution function itself (Λ) and the second quantity from the first moment distribution function (Λ_1).

For the purposes of this paper we will define four functions which will be used to determine the net reduction in loss cost from a deductible, based on the lognormal frequency function $f(x)$ with parameters μ and σ^2:

Function	*Use*
$\Lambda(x) = \int_0^x f(u)\,du$	To determine ratio of number of claims less than amount x to total number of claims. Basic distribution function.
$G(x) = \int_x^\infty f(u)\,du = 1 - \Lambda(x)$	Determine ratio of number of claims in excess of amount x to total number of claims.
$H(x) = \dfrac{\int_0^x uf(u)\,du}{e^{\mu + \frac{1}{2}\sigma^2}} = \Lambda_1(x)$	First moment distribution. To determine ratio of amount of claims less than amount x to total amount of all claims over the distribution.
$J(x) = \dfrac{\int_x^\infty uf(u)\,du}{e^{\mu + \frac{1}{2}\sigma^2}} = 1 - H(x)$	Ratio of amount of claims in excess of the point x to total amount.

Assuming, then, a distribution with mean α (as defined above), the ratio of the reduction in net cost from a deductible D to the "first dollar" cost, with no upper bound, would be expressed as

$$\frac{D \cdot G(D) + \alpha \cdot H(D)}{\alpha}$$

where the two terms of the numerator are, respectively, the very two quantities we set forth earlier as the ones necessary to determine the effect of a particular deductible.

In actual practice of settling collision claims, however, there is, of course, an upper bound to the distribution, represented by the actual cash value of the insured vehicle at the time of the accident. The reduction from loss cost brought about by this upper bound, which we will denote by L, can also be expressed as a ratio to the unlimited, first dollar cost, as follows:

$$\frac{\alpha \cdot J(L) - L \cdot G(L)}{\alpha}$$

The first term in the numerator represents the total amount of claims in excess of the amount L, from the first moment distribution. The second term represents the amount which would actually be paid on those claims, the product of the number of those claims above L and the value of L itself.

Estimating Parameters of the Lognormal Model

We have now assumed that each of several repair cost groups of automobiles have size of loss distributions which, ignoring upper bounds, follow the lognormal model, each group, by definition, having a different value of the parameter μ. Another assumption which would seem to be reasonable is that the value of the parameter σ^2 is equal for all groups. As shown above, this second assumption also means that all groups' distributions have the same coefficient of variation (B/α). Hewitt has shown that, under these circumstances, if all the automobiles from all groups were combined into a single distribution, and the μ's were themselves normally distributed, then the combined distribution would also be lognormal. If the variance of the μ's is S^2, then the variance of the combined distribution would be $S^2 + \sigma^2$, where σ^2 is constant for all individual groups.[6]

[6] Hewitt, *op. cit.*, Appendix A, p. 167.

The only collision data available for estimating the parameters of the lognormal is \$50-deductible collision and any such sample distribution would be a combination of all repair cost groups. Therefore, the quantity $S^2 + \sigma^2$ is estimated directly from the sample and the quantity S^2 is estimated separately by some other means.

The estimation of the parameter $S^2 + \sigma^2$ for a first-dollar collision distribution becomes rather non-elementary when our sample of \$50-deductible collision only gives values greater than or equal to \$50. Such a distribution is known as a truncated lognormal distribution, with truncation at the point of the deductible. Aitchison and Brown have treated the problem rather extensively[7], but it would be beyond the scope of this paper to attempt to summarize this treatment.

The raw data used to estimate the value of $S^2 + \sigma^2$ are shown in Exhibit I. It is based on net \$50-deductible collision claims closed during the calendar year 1971. It was determined that a reasonable working estimate of the quantity $S^2 + \sigma^2$ could be obtained from this truncated distribution by plotting the observed cumulative distribution to normal probability graph paper, using several assumed values of F(50) and then accepting the value which produced the best "fit", i.e., the value which produced the straightest line on the graph. The value so chosen was .05. This graphical process is shown in Exhibit II.

The value of $S^2 + \sigma^2$, then, was found to be approximately 1.08 from the graph. The mean of the μ's from this combined distribution is approximately 5.6, reading from the graph. This mean will be designated N.

The method we will use to estimate the value of S^2, the variance of the μ's, was demonstrated by Hewitt[8]. First assume that the mean repair cost of a repair cost group with a μ which is $2S$ below N is equal to 40% of the average repair cost of the combined distribution of all groups. Thus:

$$e^{N-2S+\sigma^2/2} = .40\, e^{N+(S^2+\sigma^2)/2}$$

and

$$-2S = \log_e 0.40 + S^2/2$$

[7] Aitchison and Brown, *op. cit.*, chapter 9.

[8] Hewitt, *op. cit.*, p. 168.

Solving for S:

$$S = .415$$
$$S^2 = .172$$
then $$\sigma^2 = 1.080\text{–}0.172 = 0.908$$

The above assumption in solving for S is the equivalent of saying the repair cost groups whose μ's are, respectively, $2S$ below and above N have mean repair costs of about \$185 and \$980. The mean repair cost of the total distribution is about \$455.

But there is still a further correction necessary in our estimate of σ^2. This parameter we are attempting to estimate would be applicable to each repair cost group's distribution with no upper bound. The sample data, even though salvage and subrogation recoveries were excluded, understate the value of σ^2 we are looking for to some degree because the claims shown are net after the application of limits based on list price. Based on some rough calculations, then, our estimate of σ^2 should be raised to about 1.00. Recalling the relationship

$$e^{\sigma^2} = \eta^2 + 1$$

where η = the coefficient of variation, it was decided to round the value of η to 1.3 so that

$$e^{\sigma^2} = 2.69$$
$$\sigma^2 = 0.98954$$
and $$\sigma = 0.99476$$

Although these assumptions and approximations are admittedly rough, any error shouldn't be large enough to invalidate the general conclusions reached from the model's application.

First conlusions from Model

A family of lognormal distributions with varying μ's and equal values of σ^2 — representing repair cost distributions with no upper bound for various repair cost groups of automobiles — can best be illustrated using normal probability graph paper. Such an illustration is shown in Exhibit III. For the purposes of this paper, a "repair cost group" will be identified with the mean cost, α, of the lognormal distribution representing that group. For example, repair cost group 100 is that group whose distribution has a mean of 100, assuming no upper bound. On the graph each straight line represents a lognormal distribution with means varying from 100 to 900. Since the coefficients of variation are constant — thereby making the value of σ^2 constant — the distributions can be graphed on the normal probability paper as parallel lines.

The first moment distributions corresponding to those distributions in Exhibit III are shown in Exhibit IV. Because of the theorem on moment distributions set forth earlier, the graphs of the first moment distributions can be drawn quite easily by simply "shifting" the basic distributions in Exhibit III to the right a distance equal to σ^2. These two exhibits should now make it rather clear to the reader why the lognormal model was judged to be such a convenient way to represent collision distributions by size of loss.

The effect of a particular deductible on a given repair cost group can be approximated from these two graphs as follows (assuming no upper bound): From Exhibit III the proportion of claims in excess of the deductible can be determined (each of these claims is reduced by the amount of the deductible) and from Exhibit IV the ratio of the amount of claims which are eliminated completely by the deductible to the total amount is determined. Since we can now determine the net cost for a given repair cost group after the effect of a given deductible, what we now need is a graph showing, in continuous form, such net cost for any repair cost group with several different sizes of deductibles. Such a graph is shown in Exhibit V. Several observations and explanations are necessary for this graph:

1. No upper bounds have been imposed upon any of the underlying lognormal distributions, or, the effect of the current market value limitation on a collision claim has been ignored. As will be covered later, the effect of such a limitation is negligible for our purposes in the case of new automobiles, i.e., age group 1. It will be shown later that, if two new automobiles, one costing $3,000 and the other $5,000, both are determined to belong in repair cost group 300, their net costs after certain deductibles would differ only slightly. But, no conclusions should yet be made from Exhibit V concerning older age groups of cars.

2. It is assumed that the absolute frequency is the same for all repair cost groups and, for purposes of illustration in Exhibit V, we have used a common frequency of 1/10. Absolute frequency is defined as the frequency of all claims which would be incurred from first dollar

coverage. Similarly, any time the term net cost per claim is used we will define it to mean the net cost, after a deductible, divided by the total number of claims which would be incurred on a first dollar basis. There is no reason to expect that, all other rating characteristics equal, the absolute frequency of a risk would be any different carrying one deductible than it would carrying another.

3. With an absolute frequency of 1/10, what is actually shown on the graph, then, are relative loss costs of repair cost groups for various deductibles. Any difference in the actual absolute frequency and our estimate of 1/10 would not affect the relative loss costs of the repair cost groups.

4. The net loss cost graph for each deductible approaches asymptotically a line which is parallel to the "first dollar, no deductible" line and a vertical distance below it equal to the product of the absolute frequency times the amount of the deductible. If the value of σ^2 were less than our assumed value the lines would approach their respective asymptotes faster, and vice versa.

5. For all repair cost groups above 200 or 300, the relationship between the net loss costs for $50 and $100-deductible collision is a constant dollar difference, for all practical purposes. For higher deductibles, the relationship between net loss cost by deductible as you go from one cost group to another is not as easy to generalize. But even a cursory glance at the graph leads one to conclude readily that to assume that the various deductibles are related to one another on a constant percentage basis would result in rather substantial error.

6. Using a constant percentage relationship between deductibles as you go from the lower cost groups to the higher ones would undoubtedly lead to understatement of the loss cost for the higher groups, and probably an overstatement in the lower groups. This observation is not only true as you compare two cost groups for a given year, but, perhaps even more important, it is equally true for temporal changes in overall average cost per claim (again, based on absolute frequency, as defined above). For example, if, over all cost groups, the average net loss cost (and, as a result, the gross rate) of $100-deductible collision was 70% of $50-deductible net loss cost in a given year, then as the average claim cost increased from year to year, the $100-deductible rates would become more and more inadequate when related to $50-deductible rates.

If a 70% factor were correct seven years ago, it couldn't be adequate today.

Age Groups, Depreciation Factors, and Trend Factors

The graphs shown in Exhibit V represent net loss costs for age group 1 automobiles only. For automobiles age group 2 and older these additional variables need to be introduced:

1. *Depreciation.* As was mentioned earlier, the list price is of little significance for new automobiles belonging in the same repair group. But as the car depreciates, the reduced value of the upper bound begins to take a larger "slice" out of the top of the distribution (i.e., more "totals") and this factor has to be included in our model. The most feasible way to accomplish this would be to estimate a common depreciation factor d, so that, if the original list price of an automobile in age group 1 is L, the market value for the car when it is age group n can be approximated by Ld^{n-1}. Without making a comprehensive study in this area, the author has chosen, for a rough approximation, .75 as the value of d to use in this study.

2. *Trend Factors.* If the overall absolute frequency were to remain unchanged from one year to the next, the need for trend factors in age group 1 automobiles would be completely obviated by the repair cost grouping — assuming that current repair parts costs and labor charges were used in grouping the new automobiles each year. For age group 2 and older models, to simplify coding, let us stipulate that once a new car is classed into a particular repair cost group, say 300, when new, then it remains in that same class throughout its life. Suppose that it can be determined that the index of repair parts costs and labor charges can be expected to increase at a rate of $1 + r$ per year. Then, if a particular automobile was determined to have a first dollar mean repair cost of α when in age group 1, it could be expected to develop a gross mean repair cost of $\alpha\,(1 + r)^{n-1}$ when it was in age group n. Expected repair costs still would be distributed lognormally with variance σ^2 and with the top of the distribution chopped off by the depreciated market value.

3. *Frequency Decrements by Age Group.* It is a well documented phenomenon that absolute claim frequency decreases as insured vehicles advance from one age group to another. For our model we need to determine what these decrements are, on the average, and to assume that

they would apply to one repair cost group as well as another. To estimate what these decrements should be, we have used the combined frequency experience of all independent companies reporting to the National Association of Independent Insurers. The data, covering the period 1968–1970, are shown in Exhibit VI. We will use the notation C_n to denote the frequency decrement for age group n, where C_1 is unity.

The Complete Model for All Age Groups

We can now derive an expression for net loss cost for repair cost group α, age group n, with initial list price L, depreciation factor d, rate of increase in cost of parts and labor $(1 + r)$, with a deductible D, as follows:

$$\text{Net loss cost} = AC_n \Big[\alpha(1+r)^{n-1} - DG(D) - \alpha(1+r)^{n-1} H(D) - \alpha(1+r)^{n-1} J(Ld^{n-1}) + Ld^{n-1} G(Ld^{n-1}) \Big]$$

Where the functions G, H, and J are defined earlier, and the quantity A denotes the absolute frequency for age group 1.

Based on this model formula, we have calculated in tabular form net loss costs (before the frequency decrement is applied) for several combinations of repair cost groups and list price groups for the deductibles customarily in use. For each repair cost group, the tabulation is made for two original list prices, representing the approximate maximum and minimum list price which could be associated with the particular mean repair cost. The trend factor used is 1.05. The computer printouts are shown in Exhibit VII. The reader should again note that the term "net per claim," for the purpose of these calculations, means the net cost after the deductible divided by the total absolute number of claims (including those which are eliminated by the deductible).

By comparing the "net per claim" for a given cost group and deductible with the minimum initial list price with the corresponding net per claim for the maximum list price under the same cost group, the reader should be able to see clearly how the list price is rather insignificant in the first few age groups, but becomes so significant at age 6 and 7 that it would seem that any repair cost rating structure derived from our model might well need to keep some list price distinction, perhaps as a supplement to the repair cost grouping. The number of repair cost groups and/or list price groups to be used in a rating structure would have to be determined primarily from a practical standpoint.

Collision Rates with Built-In Trend Factors

Perhaps the most salient feature of the model ratemaking formula outlined in this study is that, with current year automobiles being grouped in accordance with current expected repair costs and age groups relativities obtained as the product of the net costs shown in Exhibit VII and the frequency decrements in Exhibit VI, the resulting collision rating structure will have a completely built-in trend factor. Theoretically, no base rate change would have to be made unless dictated by a discernible trend in absolute claim frequency, or if the built-in trend factor itself would have to be modified in the formula because of changing economic conditions.

The manner in which the trend factor would be computed for the formula would require special attention. From engineering studies — similar to many that are in progress at the present time — a "typical" average collision could be derived. Such a collision could be defined as a group of weights corresponding to certain automobile parts, the weights being roughly equivalent to the frequency in which the respective parts are in need of repair or replacement. This "average" collision would also include the average number of hours of labor. From such an annual study an overall repairability index could be obtained. From a sequence of these indices over a few years, the trend factor could be obtained.

The trend factor is determined from repairability data only. The damageability factor enters into the picture only in the original placement of a particular model automobile into a particular repair cost group, where the relative susceptibility to damage of a given automobile is quite significant. But the improvement (in the aggregate) of damageability from year to year should play no part in the establishment of a trend factor, since the trend factor would relate only to the cost of repairing a given model (say 1968) in one year (say 1971) compared to the cost in a previous year (e.g., 1969). The damageability of that model should not change appreciably from year to year.

A recent study made in Texas took a sampling of collision claims, originally appraised in years prior to 1970, and reappraised those same claims based on 1970 parts and labor prices.[9] Such a comparison would be closely related to the repairability-oriented trend factor we are suggesting for our model. Based on this study, the average annual increase in parts and labor prices was approximately 8 per cent.[10] Because of the current phase of wage-price controls imposed by the Government — wherein any casualty/property trend factor to be applied beyond the inception date of this phase must be reduced to ⅝ths of the value which otherwise would have been used — the author chose to use a 5 per cent trend factor in all calculations in this study.

Even in such a guise as has been outlined in this paper, automobile collision rates must still be shown to be adequate, not excessive, and not unfairly discriminatory. In the process of making such a determination for rates developed using our model, however, the emphasis is shifted drastically from where it is for current physical damage ratemaking and rate regulation. For example, the two primary items which would have to be subject to serious scrutiny each year would be (1) the actual grouping of new models by repair cost group, based on engineering and other data available, and (2) the determination of the repairability trend factor to be used. Of slightly less importance would be the checking of overall trends in absolute claim frequency and the frequency decrements by age group. Some items which have great significance in present day physical damage ratemaking, such as 2 or 3-year loss ratios at the current rate level, would have little bearing on the ratemaking scheme outlined in this paper.

Conclusion

In using any mathematical model to represent distributions by size of loss of automobile collision claims and making other convenient assumptions, such as we have in this paper, there will always be room for criticism because there will always be many exceptions which don't always abide by our assumptions. But in order to achieve some logic and order to physical damage ratemaking, particularly deductible collision, the use of the model suggested in this paper provides a representation of real-world data which has a proper blend of accuracy and

[9] Grady D. Bruce and Robert E. Witt, *A Survey of Trends in the Consumer Cost of Medical Care and Automobile Repair in Texas*, report to Texas Automobile Insurance Service Office, November, 1970.

[10] *Ibid.*, p. 55.

convenience of handling. More sophisticated models might improve the fit of the actual data a few notches, and other refinements, such as frequency variations between models, might be somewhat more true to life. But the lognormal distribution is a good place to start and to demonstrate that the methods customarily used today in collision ratemaking are inadequate. The prospects of our industry having access to some measure of expected average repair cost by model should provide all the impetus required for us in the physical damage pricing business to finally get our house in order.

EXHIBIT I

DISTRIBUTION BY SIZE OF LOSS OF $50-DEDUCTIBLE COLLISION CLAIMS CLOSED IN 1971

Loss Intervals* (Net after deductible)	Claim Count	Accum. Count (Net)	Loss Amount (Net)	Average Loss	Estimated First Dollar Cum. Count	F(x)
less than deductible		—	—	—	(778)	(.050)
00-25	719	719	13,633.68	18.96	1,497	.096
25-50	856	1,575	31,241.43	36.50	2,353	.151
50-75	904	2,479	57,073.72	63.13	3,257	.209
75-100	921	3,400	80,832.96	87.76	4,178	.269
100-125	898	4,298	100,938.33	112.40	5,076	.326
125-150	905	5,203	124,677.95	137.76	5,981	.385
150-175	712	5,915	115,570.86	162.31	6,693	.430
175-200	703	6,618	131,984.80	187.74	7,396	.476
200-225	557	7,175	118,231.39	212.26	7,953	.511
225-250	555	7,730	132,062.80	237.95	8,508	.547
250-300	909	8,639	249,286.49	274.24	9,417	.605
300-350	684	9,323	221,826.40	324.30	10,101	.649
350-400	610	9,933	229,129.80	374.62	10,711	.689
400-450	507	10,440	215,362.38	424.77	11,218	.721
450-500	461	10,901	219,019.14	475.09	11,679	.751
500-600	670	11,571	367,878.81	549.07	12.349	.794
600-700	552	12,123	358,895.26	650.17	12,901	.829
700-800	431	12,554	323,360.81	750.25	13,332	.857
800-900	372	12,926	315,804.96	848.93	13,704	.881
900-1000	256	13,182	242,234.24	946.22	13,960	.898
1000-1100	218	13,400	228,765.26	1,049.38	14,178	.912
1100-1200	167	13,567	191,713.77	1,147.98	14,345	.922
1200-1300	156	13,723	194,854.35	1,249.06	14,501	.932
1300-1400	119	13,842	161,421.85	1,356.48	14,620	.940
1400-1500	117	13,959	170,597.09	1,458.09	14,737	.948
1500-1600	112	14,071	174,692.77	1,559.75	14,849	.955
1600-1700	93	14,164	153,629.12	1,651.92	14,942	.961
1700-1800	81	14,245	142,029.91	1,753.45	15,023	.966
1800-1900	74	14,319	137,208.47	1,854.16	15,097	.971
1900-2000	42	14,361	82,286.54	1,959.20	15,139	.973
2000-2500	213	14,574	477,137.73	2,240.08	15,352	.987
2500-3000	109	14,683	298,718.15	2,740.53	15,461	.994
3000-4000	72	14,755	244,135.38	3,390.76	15,533	.999
4000-5000	12	14,767	51,857.83	4,321.48	15,545	.999
5000-Up	8	14,775	53,234.96	6,654.37	15,553	1.000
TOTAL	14,775		6,411,329.39	433.93	15,553	

*The top point in each interval used as value of X to compute distribution function.

EXHIBIT II

FITTING OBSERVED DISTRIBUTION OF $50-DEDUCTIBLE COLLISION LOSSES BY SIZE TO LOGNORMAL

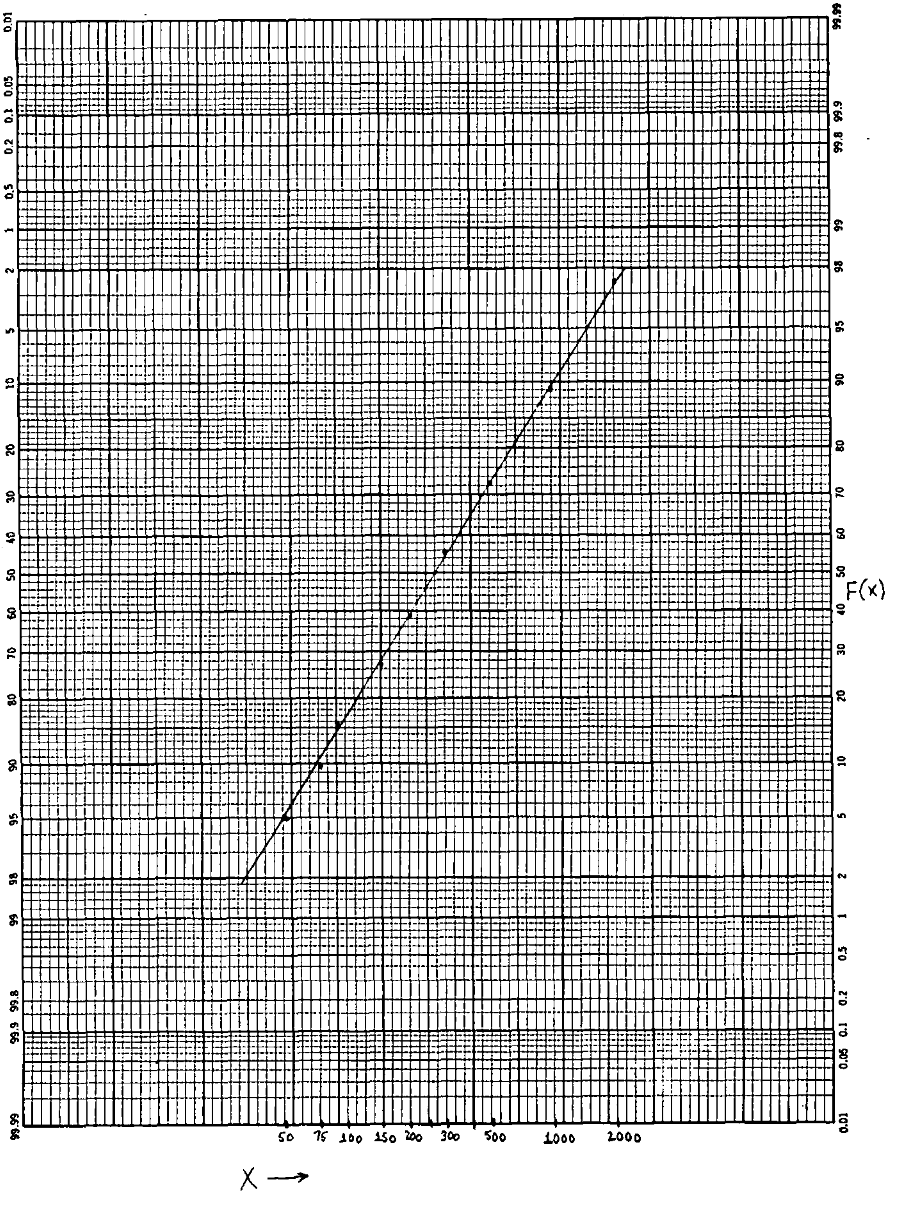

EXHIBIT III
DISTRIBUTION BY SIZE OF LOSS FOR VARIOUS REPAIR COST GROUPS
(LOGNORMAL WITH η = 1.3)

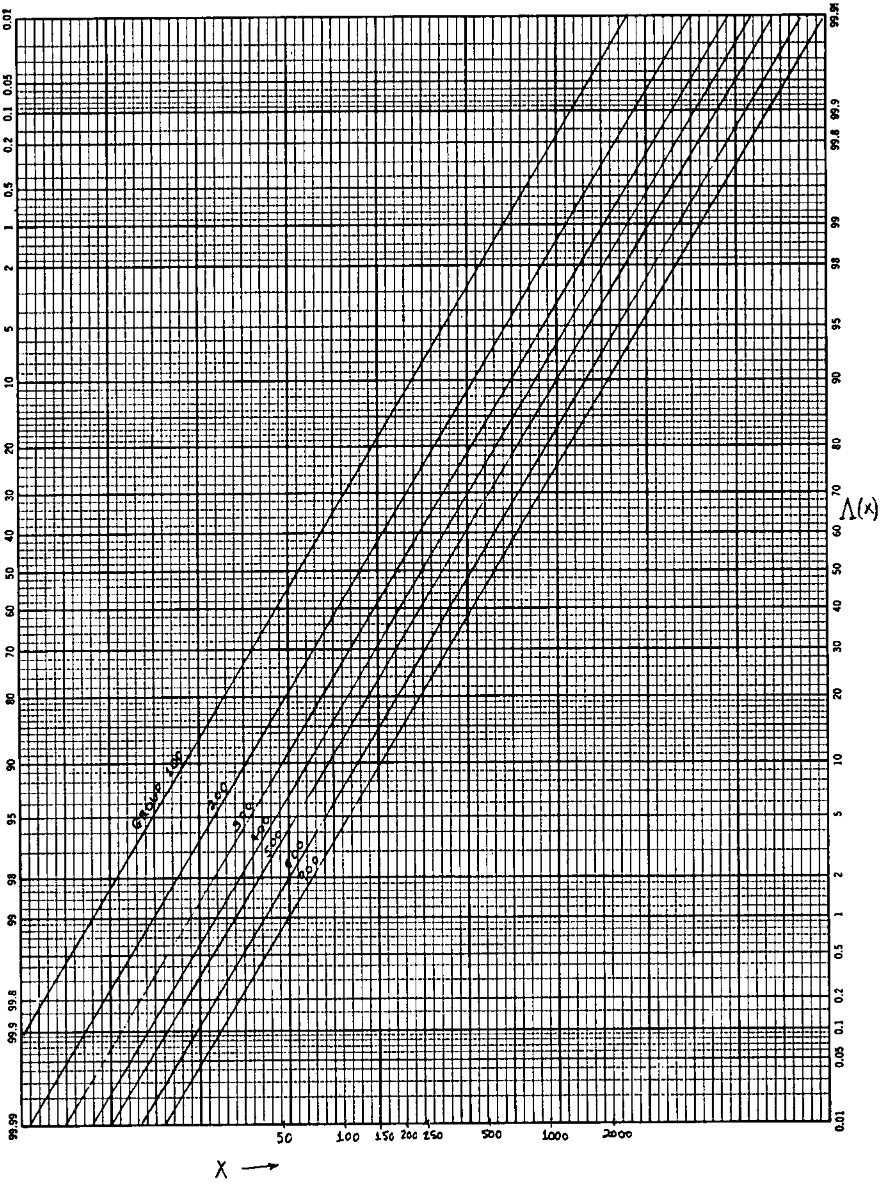

EXHIBIT IV
FIRST MOMENT DISTRIBUTIONS FOR VARIOUS REPAIR COST GROUPS
$\lambda = 1.3$

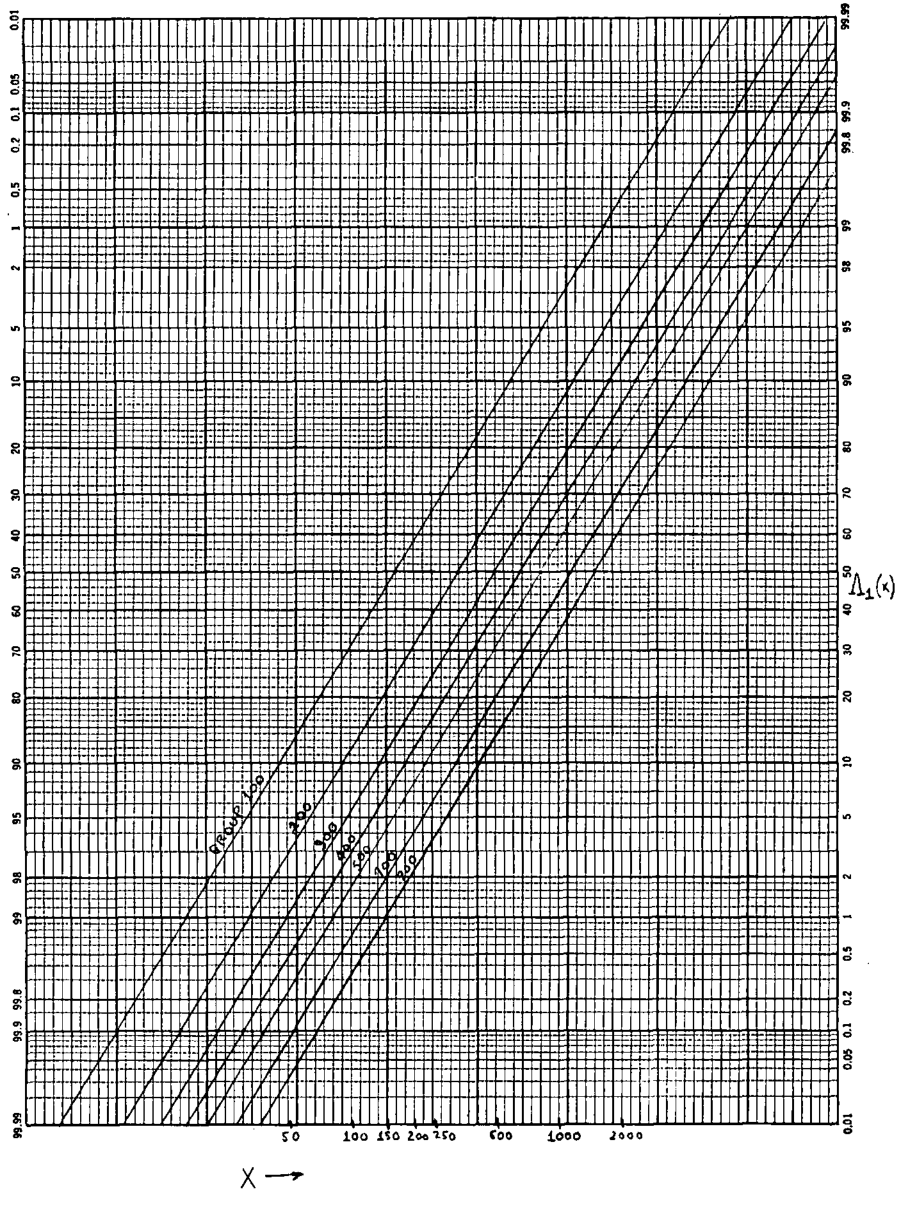

EXHIBIT V

NET LOSS COST BY REPAIR COST GROUP FOR VARIOUS DEDUCTIBLES

ASSUME ABSOLUTE FREQUENCY = 1/10 AND NO UPPER BOUND

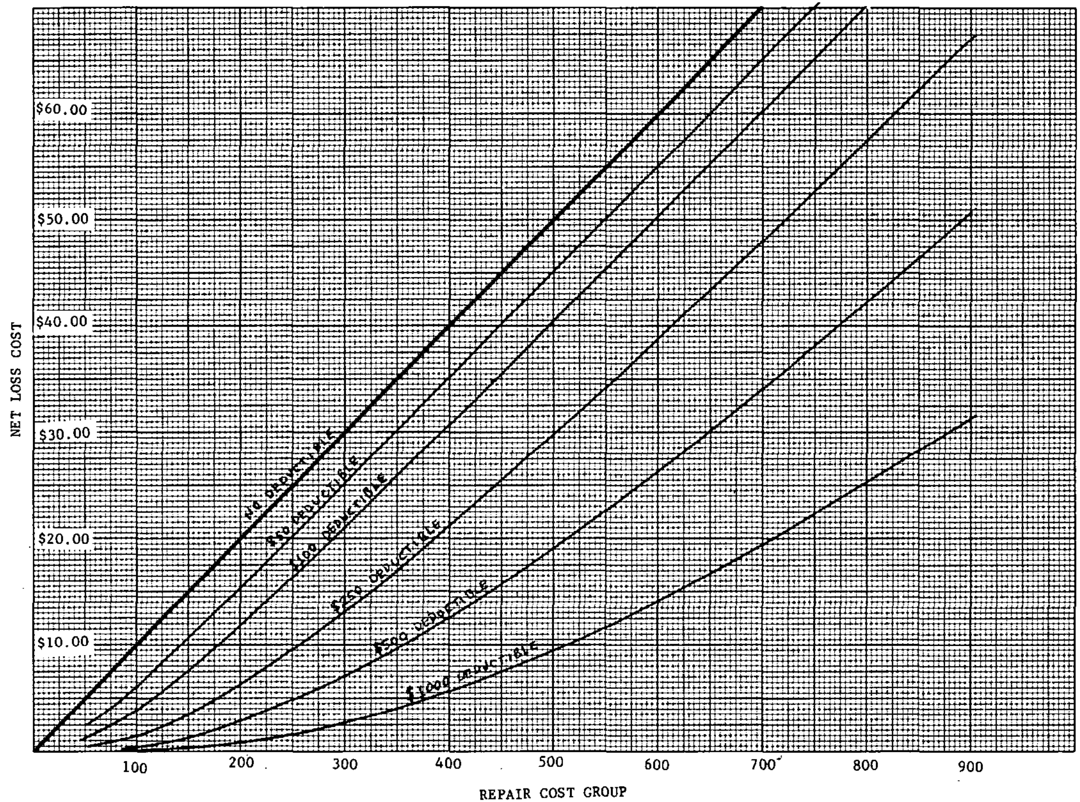

EXHIBIT VI

FREQUENCY DECREMENTS FOR COLLISION BY AGE GROUPS*

Age Group	Freq. per 100 Exposure	Age 4-7 Interpolated**	Relativity To Age 1
1	14.6	14.6	1.000
2	12.8	12.8	.877
3	11.1	11.1	.760
4	9.1	9.6	.658
5	9.1	9.0	.616
6	9.1	8.6	.589
7	9.1	8.4	.575

*Source: National Association of Independent Insurers, Countrywide 1971 Compilation, Private Passenger Non-Fleet, Calendar Years 1968-1970. Used with permission.

**Interpolated frequencies of age groups 4-7 based on rough approximation of relative exposures of these age groups.

EXHIBIT VII—SHEET 1

NET COST BY AGE GROUP FOR REPAIR COST CLASS 300

INITIAL LIST PRICE	2000		DEPRECIATION FACTOR	.75
TREND FACTOR	1.050		COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	300.00	315.00	330.75	347.29	364.65	382.88	402.02
LIMIT POINT, L	2000.00	1500.00	1125.00	843.75	632.81	474.61	355.96
G OF L	.0081	.0194	.0420	.0823	.1465	.2379	.3538
G OF L × L	16.20	29.10	47.25	69.44	92.71	112.91	125.94
J OF L	.0793	.1420	.2317	.3464	.4773	.6108	.7323
J OF L × MEAN	23.79	44.73	76.63	120.30	174.05	233.86	294.40
NET REDUCTION FROM LIMIT	7.59	15.63	29.38	50.86	81.34	120.95	168.46
NET PER CLAIM, NO DEDUCTIBLE	292.41	299.37	301.37	296.43	283.31	261.93	233.56
D EQUAL 50							
G OF D	.9038	.9119	.9195	.9266	.9332	.9394	.9450
G OF D × D	45.19	45.60	45.98	46.33	46.66	46.97	47.25
H OF D	.0108	.0095	.0082	.0072	.0063	.0055	.0048
H OF D × MEAN	3.24	2.99	2.71	2.50	2.30	2.11	1.93
NET REDUCTION FROM DEDUCTIBLE	48.43	48.59	48.69	48.83	48.96	49.08	49.18
NET PER CLAIM, 50 DEDUCTIBLE	243.98	250.78	252.68	247.60	234.35	212.85	184.38
D EQUAL 100							
G OF D	.7281	.7441	.7596	.7746	.7891	.8030	.8163
G OF D × D	72.81	74.41	75.96	77.46	78.91	80.30	81.63
H OF D	.0545	.0494	.0446	.0402	.0361	.0324	.0290
H OF D × MEAN	16.35	15.56	14.75	13.96	13.16	12.41	11.66
NET REDUCTION FROM DEDUCTIBLE	89.16	89.97	90.71	91.42	92.07	92.71	93.29
NET PER CLAIM, 100 DEDUCTIBLE	203.25	209.40	210.66	205.01	191.24	169.22	140.27
D EQUAL 250							
G OF D	.3767	.3955	.4145	.4337	.4531	.4726	.4921
G OF D × D	94.18	98.88	103.63	108.43	113.28	118.15	123.03
H OF D	.2480	.2328	.2180	.2039	.1903	.1773	.1648
H OF D × MEAN	74.40	73.33	72.10	70.81	69.39	67.88	66.25
NET REDUCTION FROM DEDUCTIBLE	168.58	172.21	175.73	179.24	182.67	186.03	189.28
NET PER CLAIM, 250 DEDUCTIBLE	123.83	127.16	125.64	117.19	100.64	75.90	44.28
D EQUAL 500							
G OF D	.1560	.1680	.1807	.1939	.2076	.2219	.2368
G OF D × D	78.00	84.00	90.35	96.95	103.80	110.95	118.40
H OF D	.5064	.4869	.4673	.4479	.4285	.4094	.3905
H OF D × MEAN	151.92	153.37	154.56	155.55	156.25	156.75	156.99
NET REDUCTION FROM DEDUCTIBLE	229.92	237.37	244.91	252.50	260.05	267.70	275.39
NET PER CLAIM, 500 DEDUCTIBLE	62.49	62.00	56.46	43.93	23.26	****	****
D EQUAL 1000							
G OF D	.0439	.0486	.0537	.0593	.0653	.0718	.0788
G OF D × D	43.90	48.60	53.70	59.30	65.30	71.80	78.80
H OF D	.7620	.7466	.7307	.7142	.6973	.6800	.6622
H OF D × MEAN	228.60	235.18	241.68	248.03	254.27	260.36	266.22
NET REDUCTION FROM DEDUCTIBLE	272.50	283.78	295.38	307.33	319.57	332.16	345.02
NET PER CLAIM, 1000 DEDUCTIBLE	19.91	15.59	5.99	****	****	****	****

EXHIBIT VII—SHEET 2

NET COST BY AGE GROUP FOR REPAIR COST CLASS 300

INITIAL LIST PRICE	4000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	300.00	315.00	330.75	347.29	364.65	382.88	402.02
LIMIT POINT, L	4000.00	3000.00	2250.00	1687.50	1265.63	949.22	711.92
G OF L	.0010	.0028	.0077	.0185	.0402	.0792	.1419
G OF L × L	4.00	8.40	17.33	31.22	50.88	75.18	101.02
J OF L	.0176	.0385	.0764	.1375	.2256	.3389	.4693
J OF L × MEAN	5.28	12.13	25.27	47.75	82.27	129.76	188.67
NET REDUCTION FROM LIMIT	1.28	3.73	7.94	16.53	31.39	54.58	87.65
NET PER CLAIM, NO DEDUCTIBLE	298.72	311.27	322.81	330.76	333.26	328.30	314.37
D EQUAL 50							
G OF D	.9038	.9119	.9195	.9266	.9332	.9394	.9450
G OF D × D	45.19	45.60	45.98	46.33	46.66	46.97	47.25
H OF D	.0108	.0095	.0082	.0072	.0063	.0055	.0048
H OF D × MEAN	3.24	2.99	2.71	2.50	2.30	2.11	1.93
NET REDUCTION FROM DEDUCTIBLE	48.43	48.59	48.69	48.83	48.96	49.08	49.18
NET PER CLAIM, 50 DEDUCTIBLE	250.29	262.68	274.12	281.93	284.30	279.22	265.19
D EQUAL 100							
G OF D	.7281	.7441	.7596	.7746	.7891	.8030	.8163
G OF D × D	72.81	74.41	75.96	77.46	78.91	80.30	81.63
H OF D	.0545	.0494	.0446	.0402	.0361	.0324	.0290
H OF D × MEAN	16.35	15.56	14.75	13.96	13.16	12.41	11.66
NET REDUCTION FROM DEDUCTIBLE	89.16	89.97	90.71	91.42	92.07	92.71	93.29
NET PER CLAIM, 100 DEDUCTIBLE	209.56	221.30	232.10	239.34	241.19	235.59	221.08
D EQUAL 250							
G OF D	.3767	.3955	.4145	.4337	.4531	.4726	.4921
G OF D × D	94.18	98.88	103.63	108.43	113.28	118.15	123.03
H OF D	.2480	.2328	.2180	.2039	.1903	.1773	.1648
H OF D × MEAN	74.40	73.33	72.10	70.81	69.39	67.88	66.25
NET REDUCTION FROM DEDUCTIBLE	168.58	172.21	175.73	179.24	182.67	186.03	189.28
NET PER CLAIM, 250 DEDUCTIBLE	130.14	139.06	147.08	151.52	150.59	142.27	125.09
D EQUAL 500							
G OF D	.1560	.1680	.1807	.1939	.2076	.2219	.2368
G OF D × D	78.00	84.00	90.35	96.95	103.80	110.95	118.40
H OF D	.5064	.4869	.4673	.4479	.4285	.4094	.3905
H OF D × MEAN	151.92	153.37	154.56	155.55	156.25	156.75	156.99
NET REDUCTION FROM DEDUCTIBLE	229.92	237.37	244.91	252.50	260.05	267.70	275.39
NET PER CLAIM, 500 DEDUCTIBLE	68.80	73.90	77.90	78.26	73.21	60.60	38.98
D EQUAL 1000							
G OF D	.0439	.0486	.0537	.0593	.0653	.0718	.0788
G OF D × D	43.90	48.60	53.70	59.30	65.30	71.80	78.50
H OF D	.7620	.7466	.7307	.7142	.6973	.6800	.6622
H OF D × MEAN	228.60	235.18	241.68	248.03	254.27	260.36	266.22
NET REDUCTION FROM DEDUCTIBLE	272.50	283.78	295.38	307.33	319.57	332.16	345.02
NET PER CLAIM, 1000 DEDUCTIBLE	26.22	27.49	27.43	23.43	13.69	****	****

EXHIBIT VII—SHEET 3

NET COST BY AGE GROUP FOR REPAIR COST CLASS 400

INITIAL LIST PRICE	3000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	400.00	420.00	441.00	463.05	486.20	510.51	536.04
LIMIT POINT, L	3000.00	2250.00	1687.50	1265.63	949.22	711.92	533.94
G OF L	.0058	.0145	.0324	.0657	.1210	.2028	.3109
G OF L × L	17.40	32.63	54.68	83.15	114.86	144.38	166.00
J OF L	.0633	.1171	.1972	.3038	.4305	.5648	.6920
J OF L × MEAN	25.32	49.18	86.97	140.67	209.31	288.34	370.94
NET REDUCTION FROM LIMIT	7.92	16.55	32.29	57.52	94.45	143.96	204.94
NET PER CLAIM, NO DEDUCTIBLE	392.08	403.45	408.71	405.53	391.75	366.55	331.10
D EQUAL 50							
G OF D	.9444	.9497	.9546	.9591	.9632	.9670	.9704
G OF D × D	47.22	47.49	47.73	47.96	48.16	48.35	48.52
H OF D	.0048	.0042	.0036	.0032	.0026	.0024	.0020
H OF D × MEAN	1.92	1.76	1.59	1.48	1.26	1.23	1.07
NET REDUCTION FROM DEDUCTIBLE	49.14	49.25	49.32	49.44	49.42	49.58	49.59
NET PER CLAIM, 50 DEDUCTIBLE	342.94	354.20	359.39	356.09	342.33	316.97	281.51
D EQUAL 100							
G OF D	.8149	.8278	.8400	.8516	.8626	.8732	.8831
G OF D × D	81.49	82.78	84.00	85.16	86.26	87.32	88.31
H OF D	.0294	.0262	.0233	.0208	.0184	.0163	.0144
H OF D × MEAN	11.76	11.00	10.28	9.63	8.95	8.32	7.72
NET REDUCTION FROM DEDUCTIBLE	93.25	93.78	94.28	94.79	95.21	95.64	96.03
NET PER CLAIM, 100 DEDUCTIBLE	298.83	309.67	314.43	310.74	296.54	270.91	235.07
D EQUAL 250							
G OF D	.4901	.5097	.5292	.5487	.5680	.5872	.6062
G OF D × D	122.53	127.43	132.30	137.18	142.00	146.80	151.55
H OF D	.1660	.1541	.1427	.1320	.1217	.1122	.1031
H OF D × MEAN	66.40	64.72	62.93	61.12	59.17	57.28	55.27
NET REDUCTION FROM DEDUCTIBLE	188.93	192.15	195.23	198.30	201.17	204.08	206.82
NET PER CLAIM, 250 DEDUCTIBLE	203.15	211.30	213.48	207.23	190.58	162.47	124.28
D EQUAL 500							
G OF D	.2352	.2506	.2664	.2828	.2996	.3168	.3345
G OF D × D	117.60	125.30	133.20	141.40	149.80	158.40	167.25
H OF D	.3924	.3737	.3552	.3372	.3194	.3021	.2852
H OF D × MEAN	156.96	156.95	156.64	156.14	155.29	154.23	152.88
NET REDUCTION FROM DEDUCTIBLE	274.56	282.25	289.84	297.54	305.09	312.63	320.13
NET PER CLAIM, 500 DEDUCTIBLE	117.52	121.20	118.87	107.99	86.66	53.92	10.97
D EQUAL 1000							
G OF D	.0780	.0855	.0934	.1018	.1108	.1203	.1305
G OF D × D	78.00	85.50	93.40	101.80	110.80	120.30	130.50
H OF D	.6641	.6461	.6277	.6090	.5900	.5709	.5515
H OF D × MEAN	265.64	271.36	276.82	282.00	286.86	291.45	295.63
NET REDUCTION FROM DEDUCTIBLE	343.64	356.86	370.22	383.80	397.66	411.75	426.13
NET PER CLAIM, 1000 DEDUCTIBLE	48.44	46.59	38.49	21.73	****	****	****

EXHIBIT VII—SHEET 4

NET COST BY AGE GROUP FOR REPAIR COST CLASS 400

INITIAL LIST PRICE	6000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	400.00	420.00	441.00	463.05	486.20	510.51	536.04
LIMIT POINT, L	6000.00	4500.00	3375.00	2531.25	1898.44	1423.83	1067.87
G OF L	.0006	.0020	.0055	.0137	.0310	.0632	.1170
G OF L × L	3.60	9.00	18.56	34.68	58.85	89.99	124.94
J OF L	.0130	.0296	.0607	.1131	.1916	.2967	.4225
J OF L × MEAN	5.20	12.43	26.77	52.37	93.16	151.47	226.48
NET REDUCTION FROM LIMIT	1.60	3.43	8.21	17.69	34.31	61.48	101.54
NET PER CLAIM, NO DEDUCTIBLE	398.40	416.57	432.79	445.36	451.89	449.03	434.50
D EQUAL 50							
G OF D	.9444	.9497	.9546	.9591	.9632	.9670	.9704
G OF D × D	47.22	47.49	47.73	47.96	48.16	48.35	48.52
H OF D	.0048	.0042	.0036	.0032	.0026	.0024	.0020
H OF D × MEAN	1.92	1.76	1.59	1.48	1.26	1.23	1.07
NET REDUCTION FROM DEDUCTIBLE	49.14	49.25	49.32	49.44	49.42	49.58	49.59
NET PER CLAIM, 50 DEDUCTIBLE	349.26	367.32	383.47	395.92	402.47	399.45	384.91
D EQUAL 100							
G OF D	.8149	.8278	.8400	.8516	.8626	.8732	.8831
G OF D × D	81.49	82.78	84.00	85.16	86.26	87.32	88.31
H OF D	.0294	.0262	.0233	.0208	.0184	.0163	.0144
H OF D × MEAN	11.76	11.00	10.28	9.63	8.95	8.32	7.72
NET REDUCTION FROM DEDUCTIBLE	93.25	93.78	94.28	94.79	95.21	95.64	96.03
NET PER CLAIM, 100 DEDUCTIBLE	305.15	322.79	338.51	350.57	356.68	353.39	338.47
D EQUAL 250							
G OF D	.4901	.5097	.5292	.5487	.5680	.5872	.6062
G OF D × D	122.53	127.43	132.30	137.18	142.00	146.80	151.55
H OF D	.1660	.1541	.1427	.1320	.1217	.1122	.1031
H OF D × MEAN	66.40	64.72	62.93	61.12	59.17	57.28	55.27
NET REDUCTION FROM DEDUCTIBLE	188.93	192.15	195.23	198.30	201.17	204.08	206.82
NET PER CLAIM, 250 DEDUCTIBLE	209.47	224.42	237.56	247.06	250.72	244.95	227.68
D EQUAL 500							
G OF D	.2352	.2506	.2664	.2828	.2996	.3168	.3345
G OF D × D	117.60	125.30	133.20	141.40	149.80	158.40	167.25
H OF D	.3924	.3737	.3552	.3372	.3194	.3021	.2852
H OF D × MEAN	156.96	156.95	156.64	156.14	155.29	154.23	152.88
NET REDUCTION FROM DEDUCTIBLE	274.56	282.25	289.84	297.54	305.09	312.63	320.13
NET PER CLAIM, 500 DEDUCTIBLE	123.84	134.32	142.95	147.82	146.80	136.40	114.37
D EQUAL 1000							
G OF D	.0780	.0855	.0934	.1018	.1108	.1203	.1305
G OF D × D	78.00	85.50	93.40	101.80	110.80	120.30	130.50
H OF D	.6641	.6461	.6277	.6090	.5900	.5709	.5515
H OF D × MEAN	265.64	271.36	276.82	282.00	286.86	291.45	295.63
NET REDUCTION FROM DEDUCTIBLE	343.64	356.86	370.22	383.80	397.66	411.75	426.13
NET PER CLAIM, 1000 DEDUCTIBLE	54.76	59.71	62.57	61.56	54.23	37.28	8.37

EXHIBIT VII—SHEET 5

NET COST BY AGE GROUP FOR REPAIR COST CLASS 500

INITIAL LIST PRICE	3000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	500.00	525.00	551.25	578.81	607.75	638.14	670.05
LIMIT POINT, L	3000.00	2250.00	1687.50	1265.63	949.22	711.92	533.94
G OF L	.0107	.0250	.0523	.0997	.1722	.2718	.3939
G OF L × L	32.10	56.25	88.26	126.18	163.46	193.50	210.32
J OF L	.0962	.1671	.2652	.3862	.5196	.6508	.7660
J OF L × MEAN	48.10	87.73	146.19	223.54	315.79	415.30	513.26
NET REDUCTION FROM LIMIT	16.00	31.48	57.93	97.36	152.33	221.80	302.94
NET PER CLAIM, NO DEDUCTIBLE	484.00	493.52	493.32	481.45	455.42	416.34	367.11
D EQUAL 50							
G OF D	.9654	.9690	.9723	.9753	.9779	.9804	.9827
G OF D × D	48.27	48.45	48.62	48.77	48.90	49.02	49.14
H OF D	.0024	.0021	.0018	.0015	.0013	.0012	.0009
H OF D × MEAN	1.20	1.10	.99	.87	.79	.77	.60
NET REDUCTION FROM DEDUCTIBLE	49.47	49.55	49.61	49.64	49.69	49.79	49.74
NET PER CLAIM, 50 DEDUCTIBLE	434.53	443.97	443.71	431.81	405.73	366.55	317.37
D EQUAL 100							
G OF D	.8687	.8789	.8885	.8975	.9060	.9140	.9214
G OF D × D	86.87	87.89	88.85	89.75	90.60	91.40	92.14
H OF D	.0172	.0152	.0135	.0119	.0103	.0091	.0080
H OF D × MEAN	8.60	7.98	7.44	6.89	6.26	5.81	5.36
NET REDUCTION FROM DEDUCTIBLE	95.47	95.87	96.29	96.64	96.86	97.21	97.50
NET PER CLAIM, 100 DEDUCTIBLE	388.53	397.65	397.03	384.81	358.56	319.13	269.61
D EQUAL 250							
G OF D	.5790	.5981	.6170	.6356	.6538	.6717	.6892
G OF D × D	144.75	149.53	154.25	158.90	163.45	167.93	172.30
H OF D	.1162	.1069	.0981	.0899	.0822	.0750	.0683
H OF D × MEAN	58.10	56.12	54.08	52.04	49.96	47.86	45.76
NET REDUCTION FROM DEDUCTIBLE	202.85	205.65	208.33	210.94	213.41	215.79	218.06
NET PER CLAIM, 250 DEDUCTIBLE	281.15	287.87	284.99	270.51	242.01	200.55	149.05
D EQUAL 500							
G OF D	.3094	.3269	.3448	.3631	.3816	.4005	.4195
G OF D × D	154.70	163.45	172.40	181.55	190.80	200.25	209.75
H OF D	.3094	.2924	.2758	.2596	.2440	.2289	.2143
H OF D × MEAN	154.70	153.51	152.03	150.26	148.29	146.07	143.59
NET REDUCTION FROM DEDUCTIBLE	309.40	316.96	324.43	331.81	339.09	346.32	353.34
NET PER CLAIM, 500 DEDUCTIBLE	174.60	176.56	168.89	149.64	116.33	70.02	13.77
D EQUAL 1000							
G OF D	.1162	.1261	.1365	.1475	.1591	.1714	.1841
G OF D × D	116.20	126.10	136.50	147.50	159.10	171.40	184.10
H OF D	.5790	.5598	.5403	.5209	.5013	.4817	.4622
H OF D × MEAN	289.50	293.90	297.84	301.50	304.67	307.39	309.70
NET REDUCTION FROM DEDUCTIBLE	405.70	420.00	434.34	449.00	463.77	478.79	493.80
NET PER CLAIM, 1000 DEDUCTIBLE	78.30	73.52	58.98	32.45	****	****	****

EXHIBIT VII—SHEET 6

NET COST BY AGE GROUP FOR REPAIR COST CLASS 500

INITIAL LIST PRICE	6000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	500.00	525.00	551.25	578.81	607.75	638.14	670.05
LIMIT POINT, L	6000.00	4500.00	3375.00	2531.25	1898.44	1423.83	1067.87
G OF L	.0013	.0040	.0102	.0238	.0503	.0961	.1670
G OF L × L	7.80	18.00	34.43	60.24	95.49	136.83	178.33
J OF L	.0227	.0482	.0927	.1621	.2586	.3785	.5115
J OF L × MEAN	11.35	25.31	51.10	93.83	157.16	241.54	342.73
NET REDUCTION FROM LIMIT	3.55	7.31	16.67	33.59	61.67	104.71	164.40
NET PER CLAIM, NO DEDUCTIBLE	496.45	517.69	534.58	545.22	546.08	533.43	505.65
D EQUAL 50							
G OF D	.9654	.9690	.9723	.9753	.9779	.9804	.9827
G OF D × D	48.27	48.45	48.62	48.77	48.90	49.02	49.14
H OF D	.0024	.0021	.0018	.0015	.0013	.0012	.0009
H OF D × MEAN	1.20	1.10	.99	.87	.79	.77	.60
NET REDUCTION FROM DEDUCTIBLE	49.47	49.55	49.61	49.64	49.69	49.79	49.74
NET PER CLAIM, 50 DEDUCTIBLE	446.98	468.14	484.97	495.58	496.39	483.64	455.91
D EQUAL 100							
G OF D	.8687	.8789	.8885	.8975	.9060	.9140	.9214
G OF D × D	86.87	87.89	88.85	89.75	90.60	91.40	92.14
H OF D	.0172	.0152	.0135	.0119	.0103	.0091	.0080
H OF D × MEAN	8.60	7.98	7.44	6.89	6.26	5.81	5.36
NET REDUCTION FROM DEDUCTIBLE	95.47	95.87	96.29	96.64	96.86	97.21	97.50
NET PER CLAIM, 100 DEDUCTIBLE	400.98	421.82	438.29	448.58	449.22	436.22	408.15
D EQUAL 250							
G OF D	.5790	.5981	.6170	.6356	.6538	.6717	.6892
G OF D × D	144.75	149.53	154.25	158.90	163.45	167.93	172.30
H OF D	.1162	.1069	.0981	.0899	.0822	.0750	.0683
H OF D × MEAN	58.10	56.12	54.08	52.04	49.96	47.86	45.76
NET REDUCTION FROM DEDUCTIBLE	202.85	205.65	208.33	210.94	213.41	215.79	218.06
NET PER CLAIM, 250 DEDUCTIBLE	293.60	312.04	326.25	334.28	332.67	317.64	287.59
D EQUAL 500							
G OF D	.3094	.3269	.3448	.3631	.3816	.4005	.4195
G OF D × D	154.70	163.45	172.40	181.55	190.80	200.25	209.75
H OF D	.3094	.2924	.2758	.2596	.2440	.2289	.2143
H OF D × MEAN	154.70	153.51	152.03	150.26	148.29	146.07	143.59
NET REDUCTION FROM DEDUCTIBLE	309.40	316.96	324.43	331.81	339.09	346.32	353.34
NET PER CLAIM, 500 DEDUCTIBLE	187.05	200.73	210.15	213.41	206.99	187.11	152.31
D EQUAL 1000							
G OF D	.1162	.1261	.1365	.1475	.1591	.1714	.1841
G OF D × D	116.20	126.10	136.50	147.50	159.10	171.40	184.10
H OF D	.5790	.5598	.5403	.5209	.5013	.4817	.4622
H OF D × MEAN	289.50	293.90	297.84	301.50	304.67	307.39	309.70
NET REDUCTION FROM DEDUCTIBLE	405.70	420.00	434.34	449.00	463.77	478.79	493.80
NET PER CLAIM, 1000 DEDUCTIBLE	90.75	97.69	100.24	96.22	82.31	54.64	11.85

EXHIBIT VII—SHEET 7

NET COST BY AGE GROUP FOR REPAIR COST CLASS 600

INITIAL LIST PRICE	4000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	600.00	630.00	661.50	694.58	729.31	765.78	804.07
LIMIT POINT, L	4000.00	3000.00	2250.00	1687.50	1265.63	949.22	711.92
G OF L	.0080	.0194	.0420	.0823	.1465	.2379	.3538
G OF L × L	32.00	58.20	94.50	138.88	185.41	225.82	251.88
J OF L	.0793	.1420	.2317	.3464	.4774	.6108	.7323
J OF L × MEAN	47.58	89.46	153.27	240.60	348.17	467.74	588.82
NET REDUCTION FROM LIMIT	15.58	31.26	58.77	101.72	162.76	241.92	336.94
NET PER CLAIM, NO DEDUCTIBLE	584.42	598.74	602.73	592.86	566.55	523.86	467.13
D EQUAL 50							
G OF D	.9773	.9798	.9821	.9841	.9860	.9876	.9891
G OF D × D	48.87	48.99	49.11	49.21	49.30	49.38	49.46
H OF D	.0013	.0012	.0010	.0008	.0007	.0006	.0006
H OF D × MEAN	.78	.76	.66	.56	.51	.46	.48
NET REDUCTION FROM DEDUCTIBLE	49.65	49.75	49.77	49.77	49.81	49.84	49.94
NET PER CLAIM, 50 DEDUCTIBLE	534.77	548.99	552.96	543.09	516.74	474.02	417.19
D EQUAL 100							
G OF D	.9038	.9119	.9195	.9266	.9332	.9394	.9450
G OF D × D	90.38	91.19	91.95	92.66	93.32	93.94	94.50
H OF D	.0108	.0095	.0082	.0072	.0063	.0055	.0048
H OF D × MEAN	6.48	5.99	5.42	5.00	4.59	4.21	3.86
NET REDUCTION FROM DEDUCTIBLE	96.86	97.18	97.37	97.66	97.91	98.15	98.36
NET PER CLAIM, 100 DEDUCTIBLE	487.56	501.56	505.36	495.20	468.64	425.71	368.77
D EQUAL 250							
G OF D	.6490	.6671	.6847	.7019	.7187	.7350	.7508
G OF D × D	162.25	166.78	171.18	175.48	179.68	183.75	187.70
H OF D	.0841	.0768	.0700	.0637	.0578	.0523	.0473
H OF D × MEAN	50.46	48.38	46.31	44.24	42.15	40.05	38.03
NET REDUCTION FROM DEDUCTIBLE	212.71	215.16	217.49	219.72	221.83	223.80	225.73
NET PER CLAIM, 250 DEDUCTIBLE	371.71	383.58	385.24	373.14	344.72	300.06	241.40
D EQUAL 500							
G OF D	.3767	.3955	.4145	.4337	.4531	.4726	.4921
G OF D × D	188.35	197.75	207.25	216.85	226.55	236.30	246.05
H OF D	.2480	.2328	.2180	.2039	.1903	.1773	.1648
H OF D × MEAN	148.80	146.66	144.21	141.62	138.79	135.77	132.51
NET REDUCTION FROM DEDUCTIBLE	337.15	344.41	351.46	358.47	365.34	372.07	378.56
NET PER CLAIM, 500 DEDUCTIBLE	247.27	254.33	251.27	234.39	201.21	151.79	88.57
D EQUAL 1000							
G OF D	.1560	.1680	.1807	.1939	.2076	.2219	.2368
G OF D × D	156.00	168.00	180.70	193.90	207.60	221.90	236.80
H OF D	.5064	.4869	.4673	.4479	.4285	.4094	.3905
H OF D × MEAN	303.84	306.75	309.12	311.10	312.51	313.51	313.99
NET REDUCTION FROM DEDUCTIBLE	459.84	474.75	489.82	505.00	520.11	535.41	550.79
NET PER CLAIM, 1000 DEDUCTIBLE	124.58	123.99	112.91	87.86	46.44	****	****

EXHIBIT VII—SHEET 8

NET COST BY AGE GROUP FOR REPAIR COST CLASS 600

INITIAL LIST PRICE	7000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	600.00	630.00	661.50	694.58	729.31	765.78	804.07
LIMIT POINT, L	7000.00	5250.00	3937.50	2953.13	2214.85	1661.14	1245.86
G OF L	.0014	.0043	.0110	.0255	.0532	.1010	.1742
G OF L X L	9.80	22.58	43.31	75.30	117.83	167.78	217.03
J OF L	.0243	.0511	.0975	.1691	.2679	.3893	.5228
J OF L X MEAN	14.58	32.19	64.50	117.45	195.38	298.12	420.37
NET REDUCTION FROM LIMIT	4.78	9.61	21.19	42.15	77.55	130.34	203.34
NET PER CLAIM, NO DEDUCTIBLE	595.22	620.39	640.31	652.43	651.76	635.44	600.73
D EQUAL 50							
G OF D	.9773	.9798	.9821	.9841	.9860	.9876	.9891
G OF D X D	48.87	48.99	49.11	49.21	49.30	49.38	49.46
H OF D	.0013	.0012	.0010	.0008	.0007	.0006	.0006
H OF D X MEAN	.78	.76	.66	.56	.51	.46	.48
NET REDUCTION FROM DEDUCTIBLE	49.65	49.75	49.77	49.77	49.81	49.84	49.94
NET PER CLAIM, 50 DEDUCTIBLE	545.57	570.64	590.54	602.66	601.95	585.60	550.79
D EQUAL 100							
G OF D	.9038	.9119	.9195	.9266	.9332	.9394	.9450
G OF D X D	90.38	91.19	91.95	92.66	93.32	93.94	94.50
H OF D	.0108	.0095	.0082	.0072	.0063	.0055	.0048
H OF D X MEAN	6.48	5.99	5.42	5.00	4.59	4.21	3.86
NET REDUCTION FROM DEDUCTIBLE	96.86	97.18	97.37	97.66	97.91	98.15	98.36
NET PER CLAIM, 100 DEDUCTIBLE	498.36	523.21	542.94	554.77	553.85	537.29	502.37
D EQUAL 250							
G OF D	.6490	.6671	.6847	.7019	.7187	.7350	.7508
G OF D X D	162.25	166.78	171.18	175.48	179.68	183.75	187.70
H OF D	.0841	.0768	.0700	.0637	.0578	.0523	.0473
H OF D X MEAN	50.46	48.38	46.31	44.24	42.15	40.05	38.03
NET REDUCTION FROM DEDUCTIBLE	212.71	215.16	217.49	219.72	221.83	223.80	225.73
NET PER CLAIM, 250 DEDUCTIBLE	382.51	405.23	422.82	432.71	429.93	411.64	375.00
D EQUAL 500							
G OF D	.3767	.3955	.4145	.4337	.4531	.4726	.4921
G OF D X D	188.35	197.75	207.25	216.85	226.55	236.30	246.05
H OF D	.2480	.2328	.2180	.2039	.1903	.1773	.1648
H OF D X MEAN	148.80	146.66	144.21	141.62	138.79	135.77	132.51
NET REDUCTION FROM DEDUCTIBLE	337.15	344.41	351.46	358.47	365.34	372.07	378.56
NET PER CLAIM, 500 DEDUCTIBLE	258.07	275.98	288.85	293.96	286.42	263.37	222.17
D EQUAL 1000							
G OF D	.1560	.1680	.1807	.1939	.2076	.2219	.2368
G OF D X D	156.00	168.00	180.70	193.90	207.60	221.90	236.80
H OF D	.5064	.4869	.4673	.4479	.4285	.4094	.3905
H OF D X MEAN	303.84	306.75	309.12	311.10	312.51	313.51	313.99
NET REDUCTION FROM DEDUCTIBLE	459.84	474.75	489.82	505.00	520.11	535.41	550.79
NET PER CLAIM, 1000 DEDUCTIBLE	135.38	145.64	150.49	147.43	131.65	100.03	49.94

EXHIBIT VII—SHEET 9

NET COST BY AGE GROUP FOR REPAIR COST CLASS 700

INITIAL LIST PRICE	5000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	700.00	735.00	771.75	810.34	850.86	893.40	938.07
LIMIT POINT, L	5000.00	3750.00	2812.50	2109.38	1582.04	1186.53	889.90
G OF L	.0067	.0163	.0362	.0723	.1312	.2170	.3284
G OF L × L	33.50	61.13	101.81	152.51	207.56	257.48	292.24
J OF L	.0695	.1270	.2111	.3212	.4498	.5840	.7090
J OF L × MEAN	48.65	93.35	162.92	260.28	382.72	521.75	665.09
NET REDUCTION FROM LIMIT	15.15	32.22	61.11	107.77	175.16	264.27	372.85
NET PER CLAIM, NO DEDUCTIBLE	684.85	702.78	710.64	702.57	675.70	629.13	565.22
D EQUAL 50							
G OF D	.9845	.9862	.9879	.9893	.9906	.9919	.9929
G OF D × D	49.23	49.31	49.40	49.47	49.53	49.60	49.65
H OF D	.0008	.0007	.0006	.0005	.0004	.0003	.0002
H OF D × MEAN	.56	.51	.46	.41	.34	.27	.19
NET REDUCTION FROM DEDUCTIBLE	49.79	49.82	49.86	49.88	49.87	49.87	49.84
NET PER CLAIM, 50 DEDUCTIBLE	635.06	652.96	660.78	652.69	625.83	579.26	515.38
D EQUAL 100							
G OF D	.9277	.9342	.9402	.9459	.9510	.9558	.9602
G OF D × D	92.77	93.42	94.02	94.59	95.10	95.58	96.02
H OF D	.0070	.0062	.0054	.0047	.0040	.0035	.0030
H OF D × MEAN	4.90	4.56	4.17	3.81	3.40	3.13	2.81
NET REDUCTION FROM DEDUCTIBLE	97.67	97.98	98.19	98.40	98.50	98.71	98.83
NET PER CLAIM, 100 DEDUCTIBLE	587.18	604.80	612.45	604.17	577.20	530.42	466.39
D EQUAL 250							
G OF D	.7046	.7213	.7376	.7533	.7685	.7832	.7973
G OF D × D	176.15	180.33	184.40	188.33	192.13	195.80	199.33
H OF D	.0628	.0569	.0515	.0465	.0419	.0377	.0339
H OF D × MEAN	43.96	41.82	39.75	37.68	35.65	33.68	31.80
NET REDUCTION FROM DEDUCTIBLE	220.11	222.15	224.15	226.01	227.78	229.48	231.13
NET PER CLAIM, 250 DEDUCTIBLE	464.74	480.63	486.49	476.56	447.92	399.65	334.09
D EQUAL 500							
G OF D	.4368	.4562	.4757	.4952	.5148	.5343	.5538
G OF D × D	218.40	228.10	237.85	247.60	257.40	267.15	276.90
H OF D	.2016	.1882	.1752	.1629	.1511	.1399	.1293
H OF D × MEAN	141.12	138.33	135.21	132.00	128.56	124.99	121.29
NET REDUCTION FROM DEDUCTIBLE	359.52	366.43	373.06	379.60	385.96	392.14	398.19
NET PER CLAIM, 500 DEDUCTIBLE	325.33	336.35	337.58	322.97	289.74	236.99	167.03
D EQUAL 1000							
G OF D	.1960	.2099	.2243	.2392	.2548	.2707	.2872
G OF D × D	196.00	209.90	224.30	239.20	254.80	270.70	287.20
H OF D	.4448	.4255	.4064	.3875	.3688	.3504	.3324
H OF D × MEAN	311.36	312.74	313.64	314.01	313.80	313.05	311.81
NET REDUCTION FROM DEDUCTIBLE	507.36	522.64	537.94	553.21	568.60	583.75	599.01
NET PER CLAIM, 1000 DEDUCTIBLE	177.49	180.14	172.70	149.36	107.10	45.38	****

EXHIBIT VII—SHEET 10

NET COST BY AGE GROUP FOR REPAIR COST CLASS 700

INITIAL LIST PRICE	8000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	700.00	735.00	771.75	810.34	850.86	893.40	938.07
LIMIT POINT, L	8000.00	6000.00	4500.00	3375.00	2531.25	1898.44	1423.83
G OF L	.0016	.0046	.0116	.0267	.0556	.1047	.1796
G OF L × L	12.80	27.60	52.20	90.11	140.74	198.77	255.72
J OF L	.0255	.0534	.1011	.1744	.2747	.3973	.5310
J OF L × MEAN	17.85	39.25	78.02	141.32	233.73	354.95	498.12
NET REDUCTION FROM LIMIT	5.05	11.65	25.82	51.21	92.99	156.18	242.40
NET PER CLAIM, NO DEDUCTIBLE	694.95	723.35	745.93	759.13	757.87	737.22	695.67
D EQUAL 50							
G OF D	.9845	.9862	.9879	.9893	.9906	.9919	.9929
G OF D × D	49.23	49.31	49.40	49.47	49.53	49.60	49.65
H OF D	.0008	.0007	.0006	.0005	.0004	.0003	.0002
H OF D × MEAN	.56	.51	.46	.41	.34	.27	.19
NET REDUCTION FROM DEDUCTIBLE	49.79	49.82	49.86	49.88	49.87	49.87	49.84
NET PER CLAIM, 50 DEDUCTIBLE	645.16	673.53	696.07	709.25	708.00	687.35	645.83
D EQUAL 100							
G OF D	.9277	.9342	.9402	.9459	.9510	.9558	.9602
G OF D × D	92.77	93.42	94.02	94.59	95.10	95.58	96.02
H OF D	.0070	.0062	.0054	.0047	.0040	.0035	.0030
H OF D × MEAN	4.90	4.56	4.17	3.81	3.40	3.13	2.81
NET REDUCTION FROM DEDUCTIBLE	97.67	97.98	98.19	98.40	98.50	98.71	98.83
NET PER CLAIM, 100 DEDUCTIBLE	597.28	625.37	647.74	660.73	659.37	638.51	596.84
D EQUAL 250							
G OF D	.7046	.7213	.7376	.7533	.7685	.7832	.7973
G OF D × D	176.15	180.33	184.40	188.33	192.13	195.80	199.33
H OF D	.0628	.0569	.0515	.0465	.0419	.0377	.0339
H OF D × MEAN	43.96	41.82	39.75	37.68	35.65	33.68	31.80
NET REDUCTION FROM DEDUCTIBLE	220.11	222.15	224.15	226.01	227.78	229.48	231.13
NET PER CLAIM, 250 DEDUCTIBLE	474.84	501.20	521.78	533.12	530.09	507.74	464.54
D EQUAL 500							
G OF D	.4368	.4562	.4757	.4952	.5148	.5343	.5538
G OF D × D	218.40	228.10	237.85	247.60	257.40	267.15	276.90
H OF D	.2016	.1882	.1752	.1629	.1511	.1399	.1293
H OF D × MEAN	141.12	138.33	135.21	132.00	128.56	124.99	121.29
NET REDUCTION FROM DEDUCTIBLE	359.52	366.43	373.06	379.60	385.96	392.14	398.19
NET PER CLAIM, 500 DEDUCTIBLE	335.43	356.92	372.87	379.53	371.91	345.08	297.48
D EQUAL 1000							
G OF D	.1960	.2099	.2243	.2392	.2548	.2707	.2872
G OF D × D	196.00	209.90	224.30	239.20	254.80	270.70	287.20
H OF D	.4448	.4255	.4064	.3875	.3688	.3504	.3324
H OF D × MEAN	311.36	312.74	313.64	314.01	313.80	313.05	311.81
NET REDUCTION FROM DEDUCTIBLE	507.36	522.64	537.94	553.21	568.60	583.75	599.01
NET PER CLAIM, 1000 DEDUCTIBLE	187.59	200.71	207.99	205.92	189.27	153.47	96.66

EXHIBIT VII—SHEET 11

NET COST BY AGE GROUP FOR REPAIR COST CLASS 800

INITIAL LIST PRICE	6000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	800.00	840.00	882.00	926.10	972.41	1021.03	1072.08
LIMIT POINT, L	6000.00	4500.00	3375.00	2531.25	1898.44	1423.83	1067.87
G OF L	.0058	.0145	.0324	.0657	.1210	.2028	.3109
G OF L × L	34.80	65.25	109.35	166.30	229.71	288.75	332.00
J OF L	.0633	.1171	.1972	.3038	.4305	.5648	.6920
J OF L × MEAN	50.64	98.36	173.93	281.35	418.62	576.68	741.88
NET REDUCTION FROM LIMIT	15.84	33.11	64.58	115.05	188.91	287.93	409.88
NET PER CLAIM, NO DEDUCTIBLE	784.16	806.89	817.42	811.05	783.50	733.10	662.20
D EQUAL 50							
G OF D	.9890	.9903	.9915	.9927	.9936	.9944	.9951
G OF D × D	49.45	49.52	49.58	49.64	49.68	49.72	49.76
H OF D	.0005	.0004	.0004	.0002	.0002	.0003	.0002
H OF D × MEAN	.40	.34	.35	.19	.19	.31	.21
NET REDUCTION FROM DEDUCTIBLE	49.85	49.86	49.93	49.83	49.87	50.03	49.97
NET PER CLAIM, 50 DEDUCTIBLE	734.31	757.03	767.49	761.22	733.63	683.07	612.23
D EQUAL 100							
G OF D	.9444	.9497	.9546	.9591	.9632	.9670	.9704
G OF D × D	94.44	94.97	95.46	95.91	96.32	96.70	97.04
H OF D	.0048	.0042	.0036	.0032	.0026	.0024	.0020
H OF D × MEAN	3.84	3.53	3.18	2.96	2.53	2.45	2.14
NET REDUCTION FROM DEDUCTIBLE	98.28	98.50	98.64	98.87	98.85	99.15	99.18
NET PER CLAIM, 100 DEDUCTIBLE	685.88	708.39	718.78	712.18	684.65	633.95	563.02
D EQUAL 250							
G OF D	.7491	.7645	.7793	.7936	.8073	.8205	.8330
G OF D × D	187.28	191.13	194.83	198.40	201.83	205.13	208.25
H OF D	.0478	.0431	.0387	.0348	.0312	.0279	.0249
H OF D × MEAN	38.24	36.20	34.13	32.23	30.34	28.49	26.69
NET REDUCTION FROM DEDUCTIBLE	225.52	227.33	228.96	230.63	232.17	233.62	234.94
NET PER CLAIM, 250 DEDUCTIBLE	558.64	579.56	588.46	580.42	551.33	499.48	427.26
D EQUAL 500							
G OF D	.4901	.5097	.5292	.5487	.5680	.5872	.6062
G OF D × D	245.05	254.85	264.60	274.35	284.00	293.60	303.10
H OF D	.1660	.1541	.1427	.1320	.1217	.1122	.1031
H OF D × MEAN	132.80	129.44	125.86	122.25	118.34	114.56	110.53
NET REDUCTION FROM DEDUCTIBLE	377.85	384.29	390.46	396.60	402.34	408.16	413.63
NET PER CLAIM, 500 DEDUCTIBLE	406.31	422.60	426.96	414.45	381.16	324.94	248.57
D EQUAL 1000							
G OF D	.2352	.2506	.2664	.2828	.2996	.3168	.3345
G OF D × D	235.20	250.60	266.40	282.80	299.60	316.80	334.50
H OF D	.3924	.3737	.3552	.3372	.3194	.3021	.2852
H OF D × MEAN	313.92	313.91	313.29	312.28	310.59	308.45	305.76
NET REDUCTION FROM DEDUCTIBLE	549.12	564.51	579.69	595.08	610.19	625.25	640.26
NET PER CLAIM, 1000 DEDUCTIBLE	235.04	242.38	237.73	215.97	173.31	107.85	21.94

EXHIBIT VII—SHEET 12

NET COST BY AGE GROUP FOR REPAIR COST CLASS 800

INITIAL LIST PRICE	9000	DEPRECIATION FACTOR	.75
TREND FACTOR	1.050	COEFFICIENT OF VARIATION	1.3

	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7
MEAN REPAIR COST, NO LIMIT	800.00	840.00	882.00	926.10	972.41	1021.03	1072.08
LIMIT POINT, L	9000.00	6750.00	5062.50	3796.88	2847.66	2135.75	1601.81
G OF L	.0017	.0048	.0121	.0277	.0574	.1076	.1838
G OF L × L	15.30	32.40	61.26	105.17	163.46	229.81	294.41
J OF L	.0265	.0551	.1040	.1785	.2801	.4034	.5374
J OF L × MEAN	21.20	46.28	91.73	165.31	272.37	411.88	576.14
NET REDUCTION FROM LIMIT	5.90	13.88	30.47	60.14	108.91	182.07	281.73
NET PER CLAIM, NO DEDUCTIBLE	794.10	826.12	851.53	865.96	863.50	838.96	790.35
D EQUAL 50							
G OF D	.9890	.9903	.9915	.9927	.9936	.9944	.9951
G OF D × D	49.45	49.52	49.58	49.64	49.68	49.72	49.76
H OF D	.0005	.0004	.0004	.0002	.0002	.0003	.0002
H OF D × MEAN	.40	.34	.35	.19	.19	.31	.21
NET REDUCTION FROM DEDUCTIBLE	49.85	49.86	49.93	49.83	49.87	50.03	49.97
NET PER CLAIM, 50 DEDUCTIBLE	744.25	776.26	801.60	816.13	813.63	788.93	740.38
D EQUAL 100							
G OF D	.9444	.9497	.9546	.9591	.9632	.9670	.9704
G OF D × D	94.44	94.97	95.46	95.91	96.32	96.70	97.04
H OF D	.0048	.0042	.0036	.0032	.0026	.0024	.0020
H OF D × MEAN	3.84	3.53	3.18	2.96	2.53	2.45	2.14
NET REDUCTION FROM DEDUCTIBLE	98.28	98.50	98.64	98.87	98.85	99.15	99.18
NET PER CLAIM, 100 DEDUCTIBLE	695.82	727.62	752.89	767.09	764.65	739.81	691.17
D EQUAL 250							
G OF D	.7491	.7645	.7793	.7936	.8073	.8205	.8330
G OF D × D	187.28	191.13	194.83	198.40	201.83	205.13	208.25
H OF D	.0478	.0431	.0387	.0348	.0312	.0279	.0249
H OF D × MEAN	38.24	36.20	34.13	32.23	30.34	28.49	26.69
NET REDUCTION FROM DEDUCTIBLE	225.52	227.33	228.96	230.63	232.17	233.62	234.94
NET PER CLAIM, 250 DEDUCTIBLE	568.58	598.79	622.57	635.33	631.33	605.34	555.41
D EQUAL 500							
G OF D	.4901	.5097	.5292	.5487	.5680	.5872	.6062
G OF D × D	245.05	254.85	264.60	274.35	284.00	293.60	303.10
H OF D	.1660	.1541	.1427	.1320	.1217	.1122	.1031
H OF D × MEAN	132.80	129.44	125.86	122.25	118.34	114.56	110.53
NET REDUCTION FROM DEDUCTIBLE	377.85	384.29	390.46	396.60	402.34	408.16	413.63
NET PER CLAIM, 500 DEDUCTIBLE	416.25	441.83	461.07	469.36	461.16	430.80	376.72
D EQUAL 1000							
G OF D	.2352	.2506	.2664	.2828	.2996	.3168	.3345
G OF D × D	235.20	250.60	266.40	282.80	299.60	316.80	334.50
H OF D	.3924	.3737	.3552	.3372	.3194	.3021	.2852
H OF D × MEAN	313.92	313.91	313.29	312.28	310.59	308.45	305.76
NET REDUCTION FROM DEDUCTIBLE	549.12	564.51	579.69	595.08	610.19	625.25	640.26
NET PER CLAIM, 1000 DEDUCTIBLE	244.98	261.61	271.84	270.88	253.31	213.71	150.09