Simulating Serious Workers' Compensation Claims

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Abstract

This paper presents a rationale for using simulation to generate samples of serious Workers' Compensation claims. It further describes choices which must be made in sources and use of data as well as procedure and interpretation of results. Components of a specific model are developed and a few conclusions drawn based on our knowledge of some actual studies using simulation.

Background

The description of size of loss distributions for any of the major lines of insurance has been a subject of much discussion in the literature of the Casualty Actuarial Society since its inception. Much of this discussion has centered on tabulating, trending, developing and fitting curves to existing empiric samples. We have come a long way in this area of research.

The need for accurate size of loss distributions in Workers' Compensation insurance is especially great. Estimating costs and consequences of purchasing or providing excess insurance/reinsurance, evaluating the effects of accident limitations in a retro plan, or as an input to the estimate of an aggregate loss distribution are some of the possible applications. One could easily imagine sundry applications to other than excess ratemaking, such as class ratemaking, or evaluation of experience rating parameters, notably D-ratios, or even reserving, that do not come under those headings.

Unfortunately, the Workers' Compensation severity distribution is especially difficult to describe analytically, much less project to some future coverage period. Samples exist only of past experience, which may not be relevant. Trend and development models are some attempts to deal with this which can be trained to work quite well, especially of the less volatile or shorter tailed lines of insurance. Workers' Compensation is subject not only to the problems of trend and development as in other long-tailed lines but the further complication of legislative changes which affect future losses and often not in a way that is proportional by size.

A further complication to the development problem is the custom of many insurers to reserve serious Workers' Compensation claims on a present value basis. This not only means a compactification of claims along the time value of money, but a discount for mortality, which is really a kind of an averaging process akin to but different from assuming everyone lives their life expectancy. Some will eventually live longer and some less, spreading out the distribution. The discount for interest is greatest in cases with longest life expectancy, usually the costliest cases, so further reducing the spread.

Since benefit provisions differ from state to state, it is difficult to determine which states can be meaningfully combined with others. Unfortunately, single states do not usually generate enough claims to confidently estimate statistics of the severity distribution. Use of more years' data can increase the number of claims but this puts greater dependence on trend and development models mentioned above. Still, it is not impossible to adjust individual claims for the effects of law amendments or even model the dispersion of claim durations using life tables; this may be useful and would incorporate many of the elements of the simulation approach to be discussed below.

It would be well to review the literature on sampling techniques before describing the simulation process. In a very real way, simulation merely produces an ersatz sample which can be - and has been - used in the same way as the empiric one.

One should perhaps look at Dunbar Uhthoff's 1950 treatise on Excess Loss Ratios but since neither of our Proceedings collections go back that far, we find Frank Harwayne's more up to date "Accident Limitations for Retrospective Rating" of 1976 to be preferable.

Harwayne looks at collections of claims by serious injury type - Fatal, Permanent Total and Major Permanent Partial to first determine excess ratios for claim amounts expressed as a ratio to average. This is a key idea and allows one to generate overall excess ratios by expressing a loss limit as a ratio to the state-wide averages by type, then weighting the appropriate three excess ratios by the relative amount of loss in each injury type. Using ratios to average in the tables of excess ratios makes it easy to recognize scale differences in size of loss distributions by state or hazard group. Differences in the shapes of the distributions, however, are still not accounted for.

Of course, the weighted excess loss ratio is still not an ELPF. Adjustments must be made for loss development, law change, multiple claim occurrences, risk and, of course, a loss to premium ratio before a usable number will be had. It is in these adjustments that the procedure is weakest, for judgement plays such a large part in the evaluation of their effects.

Still, the basic idea of a weighted excess ratio by injury type stands as a paragon for all that follows.

Directions of Research

The problem of simulating Workers' Compensation serious claims has been addressed by several actuaries, including Gary Venter and Gregg Evans at Prudential Reinsurance (the "PR" Model); the consulting firm of Liscord, Ward and Roy in their 1980 development for the Minnesota Workers' Compensation Reinsurance Association (the "LW&R" Model); Robert Sturgis of Tillinghast, Nelson and Warren in a 1984 revised model for Minnesota, (the "TNW" Model); the research team of Frank Harwayne, Charles Gruber and Michael Schwartz for NCCI in 1981 (the "NCCI" Model); and Lee Steeneck of General Reinsurance (the "GR" Model) who uses simulation to establish reserves for specific excess Workers' Compensation claims. It will be instructive to refer to some of the choices made by each as we discuss the methodology of simulation, but keep in mind the versions of the models we used are not the latest and this paper is not an analysis of the models.

An overview of their approaches will be followed by a more detailed outline of choices necessary to utilize this method.

The essential feature of these models is the creation of an ersatz sample of serious claims from which excess loss ratios can be calculated. These can be used much like the empiric samples in the traditional method described above, however, there are several aspects of the models which demand departure from the historical excess ratio approach. These follow below.

1) Simulation of only Fatal and Permanent Total Claims.

   Due credit must be given to TNW, LW&R and NCCI for attempting simulations of Major Permanent Partial claims but, to our knowledge, this is not used for pricing applications by any of the current models. The overriding influence of administration rather than statute in these cases makes modeling less reliable, the relatively small excess ratio makes it less significant, and the larger number of claims available makes it less necessary.

2) Simulation only of possible outcomes of a single claim.

   Such a strategy is used by General Reinsurance for calculating an average excess reserve for a reported serious claim.

3) The use of trend, development and law change assumptions.

Adjusting historic claims for these phenomena is minimized by simulating at current (or projected) levels of wages and benefits.

4) Escalation and Interest Assumptions.

Historic claims in some states exhibit the effect of statutory adjustments for cost of living, and the reserves at each evaluation may have been discounted for some rate of interest. A proper use of this data in the empiric method should entail adjustment of these parameters for future conditions. Certainly the simulation method must project these effects to future claims. Runs of various models which involved variances of escalation assumptions have demonstrated the dramatic effect on excess pricing of this characteristic.

The Simulation Procedure

The beginning of the simulation procedure is the creation of a large number of individual case situations, to be administered under projected conditions. Many factors affect the size of a Workers' Compensation claim. State law will directly determine the periodic indemnity amount based on type of injury, dependency status (number and ages of dependents), and wage of worker.

Duration probabilities of the payment stream will depend on ages of worker and/or his dependents and the propensity for widows (or widowers) to remarry. The medical portion of a loss can be as large or larger than the indemnity. Other determinants of the loss include state provisions for escalation of benefits, interest assumptions and social security offsets.

Fortunately, distributions for all these factors are available. Fratello's 1955 Proceedings article on "The Workmen's Compensation Injury Table..." contains many. Updates and newer tables have been contributed by NCCI and others.

This information can be synthesized via simulation to produce a loss size distribution. We describe below the simulation of a single claim amount which, done repeatedly, generates a distribution.

The components of loss discussed above are displayed on Exhibit 1. An example of how these can be combined to produce a single claim size follows.

1. <u>Select Type of Claim</u>

   The time honored method for estimating ELPF's uses sample claims to calculate excess loss ratios for the three serious claim types. With simulation, one procedure is to create discrete sets of claims for Fatal (F), Permanent Total (PT) and Major Permanent Partial (MPP) and use them like real claims. Because of difficulties mentioned above, the simulation of MPP claims is usually omitted. In this case, the simulation of F and PT claims are completed separately and the results only combined at the time a total excess ratio is computed. Another procedure is to simulate F and PT claims in a single set, with the relative probabilities of occurrence assigned to each. The resulting set of claims can be used to compute a single excess ratio without weighting. There will still be a need to estimate the effect of MPP claims in both cases, but this is usually a small adjustment.

Let us assume a Fatal claim has been selected in the sequel. The steps for PT are similar but simpler because the benefit flows to the worker and it is not necessary to track life expectancy of a flock of dependents. (It may still be necessary to use dependency status to calculate benefits; in this case, the same tables can be used.)

2. <u>Simulate Dependency Status</u>

Using appropriate injury tables, one must establish type of dependents and their ages. Table 1 is an excerpt from the NCCI injury table for dependency status, which is a 1973 update of Fratello's work. Simulation from this table will be a simple matter of selecting a random number between 1 and 11,397. The process is described in more detail below.

3. Simulate Age of Dependents

Once dependency status is established, it will be easy to use Tables 2, 3 and 4 to choose ages of widows, children or dependent parents. Tables 2 and 4 are taken from the NCCI 1973 update to the Workers' Compensation Injury Table, with the previous numbers shown in parentheses. Table 3 was built from U.S. Census data and Actuarial judgements.

In PT cases, it will be necessary to establish the age of the worker. In these cases, Table 5 from the same NCCI update may be used.

4. Simulate Wage

The wage of the worker will be needed to calculate a benefit amount. Table 6 is the 1973 Standard Wage Distribution table used by NCCI. A random number between 0 and 1 can be used to select an entry in column A, move to the corresponding R value which will be applied to the Statewide Average Weekly Wage (SAWW) to obtain a dollar amount.

5. Alternate Steps 2, 3, 4

It would be naive to assume dependency, age and wage are independent, which is just what has been done up to now. The use of informed judgement to combine data in a reasonable way would be more actuarial than to blithely assume independence. Dependency status, e.g., ought to imply a range of reasonableness for the ages of worker, widow and children. NCCI uses such ranges in their simulations to eliminate unrealistic combinations. Wages should also be related to worker age.

For the PR model, judgement was used to combine the information on the Standard Injury Table with information from the U.S. Bureau of the Census on husband-wife age distributions, number of children by age of mother, and wages by age to produce Tables 7 and 8. These tables were used in a way described now.

The choice of a cell in Table 7 establishes the number and type of dependents and a range of ages for the widow - if one exists - or the worker otherwise. To illustrate how random selection from the table might be done, we can imagine assigning 100,000 individuals to the cells according to the frequencies shown in the exhibit.

Then picking a random number in between 1 and 100,000 specifies a cell, namely the cell the nth individual occupies. If this picking is done enough times, the selected cells will be distributed closely to those in the exhibit. Actual age can be selected as a random draw from within the age group, assuming, e.g., a uniform distribution.

The use of Table 8 would be similar to Table 7 except previous results will determine which row of the table would be used. The non-independence of age/wage/dependency should be obvious in this procedure.

Actual wage amounts must be established by selecting a point in the range and applying it to current or projected state average weekly wage.

Recent evidence shows the average wages of F and PT victims to be significantly greater than the SAWW. It would be appropriate to increase SAWW by a factor of 1.3 or 1.5 or more when extending the tabular values to produce actual wages.

6. Simulate Ages of Children and/or Parents

Since we have established age of the widow or deceased worker, we can now utilize Table 3 to establish the age of the dependent children. The PR model selected a single age from a normal distribution with mean u, where u comes from the table, and variance $\sigma = u/6$. The NCCI model allows the children to have different ages. The PR assumption sacrifices some verisimilitude for the sake of simplicity at minimal loss of accuracy on the large cases. Parents ages can be simulated from Table 4 or taken directly as some 20 years more than the worker.

7. <u>Simulate Time Period to Death or Remarriage</u>

Tables 9 and 10 are single decrement tables for remarriage or mortality respectively. The remarriage table is based on "The 1979 NCCI Remarriage Table," by Philip Heckman (PCAS 1982, p52). In Table 10 widows use the woman's columns; children, parents and siblings use total population statistics.

To illustrate how a random draw can be made based on these tables take the case of a dependent parent of age 50. Table 8 indicates that of 100,000 births, 88,972 attain age 50. Pick a random number n from 1 to 88,972, intended to represent the nth longest lived person for this group. Finding the year attained by the nth longest lived person in the table then represents a random draw of attained age according to the distribution of lives represented by the tables. *Suppose for example, n =*

44,486 were the random number drawn. Then the individual would survive until age 76 but not 77, according to the table.

This is the manner in which all lifetimes are simulated, except for widows, who use the women's life table and the remarriage table. The remarriage table considers probabilities of remarriage to be a function of the widow's age and, for the first five years, the length of time widowed. For instance, out of 100,000 widowed at age 16, 93,359 would not have remarried 1 year later. Out of 83,912 widowed at age 17, 78,860 will not have remarried 1 year later. After 5 years, further increments go down the last column. Thus, of the 100,000 16 year old widows, 39,899 would be unremarried seven years later, the same as the number of 17 year old widows remaining 6 years after widowhood. Note that this table is not decremented for death but just for remarriage.

A combined table can be constructed by assuming the probability of a widow being alive and still single equals the probability of being alive times the probability of being single. A random draw from this combined distribution gives the year in which the widow's payment status fails, due to either death or remarriage, but not mentioning which. Since some states specify an additional benefit on remarriage, it must be decided whether the status failed because of death or remarriage. This is done by a random choice where the chance of remarriage is proportional to the number of such statuses that fail due to remarriage in that number of years.

8. Simulation of Medical Benefit

For fatal cases, the usual procedure is to add a flat amount. For Permanent Total, medical can be a significant amount. The PR model used a lognormal distribution with σ = .90463 and u = 10.8578 + (40 - age) $\div$ 62.5, where age means that age at injury. This gives a coefficient of variation of 1.1255 for every age and means of 107,700, 78,200, and 56,800 at ages 20, 40 and 60 respectively, based on the formulas $CV^2 = e^{\sigma^2} - 1$ and mean $= e^{\mu + \sigma^2/2}$. Much of the medical costs are of an ongoing nature, and it was felt that the younger injured worker would accumulate more of these costs. The LW&R model used a lognormal distribution with coefficient of variation 0.9, but correlated the scale with the indemnity amount.

For discounting purposes some stream of medical payments must be selected. For example, it could be assumed half the medical amount be paid the first year and the other half throughout the life of the injured worker.

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A recent NCCI review of Minnesota data suggests the lognormal distribution is not heavy enough in the tail to properly fit medical amounts; a few mega losses seem to occur often enough that they should be accounted for. More work is needed in this area.

9. Social Security Offsets

Social Security can have a significant impact on proper excess pricing and must be incorporated in the model. The Actuarial Committee of the Minnesota WCRA has spent more than a little time debating possible models for this offset and noting the effects of each.

Most, but not all, pensioners are eligible for Old Age or Disability benefits. NCCI takes 90% of workers age 20 and below as eligible, graduating to 100% at age 40. This is probably an overestimate according to the Minnesota studies and later versions of the LW&R model reflect this fact.

Benefit amount must be computed based on the Average Indexed Weekly Wage (AIWW) and dependency status. The latter has been established by simulation, while some assumptions as to earnings history must be made to estimate the former from current wage.

10. Other Determinants

After the above selections have been made, all the details needed to calculate indemnity benefits are present. *The benefit provisions of the relevant* jurisdiction must then be consulted to specify the payment stream.

For states with escalating benefits the indemnity payments increase periodically in proportion to some index, e.g., the state average weekly wage. By assuming a value of this index for each future year, the payment stream can be adjusted. 5 to 7% annual escalation rates are reasonable long term assumptions, but you may have a better crystal ball.

Once the payment stream has been determined, average payments, average payments excess of given retentions, discounted payments, etc. can be calculated. Discounted payments excess of given retentions can be calculated, but with care. The retention cannot simply be subtracted from the present value of the total payments. Rather the point at which the retention is pierced must be noted, and the present value of the subsequent payments determined. See Ronald Ferguson's "Actuarial Note on Workermen's Compensation Loss Reserves" in PCAS, 1971 for details.

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Per Occurrence Simulations

The steps outlined thus far can be used to build a collection of individual claims which can be used much like empiric data. In the case of either, the exigency remains that most excess (re)insurance attaches on an occurrence basis. This is also the case for the application of loss limits in a retro program, hence impacting ELPF's.

There is little data available to quantify the transition from claims to occurrences. Historically, a judgement loading factor of 1.1 or more has been used to compensate for this. We suggest a more analytical method using a second stage simulation, detailed below.

We first select a distribution of fatalities per accident. We can construct multiple claimant occurrences using this distribution by adding random claim amounts from the already compiled per claim distribution according to a simulated claim count.

In the PR model, a form of the Weibull distribution was used for the number of fatalities per accident. This distribution function is $F(x) = 1 - e^{-3x^{.375}}$, discretized by considering the probability in the interval n $\pm$ .5 to be the probability of N = n accidents. More specifically for n $\geq$ 1, Pr(N $\leq$ n) = F(n + .5) is the probability of at most n claimants.

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This distribution was selected largely by judgement, as data is sparse. However, the Kansas Department of Human Resources had 1978 and 1979 data indicating that about 3% of fatal work accidents involved more than one fatality, which is consistent with this model. Exhibit 2 shows some of the results of a Tillinghast study for Pennsylvania Workers' Compensation ratemaking. Our relative frequencies are higher, 52.2% for two claim occurrences, 20.8 for three, etc. to 0.7 for ten. We believe this adds a measure of risk to balance the occasionally reported 30 fatality accident.

Random number generation from a Weibull is particularly simple, since the distribution has a closed form inverse. Let q = 1 - F(x). Then $q = e^{-3x^{.375}}$ or $x = \frac{-\ln q}{3}^{8/3}$. Thus, x can be generated by picking q at random from (0, 1) and calculating x. It is slightly simpler to do this from a pick of 1 - F(x) but a similar expression could follow from a pick of F(x).

Results we have obtained using this second stage simulation have indicated the roughness of a flat 1.1 loading factor. This is probably excessive for lower retentions, even up to $100,000, but eventually inadequate, e.g. at $1-2 million, where loadings of 50% or more may be indicated.

Conclusions

Simulation has made possible more precise estimation of excess Workers' Compensation costs. Use of these models in actual pricing/reserving by WCRA, NCCI, Pru Re and Gen Re is an indication of the value of the method.

The power of the method resides not only in precision, but the ability to easily measure the effects of changes in state laws, trend and development. Our study showed the loss severity distributions in states with 1) maximum aggregate benefits, 2) no overall limit, or 3) benefits that escalate via cost of living adjustment to be respectively 1) negatively, 2) hardly, and 3) highly skewed. Other differences in laws have measurable, if not dramatic, effect on size of loss distributions.

All of the referenced studies noted differences in severity by type of claim, although treatments differ. One of the original hypotheses to be tested by the NCCI model was that it would be enough to simulate fatal claims and use that distribution for permanent partial. This would reduce the total number of simulations necessary and was demonstrably conservative, so was a practical shortcut. Experience with these models has indicated a significant difference in the permanent partial distribution and now these claims receive separate consideration.

We have tried to systematize the simulation of Workers' Compensation claims. Room for further research in this area is great and some has been cited. We believe the method is sound and its development worthwhile.

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Simulating Workers' Compensation Serious Claims

Determinants of Benefits

I. <u>Type of Claim</u>

- A. Permanent Total
- B. Fatal
- C. Permanent Partial
  1. Major
  2. Minor

II. <u>Indemnity Amount</u>

- A. State Laws
- B. Wage of Worker
- C. Dependency Status
- D. Type of Disability

III. <u>Duration</u>

- A. Age of Worker
- B. Ages of Dependents
  1. Wife
  2. Children
  3. Parents
  4. Siblings

IV. <u>Termination</u>

- A. Death
- B. Majority
- C. Remarriage

V. <u>Medical Amount</u>

- A. Flat
- B. Correlation with
  1. Age
  2. Indemnity
  3. Type of Accident

VI. Payment Stream

A. Interest Assumptions

B. Escalation Assumptions

C. Social Security Offsets

D. State Maximums

Notes:

1. Simulation may determine range of ages or salaries - second simulation exact age

2. Correlation between type of accident, age, dependency status, wage, medical amount, may or may not be incorporated

Exhibit 2

Relative Frequencies for Catastrophes

1972 (5th report) to 1976 (1st report) data

Number of Claims	Catastrophe Count	Relative Frequency	Smoothed Estimates
2	120	69.4%	69.0
3	27	15.6	16.0
4	11	6.4	6.5
5	5	2.9	3.0
6	4	2.3	2.0
7	2	1.2	1.5
8	1	0.6	1.0
9	2	1.2	0.5
10	1	0.6	0.5
Total	173	100.0	100.0

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Accident Frequency - Fatal Cases
(According to Dependency)

Actual No. of Cases†	Type of Dependency
1,677	No Dependents
4,058	Widow Alone
1,552	Widow with 1 child
1,464	Widow with 2 children
936	Widow with 3 children
473	Widow with 4 children
248	Widow with 5 children
184	Widow with more than 5 children (Average 7)
182	1 Orphan
115	2 Orphans
81	3 Orphans
37	4 Orphans
12	5 Orphans
3	6 Orphans
142	1 Parent
191	2 Parents
13	1 Brother or Sister
1	2 Brothers or Sisters
28	One other Dependent
11,397	Total

†The above distribution was derived from actual case reports from the following states: California, Delaware, Massachusetts, New York, Pennsylvania, and Texas. Only types of dependency which occurred in the study are listed.

Age Distribution of Widows - Fatal Disability †

Age Groups	Widow Alone		Widow with 1 Child		Widow with 2 Children		Widow with 3 Children		Widow with 4 Children		Widow with 5 Children		Widow with more than 5 Children		Total Widow with Children	
10-14	13	-	4	-	1	-	-	-	-	-	-	-	-	-	5	-
15-19	84	(84)	90	(101)	34	(19)	3	(2)	3	-	-	-	-	-	130	(122)
20-24	124	(195)	180	(375)	194	(177)	54	(70)	24	(14)	8	(6)	2	-	462	(642)
25-29	81	(225)	127	(319)	192	(342)	116	(180)	46	(86)	31	(31)	10	(25)	522	(983)
30-34	67	(216)	74	(271)	121	(360)	140	(217)	98	(94)	39	(53)	22	(49)	494	(1,044)
35-39	124	(254)	97	(259)	139	(285)	145	(185)	71	(112)	48	(48)	34	(58)	534	(947)
40-44	253	(416)	174	(273)	179	(201)	96	(118)	71	(62)	30	(37)	22	(43)	572	(734)
45-49	563	(544)	173	(231)	115	(135)	65	(53)	23	(36)	10	(9)	12	(14)	398	(478)
50-54	779	(777)	144	(166)	56	(79)	15	(33)	7	(6)	4	(5)	7	-	233	(289)
55-59	806	(669)	68	(115)	7	(33)	6	(10)	2	(4)	1	-	-		84	(163)
60-64	431	(601)	10	(32)	2	(1)	-	(1)	2	-	-		-		14	(34)
65-69	151	(347)	2	(8)	3	(1)	-		-	-	-		-		5	(9)
70-74	68	(137)	-	(2)	-		-		-		-		-		-	(2)
75-79	13	(39)	-		-		-		-		-		-		-	-
80-84	6	(6)	-		-		-		-		-		-		-	
85-89	1	-	-		-		-		-		-		-		-	
Total	3,564	(4,510)	1,143	(2,152)	1,043	(1,633)	640	(869)	347	(414)	171	(189)	109	(189)	3,453	(5,447)

†Numbers in parentheses are from the current injury table.

Table 2

Childrens Mean* Ages

Widow's Age:	17-24	25-34	35-44	45-54	55-64	65 +
Number of Children						
1	5	8	10	12	14	17
2	5	7	9	11	13	16
3 or more	6	7	9	12	13	15
Worker's Age:	17-24	25-34	35-44	45-54	55-64	65 +
Number of Orphans						
1	8	10	12	13	15	17
2	8	9	11	13	15	17
3	5	7	9	11	14	16
4	5	7	9	11	14	16

*All children are taken to be the same age for a given claim. This age is generated randomly from a normal distribution with the above means and a standard deviation of 1/6th of the mean.

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Age Distribution of Parent or Parents - Fatal Disability+

Age Group	One Parent	Two Parents
25-29	2 -	0 -
30-34	4 (3)	0 (3)
35-39	1 (11)	13 (14)
40-44	6 (32)	20 (50)
45-49	11 (52)	12 (46)
50-54	11 (46)	16 (58)
55-59	11 (74)	9 (67)
60-64	12 (65)	4 (54)
65-69	12 (65)	3 (32)
70-74	12 (53)	4 (22)
75-79	8 (33)	1 (14)
80-84	9 (30)	0 (8)
85-89	2 -	0 -
Total	101 (464)	82 (368)
Average Age:		
Arithmetic	61 (61)	49 (56)
Pension	61 (61)	50 (56)
Pension (5% Escalation)	58	48
Pension (6% Escalation)	57	48

+Numbers in parentheses are from the current injury table

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Age Distribution - Permanent Total Disability

Age Group	No. Of Cases†	
Under 15	4	(2)
15 - 19	128	(45)
20 - 24	307	(110)
25 - 29	410	(137)
30 - 34	494	(177)
35 - 39	571	(251)
40 - 44	697	(237)
45 - 49	771	(309)
50 - 54	794	(309)
55 - 59	818	(360)
60 - 64	621	(376)
65 - 69	187	(287)
70 - 74	95	(154)
75 - 79	35	(68)
80 - 84	7	(13)
85 - 89	3	-
Total	5,942	(2,835)

Average Age - Arithmetic	46	(50)
Pension	47	(50)
Pension (5% Esc.)	44	
Pension (6% Esc.)	43	

†Numbers in parentheses are from the current injury table.

1973 Standard Wage Distribution Table

R = Ratio to Average Wage
A = Percentage of workers receiving not more than the percentage of the average wage indicated by column R B = Percentage of wages received by the percentage
B = Percentage of wages received by the percentage of workers in column A

R	A	B	R	A	B	R	A	B
.05	.1068	.0030	2.40	98.8248	96.4991	4.75	99.9210	99.5369
.10	.3511	.0222	2.45	98.9702	96.8502	4.80	99.9245	99.5542
.15	.8384	.0845	2.50	99.1283	97.2237	4.85	99.9277	99.5700
.20	1.4357	.1903	2.55	99.2172	97.4447	4.90	99.9290	99.5762
.25	2.1432	.3483	2.60	99.3278	97.7304	4.95	99.9316	99.5881
.30	2.9058	.5629	2.65	99.3962	97.9051	5.00	99.9337	99.5984
.35	3.7375	.8393	2.70	99.4464	98.0372	5.05	99.9357	99.6093
.40	4.7328	1.2173	2.75	99.5127	98.2151	5.10	99.9390	99.6258
.45	6.1073	1.8188	2.80	99.5551	98.3291	5.15	99.9415	99.6393
.50	8.2201	2.8537	2.85	99.5867	98.4178	5.20	99.9438	99.6516
.55	11.6032	4.6692	2.90	99.6240	98.5226	5.25	99.9453	99.6594
.60	15.3290	6.7892	2.95	99.6515	98.6021	5.30	99.9483	99.6752
.65	20.5672	10.1290	3.00	99.6742	98.6709	5.35	99.9488	99.6778
.70	25.9600	13.7452	3.05	99.6888	98.7150	5.40	99.9498	99.6836
.75	32.3089	18.2868	3.10	99.7116	98.7817	5.45	99.9508	99.6892
.80	37.5110	22.2523	3.15	99.7288	98.8358	5.50	99.9539	99.7064
.85	42.9709	26.6884	3.20	99.7427	98.8809	5.55	99.9552	99.7130
.90	48.2321	31.2144	3.25	99.7614	98.9448	5.60	99.9559	99.7174
.95	53.1109	35.7149	3.30	99.7825	99.0090	5.65	99.9569	99.7228
1.00	58.4036	40.9066	3.35	99.7922	99.0422	5.70	99.9584	99.7318
1.05	62.9643	45.6459	3.40	99.7995	99.0666	5.75	99.9607	99.7447
1.10	67.1858	50.1850	3.45	99.8141	99.1161	5.80	99.9623	99.7537
1.15	70.6767	54.0985	3.50	99.8211	99.1404	5.85	99.9656	99.7730
1.20	74.0989	58.1398	3.55	99.8308	99.1747	5.90	99.9674	99.7840
1.25	77.0678	61.7560	3.60	99.8403	99.2088	5.95	99.9684	99.7903
1.30	79.9516	65.5218	3.65	99.8457	99.2272	6.00	99.9701	99.8007
1.35	82.2534	68.5701	3.70	99.8511	99.2463	6.05	99.9712	99.8069
1.40	84.5435	71.7325	3.75	99.8575	99.2701	6.10	99.9722	99.8131
1.45	86.3620	74.3294	3.80	99.8616	99.2854	6.15	99.9727	99.8161
1.50	87.9326	76.6547	3.85	99.8657	99.3029	6.20	99.9734	99.8210
1.55	89.1240	78.4667	3.90	99.8731	99.3315	6.25	99.9753	99.8315
1.60	90.4193	80.4994	3.95	99.8774	99.3499	6.30	99.9758	99.8349
1.65	91.6370	82.4738	4.00	99.8800	99.3594	6.35	99.9763	99.8380
1.70	92.4497	83.8454	4.05	99.8835	99.3739	6.40	99.9775	99.8468
1.75	93.2448	85.2260	4.10	99.8871	99.3886	6.45	99.9780	99.8504
1.80	93.9290	86.4398	4.15	99.8949	99.4207	6.50	99.9816	99.8762
1.85	94.5674	87.5957	4.20	99.8970	99.4295	6.55	99.9831	99.8855
1.90	95.1329	88.6605	4.25	99.9000	99.4429	6.60	99.9848	99.8964
1.95	95.7436	89.8715	4.30	99.9033	99.4574	6.65	99.9851	99.8978
2.00	96.2339	90.8451	4.35	99.9058	99.4689	6.70	99.9861	99.9047
2.05	96.6383	91.6662	4.40	99.9086	99.4807	6.75	99.9871	99.9118
2.10	97.1239	92.6803	4.45	99.9091	99.4831	6.80	99.9877	99.9149
2.15	97.4920	93.4767	4.50	99.9122	99.4965	6.85	99.9892	99.9259
2.20	97.8424	94.2425	4.55	99.9142	99.5052	6.90	99.9897	99.9290
2.25	98.1208	94.8736	4.60	99.9155	99.5113	6.95	99.9902	99.9321
2.30	98.3723	95.4400	4.65	99.9173	99.5197	7.00	99.9917	99.9429
2.35	98.6285	96.0369	4.70	99.9197	99.5309			

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Exhibit 1

Dependency by Age Distribution

Widow Cases by Age of Widow

	Total	17 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 + 74
Widow alone	35,235	2,925	4,017	3,453	8,597	10,817	5,426
Widow + 1 child	15,660	2,098	4,119	3,445	3,946	1,738	314
Widow + 2 children	15,660	1,801	5,873	4,745	2,694	517	30
Widow + 3 children	11,745	1,034	4,721	4,733	1,163	82	12
Subtotal Widow Cases	78,300	7,858	18,730	16,376	16,400	13,154	5,782

Non-Widow Cases by Age of Worker

2.

	Total	17 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 + 74
1 orphan	1,600	102	357	342	340	291	168
2 orphans	1,000	64	223	214	213	182	104
3 orphans	700	45	156	150	149	127	73
4 orphans	400	26	89	86	85	73	41
1 parent	1,300	83	290	278	277	236	136
2 parents	1,700	109	379	364	362	309	177
other	300	19	67	64	64	55	31
none	14,700	941	3,280	3,146	3,128	2,672	1,533
Subtotal Non-Widow Cases	21,700	1,389	4,841	4,644	4,618	3,445	2,263
Total	100,000	9,247	23,571	21,020	21,018	17,099	8,045

Exhibit 2

Wage By Age Distributions

Percent of Average Wage

Age Widow Cases	Total	≤ 16.0	16.1 to 32.1	32.2 to 48.1	48.2 to 64.2	64.3 to 80.2	80.3 to 96.2	96.3 to 120.3	120.4 to 160.4	160.5 to 200.5	> 200.5
17 - 24	10,036	474	429	634	1,816	2,292	1.670	1,549	879	205	88
25 - 34	23,921	129	277	674	2,609	4,468	4,437	5,424	4,072	1,226	605
35 - 44	20,914	70	195	444	1,782	3,222	3,425	4,707	4,354	1,668	1,047
45 - 54	20,945	93	309	604	2,066	3,414	3,462	4,402	3,995	1,528	1,072
55 - 64	16,800	107	542	904	2,419	3,125	2,719	3,003	2,367	910	704
65 + 74	7,384	76	546	823	1,697	1,484	906	862	563	221	206
Total	100,000	949	2,298	4,083	12,389	18,005	16,619	19,947	16,230	5,758	3,722

Non Widow Cases											
17 - 24	6,400	524	449	592	1,523	1,634	911	573	168	15	11
25 - 34	22,310	81	248	667	2,598	4,456	4,393	5,147	3,501	879	340
35 - 44	21,410	59	161	397	1,729	3,220	3,480	4,914	4,573	1,785	1,082
45 - 54	21,280	82	241	502	1,827	3,232	3,426	4,629	4,452	1,709	1,180
55 - 64	18,180	91	345	647	2,148	3,342	3,210	3,589	2,865	1,102	841
65 + 74	10,430	112	854	1,278	2,564	2,121	1,199	1,095	671	268	268
Total	100,000	949	2,298	4,083	12,389	18,005	16,619	19,947	16,230	5,758	3,722

Table 5

SINGLE-DECREMENT (REMARRIAGE) TABLE - SELECT PERIOD = 5 YEARS

AGE	NUMBER OF YEARS WIDOWED 0	1	2	3	4	5
16 -	100000	93359	78930	66007	56383	49379
17 -	83912	78060	67717	57551	49042	44143
18 -	71604	67696	58957	50846	44591	39899
19 -	62021	58954	52004	45450	40318	36415
20 -	54429	51990	46396	41043	36790	33514
21 -	48320	46367	41814	37399	33044	31073
22 -	43357	41763	38023	34350	31355	28995
23 -	39266	37950	34859	31770	29230	27215
24 -	35871	34790	32200	29590	27429	25683
25 -	33031	32129	29950	27737	25874	24362
26 -	30637	29800	28033	26140	24530	23213
27 -	28605	27965	26390	24761	23364	22211
28 -	26869	24325	24974	23566	22347	21334
29 -	25377	24912	23740	22524	21457	20563
30 -	24080	23680	22600	21612	20674	19883
31 -	22969	22624	21747	20812	19984	19201
32 -	21993	21695	20929	20106	19374	18748
33 -	21140	20880	20209	19484	18033	18274
34 -	20391	20164	19574	18932	18352	17652
35 -	19731	19532	19011	18442	17925	17475
36 -	19147	18972	18512	18005	17543	17139
37 -	18630	18476	18068	17616	17201	16837
38 -	18170	18035	17672	17268	16895	16547
39 -	17761	17641	17318	16956	16621	16323
40 -	17395	17289	17008	16676	16373	16104
41 -	17060	16973	16715	16424	16151	15907
42 -	16774	16690	14459	16196	15950	15720
43 -	16510	16435	16228	15991	15760	15547
44 -	16272	16205	16019	15806	15603	15420
45 -	16050	15990	15831	15630	15455	15280
46 -	15865	15811	15660	15406	15319	15167
47 -	15690	15642	15506	15340	15197	15050
48 -	15541	15490	15375	15232	15094	14960
49 -	15390	15359	15240	15110	14993	14877
50 -	15260	15233	15132	15015	14900	14795
51 -	15150	15110	15020	14921	14816	14720
52 -	15042	15014	14932	14835	14740	14651
53 -	14945	14920	14845	14757	14670	14589
54 -	14857	14834	14766	14686	14606	14532
55 -	14776	14756	14694	14621	14548	14480
56 -	14703	14685	14629	14562	14496	14433
57 -	14637	14620	14569	14500	14448	14390
58 -	14576	14541	14515	14460	14404	14351
59 -	14521	14508	14466	14415	14364	14316
60 -	14471	14459	14421	14375	14328	14284
61 -	14426	14415	14380	14338	14295	14254
62 -	14385	14375	14343	14304	14265	14228
63 -	14347	14338	14310	14274	14238	14204
64 -	14314	14306	14279	14247	14214	14192
65 -	14283	14276	14252	14222	14192	14163
66 -	14256	14249	14237	14200	14172	14144
67 -	14231	14225	14205	14180	14155	14130
68 -	14209	14203	14185	14162	14139	14116
69 -	14189	14184	14167	14146	14125	14104
70 -	14171	14166	14151	14132	14112	14093
71 -	14155	14150	14137	14119	14101	14083
72 -	14140	14136	14124	14108	14091	14075
73 -	14127	14124	14112	14097	14082	14067
74 -	14115	14112	14102	14088	14074	14060
75 -	14105	14102	14093	14080	14067	14054
76 -	14095	14093	14084	14073	14061	14049
77 -	14087	14085	14077	14066	14055	14045
78 -	14080	14078	14070	14061	14051	14041
79 -	14073	14071	14064	14056	14046	14037
80 -	14067	14065	14059	14051	14043	14034
81 -	14062	14060	14054	14047	14039	14031
82 -	14057	14055	14050	14043	14036	14029
83 -	14053	14051	14046	14040	14034	14027
84 -	14049	14048	14043	14037	14031	14025
85 -	14045	14044	14040	14035	14029	14024
86 -	14042	14041	14038	14033	14029	14022
87 -	14038	14037	14034	14029	14026	14021
88 -	14037	14036	14033	14029	14025	14020
89 -	14035	14034	14031	14028	14024	14020
90 -	14033	14032	14030	14026	14023	14019
91 -	14031	14031	14028	14025	14022	14018
92 -	14030	14029	14027	14024	14021	14018
93 -	14028	14028	14026	14023	14020	14017
94 -	14027	14026	14025	14022	14019	14017
95 -	14026	14025	14024	14021	14019	14016
96 -	14025	14024	14023	14021	14018	14016
97 -	14024	14023	14022	14020	14018	14016
98 -	14023	14022	14021	14019	14017	14015
99 -	14022	14022	14071	14019	14017	14015
100 -	14022	14021	14020	14019	14017	14015
101 -	14021	14021	14020	14018	14017	14015
102 -	14020	14020	14019	14018	14016	14015
103 -	14019	14019	14018	14017	14016	14015
104 -	14019	14019	14018	14017	14016	14015
105 -	14019	14018	14018	14017	14016	14014

1969-1971 LIFE TABLES FOR WOMEN (W) AND TOTAL POPULATION (T)

AGE	L(W)	L(T)	AGE	L(W)	L(T)	AGE	L(W)	L(T)	AGE	L(W)	L(T)
0 -	100000	100000	28 -	96724	95586	56 -	88382	84142	84 -	32921	23638
1 -	98254	97998	29 -	96636	95448	57 -	87649	83103	85 -	29538	20908
2 -	98139	97876	30 -	96544	95307	58 -	86865	81988	86 -	26206	18282
3 -	98064	97792	31 -	96445	95158	59 -	86030	80798	87 -	22940	15769
4 -	98005	97724	32 -	96339	95003	60 -	85139	79529	88 -	19801	13407
5 -	97955	97668	33 -	96224	94840	61 -	84191	78181	89 -	16858	11240
6 -	97913	97619	34 -	96101	94666	62 -	83181	76751	90 -	14160	9297
7 -	97876	97573	35 -	95966	94482	63 -	82101	75236	91 -	11715	7577
8 -	97842	97531	36 -	95821	94285	64 -	80943	73631	92 -	9523	6070
9 -	97812	97494	37 -	95662	94073	65 -	79698	71933	93 -	7595	4773
10 -	97784	97460	38 -	95490	93843	66 -	78361	70139	94 -	5943	3682
11 -	97759	97430	39 -	95302	93593	67 -	76926	68246	95 -	4565	2786
12 -	97734	97401	40 -	95097	93322	68 -	75384	66254	96 -	3443	2060
13 -	97707	97367	41 -	94876	93028	69 -	73730	64166	97 -	2553	1511
14 -	97676	97322	42 -	94637	92712	70 -	71955	61984	98 -	1864	1087
15 -	97636	97261	43 -	94379	92368	71 -	70061	59715	99 -	1342	772
16 -	97588	97181	44 -	94098	91995	72 -	68044	57360	100 -	954	542
17 -	97531	97083	45 -	93793	91587	73 -	65890	54913	101 -	669	375
18 -	97467	96970	46 -	93461	91144	74 -	63582	52363	102 -	464	257
19 -	97400	96846	47 -	93101	90662	75 -	61107	49705	103 -	318	175
20 -	97331	96716	48 -	92714	90142	76 -	58464	46946	104 -	216	117
21 -	97261	96580	49 -	92299	89579	77 -	55664	44101	105 -	145	78
22 -	97190	96438	50 -	91852	88972	78 -	52717	41192	106 -	97	52
23 -	97117	96292	51 -	91372	88315	79 -	49638	38245	107 -	64	34
24 -	97042	96145	52 -	90855	87605	80 -	46445	35285	108 -	42	22
25 -	96966	96000	53 -	90300	86838	81 -	43149	32323	109 -	27	14
26 -	96888	95859	54 -	89704	86607	82 -	39769	29375			
27 -	96807	95721	55 -	89066	85110	83 -	36344	26469			