POLICY YEAR MODIFICATION OF LOSSES*

BY

RUSSELL P. GODDARD

The process of rate-making consists essentially of dividing losses by exposure, and then loading for expenses. Unfortunately for simplicity, it is usually necessary to modify the experience somewhat in order to anticipate conditions during the period when the rates will be used. This would not of itself cause complications, and most complications arise only because it is necessary to combine several years of experience before calculating rates. The necessity of both combining and modifying experience produces some interesting results, since experience which has been combined and then modified differs from experience which has been modified before being combined. It is the purpose of this paper to investigate these differences. The illustrations are drawn entirely from workmen's compensation insurance, though some of the principles involved would apply equally well to other lines.

The usual unit of experience for compensation rate-making purposes is the policy year, consisting of all premiums earned and losses incurred on policies issued in a given calendar year. Experience on this basis was originally taken from Schedule Z, and is now available in almost all states under the Unit Plan. Classification experience is not reported by calendar year, and it is usual to think of the policy year as the smallest unit of classification experience now available, but actually the Unit Plan has produced a smaller one, the policy month. It is possible to imagine other ways of reporting experience in order to produce even smaller units. For example, if premiums were reported by month earned and losses by month of accident, it would be possible to produce a small block of experience for each calendar month. Experience reported in this form might be of some value since it would be possible to investigate seasonal trends, and in converting losses to the present law level the accident month of each loss would be known. These possibilities are mentioned merely to point out that there are smaller units of experience than the policy year. It is the purpose of this paper to study the difference between the results obtained by modifying losses as a whole or by separate

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parts, whether these parts be policy years, accident years or some smaller units.

Although it usually takes several years to produce a dependable volume of experience for rate-making purposes, it is customary to convert this experience separately by policy year instead of in bulk. Before considering the advantages of the two different methods, it would be well to consider the types of modification now used, and the purpose of each.

The principal reasons for modifying experience, and the methods used, are as follows:

1. To anticipate changes in losses, usually increases, as the experience matures and the ultimate cost becomes more definitely known. This is done by the so-called loss development factors, one for indemnity and one for medical, which are based on the developments of previous years.
2. To convert losses to their present cost, reflecting changes in the compensation statute. For this purpose law amendment factors are calculated, based on a comparison of the new law with the old. These factors are calculated separately for each type of injury, and for each policy year.
3. To reflect fluctuations in compensation cost due to various forces such as changes in wage levels, increasing or decreasing industrial activity, and technological improvements, to mention but a few. These and other factors combine to form the aleatory element in compensation ratemaking. Thus, even after the experience has been converted by the loss development and law amendment factors previously mentioned, and the premiums have been adjusted to a common rate level, there is usually considerable difference in loss ratio by policy year. "Loss projection factors" are used to make the loss ratio of each year of the experience period equal to the loss ratio of some period which is supposed to reflect future conditions. The loss ratio selected is usually that of the latest policy year for medical, and the average of the two or three latest years for indemnity. At one time the medical loss ratio was increasing so steadily that it was possible to calculate it for two and a half years in the future. The policy years selected as the basis for the loss projection factors are usually known collectively as the rate level period.

From the above it may be seen that the loss projection factors are the most important from the point of view of the over-all loss ratio. The loss development and law amendment factors are

important only in that they help determine the loss ratio of the rate-level period. For other years they have no effect on the over-all rate level since the loss projection factors bring all losses to the same level.

PROJECTION OF LOSSES TO DESIRED RATE LEVEL:

The loss projection factors might better be called trend factors, since if there is no easily recognizable upward or downward trend in loss ratio there is no necessity for them. Their purpose is to make the rates reflect the conditions prevailing during the later years of the five-year period, on the assumption that these conditions are different from those in the earlier years, and that they will still prevail during the year when the rates will be in effect.

It has not been definitely proved that the trend theory is altogether valid. There is some ground for believing that compensation costs, (exclusive of arbitrary changes due to law amendment) follow an up-and-down cycle, and that a period of rising costs is followed by one of decreasing costs. The discussion of this point is outside the province of this paper, but the view held by many is that these periods of rising or falling costs last long enough so that at any given time it is safe to assume that any discernible trend in the experience period will be continued at least until the rates are made effective.

The loss projection factors are calculated separately for each industry group, since it has been found that there is usually considerable variation in trend between groups. The division of classes into groups is sometimes rather arbitrary, and it often happens that the trend of an individual class within an industry group is different from that of the group as a whole. Such trends for individual classes are likely to be unreliable, as pointed out by Greene and Roeber in *Proceedings,* XII. In their paper on the "Permanent" Rate Making Method they state (page 261), that "investigation has demonstrated that the 'trend' of the pure premium for the individual class cannot generally be regarded as significant."

In any event, it is worth while to study different methods of loss projection and observe the effect on the individual classes within an industry group as compared with the effect on the group as a

whole. The following theoretical discussion may help in understanding the specific problem in question.

Let $\frac{a_1, a_2, a_3,}{b_1 \ b_2 \ b_3}$ etc. be a series of unequal fractions with positive denominators, such that

$$\frac{a_1}{b_1} > \frac{a_2}{b_2} > \frac{a_3}{b_3} > \text{————} > \frac{a_n}{b_n}$$

and let $p_1 < p_2 < p_3 < p_4$ ———— $< p_n$

p being positive in every case.

Then $\frac{p_1 a_1 + p_2 a_2}{p_1 b_1 + p_2 b_2} > \frac{a_1 + a_2}{b_1 + b_2}$

since, by cross-multiplication

$$p_1 a_1 b_1 + p_1 a_1 b_2 + p_2 a_2 b_1 + p_2 a_2 b_2$$

is less than $\quad p_1 a_1 b_1 + p_2 a_1 b_2 + p_1 a_2 b_1 + p_2 a_2 b_2$

transposing $\quad p_1 (a_1 b_2 - a_2 b_1) < p_2 (a_1 b_2 - a_2 b_1)$

which is true because

$$a_1 b_2 - a_2 b_1 \text{ is a positive quantity}$$

and more generally

$$\frac{p_1 a_1 + p_2 a_2 + p_3 a_3 \cdots\cdots + p_n a_n}{p_1 b_1 + p_2 b_2 + p_3 b_3 \cdots\cdots + p_n b_n} < \frac{a_1 + a_2 + a_3 \cdots\cdots + a_n}{b_1 + b_2 + b_3 \cdots\cdots + b_n}$$

Similarly, it may be shown that

$$\frac{p_1 a_n + p_2 a_{n-1} \cdots\cdots + p_{n-1} a_2 + p_n a_1}{p_1 b_n + p_2 b_{n-1} \cdots\cdots + p_{n-1} b_2 + p_n b_1} > \frac{a_1 + a_2 + a_3 \cdots\cdots + a_n}{b_1 + b_2 + b_3 \cdots\cdots + b_n}$$

In the first instance what might be called the weighted average fraction is smaller than the unweighted fraction, because the smallest weights have been coupled with the largest fractions; in the second case the weighted fraction is larger because the largest weights are used with the largest fractions.

The application of the above proposition to the specific case of loss projection may readily be seen. Assume that the losses of a given industry group and of a class within the group have been as follows, the premium volume in each case remaining constant.

Policy Year	Actual Losses	
	Industry Group	Individual Class
1	b_1	$p_1\, b_1$
2	b_2	$p_2\, b_2$
3	b_3	$p_3\, b_3$
4	b_4	$p_4\, b_4$
5	b_5	$p_5\, b_5$
Total	$(b_1+b_2+b_3+b_4+b_5)$	$(p_1b_1+p_2b_2+p_3b_3+p_4b_4+p_5b_5)$

Where $b_1 < b_2 < b_3 < b_4 < b_5$
and $p_1 < p_2 < p_3 < p_4 < p_5$

It will be seen that there is an upward trend in loss ratio for the industry group, but that the upward trend in the individual class is greater.

It is desired to project losses to the level of the latest year, so the following projection factors are calculated.

Policy Year	Projection Factor
1	$b_5 \div b_1$
2	$b_5 \div b_2$
3	$b_5 \div b_3$
4	$b_5 \div b_4$
5	1

After projection by the above factors, the total losses for the industry group are $5\, b_5$ and for the individual class

$$(b_5)(p_1 + p_2 + p_3 + p_4 + p_5).$$

The average projection for the five year period, obtained by dividing the total projected losses by the total actual losses, is

$$\frac{p_1\, b_5 + p_2\, b_5 + p_3\, b_5 + p_4\, b_4 + p_5\, b_5}{p_1\, b_1 + p_2\, b_2 + p_3\, b_3 + p_4\, b_5 + p_5\, b_5} \qquad \frac{b_5 + b_5 + b_5 + b_5 + b_5}{b_1 + b_2 + b_3 + b_4 + b_5}$$

Individual Class — Industry Group

From the previous discussion, it is apparent that the left-hand expression is less than the right. In other words, the individual class, with its greater upward trend, has received less increase in losses by projection than the industry group as a whole. This results because its lowest loss ratios are in the earlier years, for which higher projection factors are used.

On the other hand, if there had been a downward trend in the industry group and a still greater downward trend in the individual class, the individual class would have received a greater decrease in losses than the industry group as a whole. This is because its largest losses are in the earlier years, and give effect to the projection factors providing the greatest decrease. It is therefore plain that the greatest increases or decreases are felt by those classes which have relatively large losses in the early years. This produces relatively low rates for classes with a downward trend when the general trend of all classes is downward, but fails to produce high rates for classes with an upward trend when the general trend turns upward.

The following numerical examples may serve to give a clearer idea of the way loss projection by policy year operates in the actual rate-making process.

Assume that the projection factors for the period, based on the loss ratios of the industry group as a whole, are as follows:

Policy Year	Projection Factor
1	1.40
2	1.30
3	1.20
4	1.10
5	1.00
Average	(1.20)

The experience of the three largest classes within this group is as follows:

Class I		Class II		Class III	
Payroll*	Actual Losses	Payroll*	Actual Losses	Payroll*	Actual Losses
1,000,0	4,000	1,000,0	5,000	1,200,0	7,200
1,000,0	5,000	1,000,0	5,500	1,100,0	6,600
1,000,0	6,000	1,000,0	6,000	1,000,0	6,000
1,000,0	7,000	1,000,0	6,500	900,0	5,400
1,000,0	8,000	1,000,0	7,000	800,0	4,800
5,000,0	30,000	5,000,0	30,000	5,000,0	30,000

* 00 omitted.

It will be observed that these three classes have identical experience for the five-year period as a whole. If rates were based only on the five-year results, the same pure premium would be

assigned to each. This would be $.72, after inclusion of the average projection factor of 1.20 for the industry group.

Two of the classes, however, show an upward trend in pure premium, and if full credibility were to be given the experience of the latest year, the pure premiums assigned as the basis of rates would be: Class I $.80, Class II $.70, and Class III $.60.

By projecting the losses by policy year separately, however, the results differ somewhat from those just mentioned.

Policy Year	Projected Losses		
	Class I	Class II	Class III
1	5,600	7,000	10,080
2	6,500	7,150	8,580
3	7,200	7,200	7,200
4	7,700	7,150	5,940
5	8,000	7,000	4,800
Total	35,000	35,500	36,600
Pure Premium	.70	.71	.732

The pure premiums resulting are approximately the same as those which would have resulted from the use of the average projection factor. It will be observed, however, that the class with the most pronounced upward trend develops the lowest pure premium, and the class with no trend develops the highest pure premium. In manual rate-making, therefore, the use of separate factors tends to counteract the effect of upward trends in the individual classes rather than to recognize them. The use of such factors is justifiable only if we accept the trend theory for an industry group, while adopting the "cycle" theory for some of its component classes.

This fact should be kept in mind in any calculations involving the pure premiums underlying manual rates. Suppose, for example, an insurance company wished to compare its own experience under Class I, by policy year, with the experience of all companies. If the pure premiums for all companies were not available by policy year, it might be considered possible to calculate them by dividing the pure premium underlying the rate by the policy year projection factors. This method appears logical, because division is the reverse of multiplication, but it does not produce the desired results.

CLASS I

Policy Year	Actual Pure Premium	Projection Factor	Projected Pure Premium	Calculated "Actual" Pure Premium
	(1)	(2)	(3) (1) × (2)	(4) (.74) ÷ (2)
1	.40	1.40	.56	.50
2	.50	1.30	.65	.54
3	.60	1.20	.72	.58
4	.70	1.10	.77	.64
5	.80	1.00	.80	.70
Average			.70	

These results would be accentuated if the class in question had had a downward instead of an upward trend. If the losses of Class I, for example, had occurred in reverse order, the results would have been as follows:

Policy Year	Actual Pure Premium	Projection Factor	Projected Pure Premium	Calculated "Actual" Pure Premium
	(1)	(2)	(3) (1) × (2)	(4) (.70) ÷ (2)
1	.80	1.40	1.12	.53
2	.70	1.30	.91	.57
3	.60	1.20	.72	.62
4	.50	1.10	.55	.67
5	.40	1.00	.40	.74
Average			.74	

It is obvious from the above that it is impossible to return to the original pure premiums for each policy year by dividing the average projected pure premium by the policy year projection factors. This procedure is correct only for those classes which have the same trend in pure premium as the industry group.

CONCLUSION:

Loss projection factors are trend factors, reflecting the broad trends in compensation cost for a state as a whole or an industry group. Separate factors may be calculated for each policy year, or a single factor may be used for all years. These factors, however, do not always correctly reflect the independent trends of individual classes, and their unsuitability is accentuated if separate factors are used for each policy year. In the light of this consideration, and because of the unreliability of the experience

of individual classes, it is the author's opinion that projection of losses by policy year should be discontinued.

The "Permanent" Rate-Making Method, as given by Messrs. Roeber and Greene in *Proceedings*, XII, provided for a "Final Correction Factor" which was, among other things, a single projection factor for all policy years and all industry groups. This method of projection was in use for several years and was discontinued about 1930. It is now customary to project losses separately by policy year and industry group. In Wisconsin, however, no distinction is made between policy years or industry groups, but separate factors are used for Serious, Non-Serious and Medical losses. The distinction between different kinds of losses may well serve the same purpose as the distinction between industry groups, since the principal difference between one industry group and another lies in the distribution of losses. In some respects this may be the more satisfactory distinction, since the lines of demarcation between Serious, Non-Serious and Medical losses are much clearer than the lines separating the industry groups.

CONVERSION OF LOSSES TO PRESENT LAW LEVEL:

The purpose of law amendment factors in the present rate-making plan is to convert every loss to its cost under conditions obtaining during the period when the rates based on these losses will be effective. To do this accurately for each classification would require several conditions.

1. Each loss should be grouped by classification and by type of injury according to present definitions.
2. The estimate of total cost should be accurate for each loss. This is particularly important for the more serious losses, which are relatively infrequent and therefore produce few compensating errors.
3. The date of each loss should be known in order to determine whether it occurred before or after a change in the law.
4. The law amendment factors should be correctly calculated.

It is obvious that condition (3) is not met under the present rate-making plan which provides for separate factors by policy

year, but not by accident year. Even if experience were compiled by accident year the results would not be absolutely accurate unless the revisions in the law occurred on January 1. Ideally, it would be necessary to convert each loss separately.

Furthermore, conditions (1) and (2) are not always met. The difficulties encountered may best be illustrated by an actual example. Prior to September 19, 1935 the Massachusetts law provided the same maximum of $4,500 for both Permanent Total and Major cases. The present law retains the $4,500 maximum for Major cases, but the Permanent Total benefits have been increased to include a pension payable during disability. The average value of a Permanent Total case is now approximately $10,000. This change in the law appears to have caused a reduction in the number of claims classified as Permanent Total. According to Schedule Z, the number of Fatal, Permanent Total and Major cases, as compared with the total payroll exposure, was as follows:

Policy Year	Number of Cases			Total Payroll (In Millions)
	Fatal	P. T.	Major	
1929	342	77	815	1,504
1930	283	69	751	1,347
1931	205	72	585	1,133
1932	143	38	455	893
1933	200	17	498	950
1934	202	22	481	1,010
1935	179	13	452	1,073
1936	190	6	469	1,200

It seems not unreasonable to suppose that many of the cases listed as Permanent Total in policy years 1929 to 1931 might have been classed as Majors, and that the drop in number of P.T.'s reported between policy year 1935 and 1936 was due, at least in part, to the increase in benefits for this type of claim. It is quite probable that a re-examination of all the P.T. claims listed above in the light of the provisions of the present law would result in the classification of many of them as Majors.

Incidentally, it is of interest to note the variation in the number of all types of serious accidents during the eight years under review.

Policy Year	Total Payroll (In Millions)	Number of Serious Cases	Ratio to Payroll
1929	1,504	1,234	.820
1930	1,347	1,103	.818
1931	1,133	862	.761
1932	893	636	.712
1933	950	715	.753
1934	1,010	705	.698
1935	1,073	644	.600
1936	1,200	665	.554

It will be seen that there were approximately 8.2 serious accidents for every $10,000,000 of payroll in 1929, as against only 5.5 cases in 1936. Even after allowing for a change in distribution of payroll by industry group, it is evident that it is difficult to predict the number of serious cases for any future year for the state as a whole. How much more difficult it is to make a similar prediction for an individual class. According to the present rate-making procedure, 100% credibility is given to the state indications of an individual class for serious losses, if the payroll is large enough to produce the equivalent of 25 serious cases in five years. It would seem that such a small exposure would not always serve as a base for an accurate prediction of the number and cost of serious accidents in any one year in the future.

To return to the Permanent Total cases under discussion. In policy year 1935 there were 8 of these cases on the first report of Schedule Z, and 13 on the second report.

MASSACHUSETTS P. T. CASES POLICY YEAR 1935
INDEMNITY COST

Class Code	First Report	Second Report
0003	..	9,063
0006	..	4,500
2216	..	14,147
2286	9,540	10,091
2303	..	13,612
2413	..	13,997
2585	5,300	..
3724	23,725	23,725
5403	4,500	4,500
7500	..	11,263
8008	..	4,500
8037	..	9,776
8039	..	11,044
8233	14,366	..
8291	4,500	..
9015	4,500	..
9052	4,500	8,270
TOTAL	70,931	138,488

From an inspection of the indemnity cost of these accidents, it seems obvious that those costing exactly $4,500 (except the one incurred under class 9052) must have occurred prior to the change in benefits, while the others occurred later. The average indemnity cost of the 8 accidents listed on the first report was $8,866, as compared with an average cost of $10,653 for the 13 cases listed on the second report. A law amendment factor of 1.209 was applied to these losses at both the 1937 and 1938 revisions.

The factor 1.209 was an average factor, of course, somewhat too high for the accidents which occurred after the law revision, and too low for those which occurred before it. It would undoubtedly be possible to provide separate factors for these losses, but this would not entirely solve the problem, which is essentially one of making rates which will take care of future losses.

A comparison of the listing of Permanent Total cases on the first report of policy year 1935 with the listing on the second report reveals many changes. Further changes may be expected on the third and fourth reports, and some cases which were omitted on the second report may reappear. It is also of interest to note that, of the six classes which had P.T. cases in 1936, four classes had not had one in policy year 1935 on either the first or second report.

Under the present method of rate-making, if a class has a P.T. case in its experience, the effects of both the case itself and any amendments on this type of case are included in its rate. This is not entirely satisfactory, since the incidence of this type of case varies from one policy year to another, and from one reporting of the experience to another. It would be desirable if the effect of the law amendments, at least, could be felt not only by those classes which have had P.T. cases in the past, but also by those which will have them in the future.

On the theory that all serious accidents are similar, and that it is only chance that makes one accident produce a fatal claim, another a permanent total, and a third a case of major disability, it might be feasible to assign average values to all serious claims. This method would have its disadvantages, however, one of which would be that it would not reflect the differences in wage-scales from one class to another. Another method, somewhat simpler and more in line with present practice, would be to use a single

factor for serious losses, instead of separate factors for Fatal, Permanent Total, and Major.

The non-serious accidents, because of their greater prevalence, do not present the same problem. The distribution of these accidents between Minor and Temporary is usually the same from one class to another, so that there would be little difference between the results obtained by the use of one or two factors. Over a period of five years these differences would tend to disappear entirely. This has been confirmed by an actual test, the details of which are given below.

MASSACHUSETTS

POLICY YEARS 1932 - 1936

NON-SERIOUS (MINOR AND TEMPORARY) LOSSES

Class Code	Actual Losses	Losses on 8-30-38 Law Level*	Ratio Converted to Actual
2042	14,587	15,757	1.080
6504	11,999	12,999	1.083
2070	167,706	182,454	1.088
2039	22,055	23,976	1.087
2095	44,389	48,103	1.084

* Converted by the following factors.

Policy Year	Minor	Temporary
1932	1.010	1.095
1933	1.014	1.095
1934	1.012	1.095
1935	1.003	1.095
1936	1.000	1.089

It will be seen that the average effect of the ten amendment factors actually used was to increase losses between 8.0% and 8.8%. As a matter of fact, if an average factor of 1.084 had been used for both Minor and Temporary losses for all five policy years, the non-serious pure premiums for each of the five classes would have been exactly the same as those actually developed.

Examples such as those just cited lead the writer to suggest that law amendments be incorporated into the manual rates by factors

which are uniform for all policy years, but which are separate for the three principal types of benefit, i.e., Serious, Non-Serious and Medical. While this may seem a radical departure from present procedure, it actually represents only a combination of methods already in use under certain circumstances. For example, when law amendments are enacted at some time other than that of a regular rate revision, it is customary to incorporate the change in benefit cost into the rates by flat factors which entirely ignore the differences between kinds of injury. Furthermore, at any revision, there is no important distinction between policy years unless a previous law amendment has taken place within the experience period.

The chief theoretical disadvantage of the proposed plan is that it provides for no distinction between losses occurring before and after a change in law. As pointed out previously, the present plan distinguishes only between accidents occurring in different policy years, and this distinction is unnecessary if losses are numerous enough to be evenly distributed by accident year. This distinction is therefore of importance only to the serious losses, which are likely to be affected much more by conditions peculiar to each case. There can be no doubt that the use of one average factor covering parts of six accident years would result in a different modification of losses from that produced by five separate average factors, each covering parts of two accident years, but such differences would undoubtedly have very little effect on the final manual rates.

In considering the practical aspects of the proposed change in procedure, it is necessary to consider the results under the present method in some detail. The increases or decreases in benefit level resulting from amendments to the compensation statute are worked into the manual rates by the use of separate factors for each of six different kinds of benefit and five different policy years —a total of thirty separate factors. The use of so many different modifications arises from the fact that the actual revisions in a written statute, coupled with the American Accident Table, furnish a convenient basis for their calculation. As a matter of fact, the changes in manual rates which can be definitely attributed to statutory revisions are usually much less than the changes due to other forces affecting compensation costs. Furthermore,

other parts of the rate-making machinery, such as the off-balance correction factor and the contingency loading, often have more effect on general rate level than law amendments.

The following table shows certain data for the states (except Pennsylvania) which have had law amendments in the two years ending with January 1, 1939:

State	Date of Rate Revision	Changes in Manual Rate Level Attributable to	
		Experience	Law Amendment
Colorado	3- 1-37	.815	1.050
	5- 1-38	.939	
Connecticut	3-31-38	.864	1.004
Georgia	3-30-37	..	1.029
	3-31-38	1.005	
Idaho	3-31-38	1.081	1.005
Illinois	10- 1-37	.859	1.003
	10-31-38	.885	
Iowa	7- 4-37	.898	1.036
	6-30-38	.839	
Kentucky	4-16-37	..	1.044
	6-30-37	.797	
	6-30-38	1.018	
Maryland	5-31-38	.973	1.005
Massachusetts	12-31-37	.884	1.037
	12-31-38	.935	
New Mexico	3-31-37	.752	
	6-12-37	..	1.134
	3-31-38	.970	
Rhode Island	9-15-36	..	1.347
	10- 1-37	.826	
	10- 1-38	.906	
South Carolina	7- 1-37	.874	1.144
	9- 1-38	.897	
Utah	1- 1-38	.912	1.044
	1- 1-39	.867	
Vermont	2-28-37	.906	
	6- 1-37	..	1.028
	6- 1-38	.918	

A review of these changes in rate levels leads to the conclusion that law amendments are of relatively minor importance at the present time. It will be seen that, with three exceptions, every change due to law amendment was accompanied or followed by a greater change in rates due to experience. The three exceptions are the revisions in Georgia, New Mexico and Rhode Island.

(Strictly speaking, the Rhode Island law change of September 15, 1936 does not belong in this list, since it was more than two years prior to January 1, 1939). The New Mexico law amendment of June 1937, which raised rates 13.4%, followed less than three months after a general rate revision in which the experience indicated a decrease of 24.8%. The Rhode Island increase of 34.7% because of the law amendment was followed a year later by an indicated decrease of 17.4% and two years later by a further indicated decrease of 9.4%. This latter decrease would not have been so great if the 1937 rates had not included a contingency loading of 8.7%.

The exhibit appended may be of some interest, since it shows the relationship between the losses as actually incurred and the same losses as finally modified in the calculation of pure premiums. The examples cited are taken from a recent Massachusetts rate revision. It so happened that the projection factors used in this revision almost exactly balanced the loss development and the law amendment factors, so that the final modified losses are very nearly equal to the actual losses as taken from reports of Schedule Z. It will be seen that the ratio of modified losses to actual losses is fairly constant for all classes, especially for the medical portion of the experience. The largest differences between actual and modified losses occur among the serious losses, especially in the experience of classes 2300 and 2402. The presence of a permanent total claim in the experience of class 2300 without a sufficiently large number of other serious cases accounts for the increase in losses by modification for this class. For class 2402, the modified serious losses are only 87.8% of the actual losses, due to the fact that there were no serious losses in the last year of the experience period.

It is to be noted that the actual losses are very nearly equal to the modified losses in all cases where the experience is large enough to warrant 50% credibility or more; in such cases the difference in pure premium is never greater than $.02. Where the credibility is less than 50%, the differences between actual and modified losses are of academic interest only, since the rate-making formula gives so much weight to the national experience. Therefore if the losses had been modified by average law amendment and projection factors similar to those herein discussed, the

results, in terms of final manual rates, would hardly be distinguishable from those obtained today.

CONCLUSION:

On the basis of the foregoing considerations it is the author's proposal that our compensation rate-making structure be reviewed for the purpose of determining the desirability of the following changes:

1. Loss projection factors which shall be uniform for all policy years. It would probably be desirable to use separate factors for each industry group, or to make distinctions between Serious, Non-Serious and Medical losses.
2. Law amendment factors which shall be uniform for all policy years, and be separated only as between Serious, Non-Serious and Medical losses.

It would be fairly easy to demonstrate that the proposed changes would result in simplification of the present manual rate-making procedure and the experience rating plan. There can be no pretense that the few examples cited here have conclusively proved that rates so made would more accurately reflect future conditions. It is hoped, however, that the various considerations here given will be of assistance to other members of the society in any discussion of revisions in our methods of manual rate-making.

MASSACHUSETTS COMPENSATION LOSSES

POLICY YEARS 1932 - 1936

AS USED IN REVISION EFFECTIVE DECEMBER 31, 1938

Class Code	Type of Benefit	Credibility Assigned to Mass. Exp.	Actual Losses*	Modified Losses**	Ratio Modified to Actual	Indicated Pure Premiums		Formula Pure Prems. Modified
						Actual	Modified	
2042	Serious	..	13,631	13,551	.994	.26	.26	.29
	Non-Serious	.50	14,587	14,202	.974	.28	.27	.33
	Medical	.50	19,330	18,372	.950	.37	.36	.36
						.91	.89	.98
2101	Serious	..	3,685	3,783	1.027	.09	.09	.29
	Non-Serious	.50	21,736	21,708	.999	.51	.51	.52
	Medical	.50	21,586	20,764	.962	.50	.48	.49
						1.10	1.08	1.30
2164	Serious	..	..	..	..	..	..	.46
	Non-Serious	.25	8,764	9,074	1.035	.59	.62	.68
	Medical	.25	8,645	8,343	.965	.58	.56	.69
						1.17	1.18	1.83
2288	Serious	..	7,729	7,772	1.006	.29	.29	.59
	Non-Serious	.25	6,862	6,815	.993	.26	.26	.46
	Medical	.25	7,010	6,738	.961	.27	.26	.43
						.82	.81	1.48
2300	Serious	..	31,897	36,076	1.131	.37	.41	.11
	Non-Serious	.50	30,372	31,143	1.025	.35	.36	.30
	Medical	.25	28,931	26,598	.919	.33	.31	.21
						1.05	1.08	.62
2402	Serious	.25	23,329	20,493	.878	.21	.18	.18
	Non-Serious	.50	27,801	28,733	1.034	.25	.25	.23
	Medical	.50	26,738	25,869	.967	.24	.23	.22
						.70	.66	.63
2417	Serious	1.00	102,911	104,958	1.020	.26	.26	.26
	Non-Serious	1.00	99,605	97,352	.977	.25	.24	.24
	Medical	1.00	107,188	101,499	.947	.27	.26	.26
						.78	.76	.76
2623	Serious	1.00	181,228	182,168	1.005	.31	.31	.31
	Non-Serious	1.00	216,407	213,374	.986	.37	.37	.37
	Medical	1.00	200,978	191,626	.953	.35	.33	.33
						1.03	1.01	1.01
4410	Serious	1.00	87,298	85,991	.985	.36	.35	.35
	Non-Serious	1.00	105,255	103,085	.979	.43	.43	.43
	Medical	1.00	110,737	105,244	.950	.45	.43	.43
						1.24	1.21	1.21

* Actual losses as reported in Schedule Z.
** Same losses modified by loss development, law amendment and projection factors.

MASSACHUSETTS COMPENSATION LOSSES

POLICY YEARS 1932 - 1936

AS USED IN REVISION EFFECTIVE DECEMBER 31, 1938

Class Code	Type of Benefit	Credibility Assigned to Mass. Exp.	Actual Losses*	Modified Losses**	Ratio Modified to Actual	Indicated Pure Premiums		Formula Pure Prems. Modified
						Actual	Modified	
2702	Serious	..	7,801	7,057	.905	1.47	1.33	2.88
	Non-Serious	.25	9,258	9,119	.985	1.75	1.72	2.37
	Medical	.25	8,151	7,670	.941	1.54	1.45	2.47
						4.76	4.50	7.72
6319	Serious	..	21,425	20,733	.968	1.64	1.59	1.43
	Non-Serious	.50	27,125	26,942	.993	2.08	2.06	1.76
	Medical	.25	16,862	16,036	.951	1.29	1.23	1.09
						5.01	4.88	4.28
5538	Serious	.50	18,752	18,848	1.005	.32	.32	.63
	Non-Serious	1.00	27,589	27,976	1.014	.47	.48	.48
	Medical	1.00	23,742	23,010	.969	.40	.39	.39
						1.19	1.19	1.50
Total of Above Classes	Serious		499,686	501,430	1.003			
	Non-Serious		595,361	589,523	.990			
	Medical		579,898	551,769	.951			

* Actual losses as reported in Schedule Z.
** Same losses modified by loss development, law amendment and projection factors.