RECENT DEVELOPMENTS IN WORKMEN'S COMPENSATION INSURANCE RATE MAKING.

BY

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The rate making program adopted by the National Council on Compensation Insurance in 1925 and described in the paper captioned "The 'Permanent' Rate Making Method adopted by The National Council on Compensation Insurance" (*Proceedings*, Vol. XII, page 253) is, with two exceptions, the procedure now being followed by the National Council in the establishment of rates for workmen's compensation insurance. This paper will deal only with the amendments to the established program, both of which amendments have resulted from a study of experience by size of risk. The first relates to expense and the second, to pure premium or loss cost.

Except for differences due to variations from the normal state premium tax of 2%, the expense loading prior to 1928 was a uniform percentage by states. This expense loading was expressed as a percentage of gross premium on the theory that except for minimum premium risks, the expense is in direct proportion to the premium. In recognition of the fact that there is a minimum expense involved in the writing of every policy, regardless of size, the National Council early in 1928 amended the rate making program so as to include provision for an expense constant to be charged on every risk which is too small to meet the minimum requirements for experience rating. In most states, the line of demarcation between experience and non-experience rated risks is $300. A detailed explanation of this item will be found in Mr. C. J. Haugh's paper entitled "Recent Developments with Respect to the Distribution of Workmen's Compensation Insurance Costs" (*Proceedings*, Vol. XIV, page 262).

A study of loss experience on small risks was undertaken at about the same time as the corresponding investigation of expenses. New York was the first state to make an intensive study of this problem. The New York Compensation Inspection Rating Board issued in 1927 a call for loss ratio experience by size of risk to be reported separately for policy years 1924 and 1925. This call provided for the reporting of collected premiums and incurred losses by industry groups and by premium size. Upon the com-

pletion of the filing of these data, reports for all carriers were combined and presented for study. A review of the experience indicated a marked differential by size of risk. As the risk became larger, the loss ratio diminished. The degree of the trend, however, was not consistent from industry group to industry group.

After a rather prolonged study, it was decided to group all manual classifications into three broad industry groups of Manufacturing, Contracting and All Other. Within each of these groups the risks were divided as between those over and under $400, (the line of demarcation in New York as between risks subject and not subject to experience rating). The premiums were put on a manual rate basis and loss constants applicable to small risks determined so as to eliminate the differentials in loss ratios by size of risk.

In calculating the offsetting reduction in manual rates, consideration was given to the net credit produced through the application of the experience rating plan. The net result was to key manual rates to a level which, when reduced by the expected off-balance of the experience rating plan and increased by the premium derived through the application of the loss constants to small risks, reproduced the desired collected level as indicated by the New York experience for the three latest policy years. The details of this program will be found in the report to the Insurance Superintendent of New York by the Conference Committee appointed by the Superintendent to investigate the small risk problem.

In order to carry out this program in the future, a unit statistical plan was approved. This plan provides for the reporting of a miniature Schedule "Z" on each individual risk. The data thus collected will be used in compiling Schedule "Z" for rate making purposes, experience rating data and size of risk experience.

Following the New York investigation, the Massachusetts Bureau likewise issued a call for loss ratio by size of risk experience. The Massachusetts reports disclosed the same general condition that exists in New York but it was found necessary to provide different industry groupings. In Massachusetts the manual rate reductions corresponding to the addition of loss constants were more than offset by the loading required to counterbalance the effect of the experience rating plan. Massachusetts also adopted the unit system of individual risk reporting.

While this matter was still pending in Massachusetts, the National Council, in an endeavor to establish a national small risk program, issued a special call for loss ratio by size of risk experience and, as a temporary expedient, incorporated in the experience rating plan a balancing factor applicable as a flat loading to the adjusted losses of each risk. The Council call covered policy years 1924, 1925 and 1926 and required that the data for each state be reported by industry schedule (see Manual Classification Code Book published by the National Council) rather than by the broader industry groups used in Massachusetts and New York. A copy of the form used in reporting this experience is shown in Exhibit A.

These reports were combined by state and within each state by industry schedule and policy year. The reports were further summarized by combining these schedules into broader industry groups and also by combining the reports for the three years. The results show, on a countrywide basis, the existence of a generally higher manual loss ratio on small risks than on large risks. A careful analysis of the data indicated, however, that the elimination of such differential by the introduction of the so-called "loss constant program" would prove unsatisfactory. The experience shows, for states other than Massachusetts and New York, a lack of consistency between differentials by size, either on the total for the states or on the basis of industry groups from state to state. This is further emphasized by the inconsistencies within any designated group, both from year to year and by smaller divisions of such group.

A comparison between the ratios of collected to manual premiums, on the one hand, and the indicated differentials on the other, shows that a loading in manual rates sufficient to offset the deficiency in collected level would eliminate, on the average, the existing differential by size of risk. This led to the adoption of the following program for states other than Massachusetts and New York where, because of the marked differential indicated by the experience of these two states, it has been necessary to afford special consideration to the small risk problem.

1. *Experience Rating Plan.*

The elimination of the balancing factor in the experience rating plan which is applied equally to actual and expected losses and the substitution therefor of the equivalent of a uniform loading

of 3% on actual losses, to be applied through the medium of the payroll modification factors. This 3% factor is designed to offset the effect upon manual rate level that may be attributed to the character of the data reported for experience rating purposes as contrasted with the data reported in Schedule "Z" for rate making purposes.

2. *Manual Rates.*

(a) Rate Supervised States.

The remainder of the total off-balance indicated by the ratio of collected to policy year manual premiums for the three latest policy years in each state is to be eliminated by a loading in the manual rates. The full effect of such loading will be realized on risks not subject to experience rating, but owing to the credibility allowed to the risk experience, only a partial effect will be realized on risks subject to experience rating. Consequently, a collected rate differential in favor of large risks will be produced and, to a comparable extent, the loss ratio differential by size will be offset.

(b) Non-Supervised States.

The ratio of collected to manual premiums does not represent solely the off-balance of rating plans in non-supervised states. Consequently for these states the actual state indications will be limited to a maximum off-balance on the entire business of 5%, which is the approximate average indication of the supervised states.

The program outlined above was tested on the basis of the experience reported for policy years 1924, 1925 and 1926. This test shows that on the average, the differential for the states included in the study is 1.118 on the basis of present manual rates, whereas on the basis of collected rates resulting from the new program, the differential is reduced to 1.033. It will be observed that not only does the new program provide for an adequate collected level over all, but also that it virtually eliminates the average differential between small and large risks. The details of this test are shown in Exhibit B.

The amended program contemplates the following procedure in the establishment of manual rate levels. As in the past, the indicated manual rate level change, exclusive of any loading for effect of rating plans, is determined on the basis of the three latest years of experience for the state in question. Payrolls for these same three policy years are then extended at the manual rates actually in effect during each of these years to determine the policy year manual premiums. These policy year manual premiums are then

compared with the premiums actually collected during such years. The result of this comparison is the ratio of collected to manual which serves as a base for determining the required loading in manual rates. Before proceeding with the calculation of the manual loading factor, it is necessary to obtain certain other factors, namely, the average credibility for risks subject to experience rating and the percentage of the total business which is subject to experience rating. Both of these factors are obtained from the size of risk reports.

This program provides for the inclusion in the experience rating plan of the equivalent of a 3% loading on actual losses. It is, therefore, necessary to eliminate the effect of this 3% loading upon the ratio of collected to manual before proceeding with the calculation of the manual loading factor. This effect is determined by multiplying the 3% by the product of the actual loss level and the average risk credibility and adding the result to the ratio of collected to manual determined as above.

The ratio of collected to manual adjusted for this 3% loading indicates the needed increase in collected premiums. Bearing in mind the effect of credibility, the next step is to determine the increase in manual rates necessary to produce the required increase in collected rates. Having established the required loading in manual rates necessary to offset the remaining deficiency in collected premium level, the change in level indicated by the three latest years of experience is multiplied by this factor to determine the new manual rate level. The pure premiums which have already been selected on the state's rate level, exclusive of any loading for off-balance, are then multiplied into the payrolls for the three latest years to determine the manual premium level produced by these selections. As some departures from the formula pure premiums are usually made in the selection process, this level may or may not coincide with the rate level, exclusive of any loading for off-balance, indicated by the three latest years of experience. Therefore, the level of selected pure premiums is divided into the required manual rate level (including the loading factor) to obtain the factor which must be applied as a flat loading to such selected pure premiums.

It will be noted that the ratio of collected to manual is based on the three latest years of experience. It is contemplated that this loading will be changed annually in connection with the general

rate revision, using in each such revision, the indications of the three latest available policy years. In other words, the ratio of collected to manual will be based on the same three years that are used in determining rate level. In order that the manual loading will prove, over a period of years, neither redundant nor inadequate, the average credibility and the percentage of business subject to experience rating will not be changed from year to year.

In connection with each general rate revision, a summary of the state Schedule "Z" experience is presented in an exhibit called the "Premium & Loss Exhibit by Policy Year". Part I of this exhibit shows, in addition to the loss ratios on the basis of actual collected premiums and incurred losses, the loss ratios on the basis of present manual rates and incurred losses on the benefit level of the state present law. The rate level is determined by the loss ratio indicated by the combined experience (on present manual rate and present law level) of the three latest years. The change in rate level indicated by the experience is determined from a comparison of the rate level loss ratio with the permissible loss ratio. Part II of this exhibit is a comparison of the collected premiums with the premiums obtained by extending the classification payrolls of each year at the manual rates in effect during that year and serves as a basis for determining the manual rate loading described above. When experience incurred under this program becomes available for rate making purposes, it will be necessary to eliminate the effect of the loading factors from both the collected and manual premiums before proceeding with the calculation of the new manual rate loading factor.

A Premium and Loss Exhibit for a typical state will be found in Exhibit C. The following gives the detailed calculation of the manual rate loading factor based on this exhibit:

BASIC DATA

From Loss Ratio by Size of Risk Experience:	
(1) Average credibility of risks subject to experience rating..	.419
(2) Portion of total business which is subject to experience rating.....	.775
From Premium and Loss Exhibit:	
(3) Ratio of collected to manual.....	.937
(4) Rate level change indicated by the experience.....	.966
From Test of Selected Pure Premiums:	
(5) Manual level produced by the selected pure premiums..	.985

CALCULATION OF MANUAL RATE LOADING FACTOR

(6)	Average risk credibility over all [(1)×(2)]	.325
(7)	Average class credibility over all [1.00−(6)]	.675
(8)	Actual loss level modified by average credibility[(3)—(7)]	.262
(9)	Realized effect over all of equivalent of 3% loading on actual losses in Experience Rating Plan [.03×(8)]	.008
(10)	Ratio of collected to manual adjusted for this 3% loading [(3)+(9)]	.945
(11)	Corresponding required increase in collected level [1.00−(10)]	.055
(12)	Required increase in manual level [(11)÷(7)]	.081
(13)	This manual increase expressed as factor [1.00+(12)]	1.081
(14)	Required manual level [(4)×(13)]	1.044
(15)	Manual loading factor [(14)÷(5)]	1.060

In the above calculation the present manual level has been taken as 1.00. Item (1) is obtained as follows: The midpoint of each premium size group, over the minimum eligibility requirement for experience rating, reported in the Size of Risk Call is increased to an experience period (five year) basis. The average experience rating premium splits are applied to each of these values to obtain corresponding normal and excess values. From these latter values are obtained the normal and excess credibility values (Z_n and Z_e) and finally the average credibility (Z_a). The Z_a values are then weighted by the corresponding premiums reported in this Call to obtain the average credibility for risks subject to experience rating. Item (2) is likewise obtained from the Size of Risk experience by taking the ratio of premiums reported for size groups over the minimum experience rating eligibility requirement ($300. annual premium in most states) to the total premiums reported. Item (3) is taken from Part II of the Premium and Loss Exhibit and Item (4) is obtained from Part I of the same exhibit. Item (5) is a comparison of the expected losses obtained by extending the payrolls of the three latest years at the selected pure premiums with the expected losses obtained by extending the same payrolls at the present pure premiums. In Item (6) the average credibility for risks subject to experience rating is spread over the entire business. The complement of this item represents the credibility of the class experience or the manual rate portion of the adjusted loss and is shown in Item (7). The experience rating formula for determining the adjusted loss is:

$$A \cdot Z + E\,(1. - Z) = \text{Adj.}$$

where: A = Actual Loss

E = Expected Loss
Adj. = Adjusted Loss
Z = Risk Credibility
and 1. — Z = Class Credibility

Bearing in mind that the present manual or expected level has been taken as 1.00, the ratio of collected to manual represents the adjusted loss. Substituting in this formula we have:

$$A \cdot Z + 1.00 \quad (.675) = .937$$
$$\text{or } A \cdot Z = .937 - .675 = .262$$

Therefore, the actual loss level modified by credibility is .262 which is shown in Item (8). The remaining items are self-explanatory.

For practical purposes the 3% loading on actual losses in the experience rating plan will be applied on the expected loss side. Instead of including a factor of 1.03 in the loss modification factors, a factor of .971 (the reciprocal of 1.03) will be included in the payroll modification factors. The two produce identical results as will be seen from the following identity. The basic formula for determining the experience modification is:

$$\frac{A \cdot Z + E\,(1 - Z)}{E} = \text{modification}$$

Multiplying the actual losses by 1.03 this becomes:

$$\frac{1.03\,A \cdot Z + E\,(1. - Z)}{E} = \text{modification'}$$

Divide numerator and denominator by 1.03

$$\frac{A \cdot Z + \dfrac{E\,(1. - Z)}{1.03}}{\dfrac{E}{1.03}} = \frac{A \cdot Z + .971\,E\,(1. - Z)}{.971\,E}$$

$$= \text{modification'}$$

$$\therefore \frac{1.03\,A \cdot Z + E\,(1. - Z)}{E} = \frac{A \cdot Z + .971\,E\,(1. - Z)}{.971\,E}$$

$$= \text{modification'}$$

In order to produce a collected rate differential in favor of large risks and so eliminate the indicated differential by size of risk, the amended program contemplates an experience rating off-balance, that is, an off-balance from the loaded manual rate level. Consistent with this theory and with the method of determining

the manual rate loading factor, the experience rating loss modification factors will be keyed to the level indicated by the experience rather than to that level increased by the manual rate loading factor.

The rate making program established in 1925 has proven eminently satisfactory as far as *manual* rates are concerned. In other words, the use of a three year level for determining rate level has given equitable and defensible results. This rate making program contemplated, however, that the rating plans would produce a balance. The schedule rating plan was balanced within itself effective January 1, 1927. As a temporary expedient until such time as the general problem could be reviewed, the experience rating plan was balanced in 1928 by means of a flat correction on the adjusted losses of each risk. The amended rate making program outlined above, is a substitution for this temporary expedient and accomplishes two results,—first, the assurance that over a period of years the *collected* premium level will be neither inadequate nor redundant and second, except for states such as Massachusetts and New York which, because of peculiar local conditions require special treatment, the elimination of substantially all of the indicated countrywide differential by size of risk.

EXHIBIT A

NATIONAL COUNCIL ON COMPENSATION INSURANCE

LOSS RATIO EXPERIENCE FOR EACH OF THE POLICY YEARS 1924, 1925 AND 1926, BY SIZE OF RISK AND INDUSTRY SCHEDULES

State_____

Carrier_____ Policy Year_____

Industry Schedule_____ _____
No. Name

Size Group (Amount of Earned Premium)	No. of Risks	Premium Earned	Losses Incurred	Loss Ratio
Minimum Premium Risks				
0— 74				
75— 149				
150— 299				
300— 499				
500— 999				
1,000—4,999				
5,000—9,999				
10,000— and over				

EXHIBIT B

NATIONAL COUNCIL ON COMPENSATION INSURANCE

TEST OF NATIONAL COUNCIL PROGRAM

STATE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Old Collected Level			Required Loading in Manual Rates to reproduce Manual Level	New Collected Level			Old Differential Under to Over (Manual rate Basis)	New Differential Under to Over (New Collected rate Basis)
	Under 300	Over 300	All		Under 300	Over 300	All		
Alabama	1.000	.952	.959	.052	1.052	.991	1.000	1.150	1.083
California	1.000	.927	.948	.069	1.069	.972	1.000	1.108	1.007
Colorado	1.000	.903	.931	.100	1.100	.959	1.000	1.005	.877
Georgia	1.000	.917	.934	.099	1.099	.975	1.000	1.160	1.029
Kentucky	1.000	.937	.949	.071	1.071	.983	1.000	1.053	.966
Louisiana	1.000	.927	.943	.081	1.081	.977	1.000	1.096	.991
Maine	1.000	.941	.952	.066	1.066	.985	1.000	1.200	1.109
Maryland	1.000	.909	.926	.115	1.115	.973	1.000	1.069	.933
Minnesota	1.000	.929	.951	.064	1.064	.971	1.000	1.112	1.015
New Hampshire	1.000	.934	.954	.059	1.059	.975	1.000	.878	.808
Oklahoma	1.000	.942	.951	.068	1.068	.987	1.000	1.151	1.064
Tennessee	1.000	.973	.979	.017	1.017	.995	1.000	1.054	1.031
Texas	1.000	.964	.969	.035	1.035	.995	1.000	1.248	1.200
Utah	1.000	1.050	1.042	—.092	.908	1.018	1.000	1.052	1.179
Vermont	1.000	.932	.950	.067	1.067	.976	1.000	1.021	.934
Virginia	1.000	.961	.970	.031	1.031	.990	1.000	1.103	1.060
Arith. Aver.—All States	1.000	.944	.956	.057	1.057	.984	1.000	1.091	1.016
Wtd. Aver.—All States	1.000	.940	.953	.063	1.063	.982	1.000	1.118	1.033

EXHIBIT B (Cont.)

EXPLANATION OF TEST OF NATIONAL COUNCIL PROGRAM

COLUMN

(1), (2), (3) The first three columns are the same as the ratio of collected to policy year manual premiums for the period covered by policy years 1924, 1925 and 1926.

(4) The required loading in manual rates has been calculated by assuming an average credibility of 50% on risks subject to rating, and taking the percentage of business under and over $300.00 from the size of risk data.

(5), (6), (7) These columns show the new collected rate level. For risks under $300.00, the full loading will be realized. For risks over $300.00, only half of the loading will be realized but, in addition, there will be realized on such risks slightly less than half of the 3% factor incorporated in the experience rating plan. Weighting each of these collected rate levels by the proportion of business affected, we obtain the desired level of 1.00 as shown in Column (7) for all business.

(8) The differentials on a present manual rate basis are shown in this column.

(9) The differentials on the new collected rate basis are shown in this column. They show to what extent the proposed program remedies the present differentials shown in Column (8).

NOTE.—The assumption of an average credibility of 50%, as made in this test, will be replaced by an actual calculation of the average credibility in the introduction of the program in any particular state. Similarly, the latest experience will be employed to true up the present manual rate level prior to introducing the proposed loading. The results shown on this test very likely will be changed slightly when this is done.

EXHIBIT C

National Council on Compensation Insurance STATE X
Date April 1, 1929

PREMIUM AND LOSS EXHIBIT BY POLICY YEARS

PART I

(1) Policy Year	Actual Basis			Modified Basis		
	(2) Collected Premiums	(3) Incurred Losses	(4) Loss Ratio	(5) Premiums at 7-1-28 Man. Rates	(6) Losses on 8-1-28 Law Level	(7) Loss Ratio
1922	1,131,803	751,296	66.4	1,513,837	850,383	56.2
1923	1,364,350	925,108	67.8	1,796,928	1,028,405	57.2
1924	1,453,956	1,049,851	72.2	1,804,352	1,094,005	60.6
1925	1,654,365	1,173,652	70.9	1,885,122	1,194,278	63.4
1926	1,775,613	1,303,427	73.4	2,016,667	1,303,427	64.6
1927	2,196,578	1,317,383	60.0	2,411,843	1,317,383	54.6
1922–26	7,380,087	5,203,334	70.5	9,016,906	5,470,498	60.7
1925–6–7	5,626,556	3,794,462	67.4	6,313,632	3,815,088	60.4

Permissible Loss Ratio = 62.5

Change in Rate Level Indicated by Experience = $\frac{60.4}{62.5}$ = .966

PART II

(1) Policy Year	(2) Collected Premiums	(3) *Premiums at Policy Year Manual Rates	(4) Ratio Collected to Policy Year Manual
1924	1,453,956	1,592,051	.913
1925	1,654,365	1,754,867	.943
1926	1,775,613	1,866,106	.952
1924–5–6	4,883,934	5,213,024	.937

*These are premiums at the manual rates actually in effect during each of the years in question as contrasted with the premiums at present manual rates shown in Column (5) of Part I.