NOTES ON EXPOSURE AND PREMIUM BASES

BY

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When *critical conditions* and *injurable objects* exist in such relationship that accidents may result there is said to be *exposure.* The term *critical conditions* is intended to cover, rather broadly, the presence of or the absence of anything, objective or subjective, generally external to the injurable object, which contributes to the accident frequency and/or the accident severity. It is intended to cover also any part or quality of the injurable object which likewise contributes to accident frequency and/or accident severity. *Injurable objects* will be used to denote any objects, human beings included, which may be damaged or injured, including complete destruction. If the whole insurance field is to be covered, it is necessary to extend the meaning of this term to include non-material things.

As a concrete example it might be conceived that critical conditions consisting of uniform fixed physical obstructions exist in a large but restricted area with inanimate injurable objects all identical in nature, for a period of time. Let it be assumed that the objects move about freely and that when they strike against one of the obstructions they are destroyed, and immediately replaced with others of their kind. Under these simple conditions it may be shown that the hazard varies directly with the product of the three variables: *critical conditions, injurable objects,* and *period of time.* If one of these variables remains constant the hazard varies as the product of the other two and if any two of the variables remain constant the hazard varies directly as the third.

In reality, however, the situation is quite different from this simple case, for the relationship becomes extremely involved. The critical conditions may comprise the presence or absence of material objects, habits, laws, regulations, or yet many other things. They may be external to or form a part of the injurable objects. They generally differ in their contribution to both the accident frequency and the accident severity. The injurable objects also are generally dissimilar. They vary widely in their susceptibility both to the occurrence of accidents and to injury when involved in accidents. Generally the contributions to the hazard occurring

from an increase in either the critical conditions or the number of injurable objects, under conditions in which the other variable and the period of time remain constant, cannot be expressed as a linear function of the number of units of the variable. The period of time is the only one of the three variable elements into which the exposure has been divided somewhat arbitrarily, with which the hazard varies directly, the other two variables remaining constant.

Even if the contribution of each of the variables were definitely known and if the hazard underlying the exposure could be expressed as a function of them, such an expression would be too involved for practical purposes. In actual practice the time element is eliminated by considering the aggregate injuries in blocks for selected unit periods of time—usually a year. This procedure brings together injuries of all degrees of severity and it becomes necessary to express the injury aggregate in terms of a common basis. The unit of measure used for this purpose is the economic unit, the dollar. The aggregate of injuries when expressed in the monetary standard of dollars is known as the *losses*.

A new variable, or set of variables, inherent in the *evaluation standard* used is introduced in the process of expressing the aggregate injuries in terms of dollars. This standard for evaluating injuries is the scale of remuneration adopted through a formal law as in compensation, or through custom and precedent as in the courts, or through community opinion as reflected in jury verdicts and private settlements. The effect of this new variable, the evaluation standard, is indicated by the difference in the losses obtained when the same or similar injuries to either human beings or inanimate objects are expressed in monetary units by the use of different evaluation standards.

Premium Bases.

Insurance is the institution devised to transfer the losses arising out of the hazard from the few upon whom they chance to fall to the many exposed by paying the losses from funds called *premiums* which have been specially collected for this purpose. These premium funds are accumulated from charges called the *rate* collected per unit exposure. The exposure medium selected as the basis for the charge of the premium is known as the *premium basis*.

Obviously, the premiums collected are to be proportional to the hazard which is measured by the losses. The medium selected for measuring the exposure is the most important factor in making the premium collections in accordance with the probable loss incidence. The medium most desirable as a premium basis is the one possessing a combination of these two qualifications in the largest degree:

1. *Magnitude of Medium should vary with hazard.*

   It is desirable to have for premium basis an exposure medium whose magnitude varies approximately directly with the hazard when this is measured by the losses. By using a medium which varies directly with the hazard, the total premium may be obtained by multiplying the exposure expressed in units of the premium basis by the rate.

2. *The Medium should be practical and preferably already in use.*

   For measuring the exposure it is desirable to have a medium whose magnitude is readily ascertained and which is already used by the assured for other than insurance purposes. The use of a medium possessing these qualities promotes efficiency, as no additional records are necessary for measuring exposure, and enhances accuracy, as the various existing records may be used as a check.

When one considers the many diverse factors which enter into a hazard and the additional factors which enter into the evaluation of a hazard in terms of losses, one might expect that generally it would be impossible to find a medium whose magnitude varies directly with the losses. The factors underlying the losses, *critical conditions*, *injurable objects*, and *evaluation standard*, are studied as a preliminary to sorting hazards into somewhat homogeneous groups. Divisions made according to the kind of evaluation standard used, the type of injurable object covered, or the origin of critical conditions are known as *lines of insurance*. Divisions within these lines of insurance with regard to the frequency and severity of injuries or for convenience in practical procedure are known as *classifications*. These designations hold only in a very general way and have many exceptions. It is often difficult to distinguish between lines of insurance and classifications as used by different carriers or even by a single carrier.

In this discussion of premium bases it is proposed to review different media that might be used for measuring the exposure. For convenience in outlining the procedure the *injurable objects* will be divided into *human beings* and all other objects. At this time it is intended to consider only premium bases for insurance covering injuries to human beings. The coverages will be treated under four divisions which embrace the more important types. It is not intended to make this an exhaustive analysis including the special cases that may arise.

I. Coverage for injuries to designated persons.
II. Coverage to employers for industrial injuries to their employees.
III. Coverage for liability for injuries to the general public.
IV. Coverage for liability for professional acts.

I. Coverage for Injuries to Designated Persons.

1. Life Insurance.
2. Accident and Health Insurance.

In life, accident, and health insurance, coverage is given to individuals for specified injuries evaluated at specified amounts. These lines differ from the others of the four general divisions in that injuries are appraised at specified values which are prescribed in the contract. Within certain limits these specified values may be selected by the assured when making the contract.

1. Life Insurance.

In life insurance the critical conditions are those conditions external to the assured and also those bodily conditions within the assured which tend to place his life in jeopardy. The injurable object is the assured himself and the injury is the loss of his life. The measure of the injury in dollars by the evaluation standard is the amount named in the policy to be paid in case of death. The underlying assumption is that classifications, when refined with respect to age, occupation, sub-standard conditions, etc., are composed of individuals of equal essential hazard. The losses differ only because different amounts are written in the policies to be paid for the same injury, i.e. loss of life. The amount of insurance specified in the policy is obviously the exposure medium which varies directly with

the losses for the very reason that the losses are made a definite function of the amount insured by the specific provision in the policy. A medium consisting of the amount of insurance is quite practical and forms such an ideal premium basis that little thought is given to any other. In group life insurance the situation is not changed although through the use of weighted averages it becomes less obvious.

2. Accident and Health Insurance.

As in life insurance, the critical conditions of accident and health insurance are those conditions external to the assured and those internal which may produce injuries through accidents or ill health. The evaluation standard is more involved than in life insurance. The accident insurance contract generally specifies a maximum loss known as the principal sum, certain lesser losses which have a definite relativity to this maximum, and fixed weekly benefits. In health insurance the losses are evaluated through the weekly benefits written into the contract. The classifications, through sufficient subdivisions according to age, occupation, and other conditions that may affect the hazard, are assumed to be composed of individuals of equal essential hazard. Equivalent injuries sustained differ when evaluated as losses only through the variation in the principal sum and the weekly benefits because, by the terms of the policy, they are definitely related to these items. The principal sum and weekly benefits form ideal premium bases as they are quite practical and vary directly with the losses.

II. Coverage to Employers for Industrial Injuries to Their Employees.

1. Workmen's Compensation Insurance.
2. Employers' Liability Insurance.
3. Workmen's Collective Insurance.

Of the variables underlying the hazard of this group of coverages the *critical conditions* and the *injurable human beings* are substantially the same. The inherent injuries are the same under each of

these lines. The difference in the losses, which is due to a change in the *evaluation standard* used, arises out of these sources:

1. In Compensation a wider range of injuries is covered than in Employers' Liability. It does not necessarily follow, however, that the losses are larger under Compensation. In Workmen's Collective the extent of the liability assumed is stated in the contract.
2. The severity of an injury is expressed in monetary units by using different evaluation standards. In Compensation the standard is prescribed in the law. In Employers' Liability it consists in direct settlement mutually acceptable or in a jury verdict under court procedure. In Workmen's Collective the standard is specified in the contract.

Several premium bases have been considered and discussed in different degrees for these lines of insurance. As possible media for use in measuring exposure, these may be considered:

1. Payroll.
2. Restricted Payroll.
3. Man-Year.
4. Value of Product.

1. Payroll. Within the Compensation classifications the total injuries presumably vary directly with the time exposure. The indemnity cost of each injury of given severity varies with the rate of weekly compensation, which depends on the weekly wages. The indemnity losses vary as the product of the time and the weekly wages which product is represented by the payroll. Payroll as a medium does not respond fully to variation in losses to the extent that the losses are legally restricted by the maximum weekly payments and by the maximum amount paid on any case. If there were no limitation on weekly payments or on the maximum cost of a case then payroll would vary directly with the indemnity losses and from this viewpoint form an ideal medium for measuring exposures. Under the earlier Compensation laws these maximum limits were rather low and had an appreciable effect on the losses. Since then the limits have been raised

materially by amendments to the law and their effect on the losses has been very much reduced.

Medical losses vary jointly with the accident frequency and severity, and therefore with the time exposure, and with the scale of medical fees. The wages and the medical fee scale supposedly respond to the same general price level and vary with each other. Medical losses thus vary jointly with the time exposure and the wages or as a product of the time and the wages which product is the payroll. The payroll does not reflect either the time or amount limitations on the medical benefits.

The trend in Compensation has been toward raising the limits on the time period and the maximum amount of medical benefits. The present Acts come near to providing unlimited medical benefits thus tending to make the medical losses vary with the payroll.

The exposure in Compensation measured in payroll may be said to vary reasonably with the losses. From the practical viewpoint the payrolls form a desirable medium for measuring exposures. The need of payroll records for internal business administration and for reports for external agencies emphasizes their importance thus serving as an incentive to accuracy.

There is a correlation between payroll and losses in Employers' Liability although this is not so definite as in Compensation. The loss of wages resulting from an accident is a major factor in evaluating injuries whether by direct settlement or through court procedure. Workmen's Collective, in responsiveness of payroll to losses, stands somewhere between Compensation and Employers' Liability, the exact position depending on the limitations on payments written into the Workmen's Collective contract. For both Employers' Liability and Workmen's Collective, payrolls form practical media for measuring exposures.

2. Restricted Payroll. This term is used to denote ordinary payrolls after they have been modified by limiting the maximum weekly wage for any employee to an amount which when multiplied by the weekly percentage compensation rate will equal the maximum weekly payment provided in the law. Under the early, simple Compensation acts the restricted

payroll exposure would have varied directly with the indemnity losses aside from the limit as to total amount of the case. At no time would it have accounted for a time limitation on the total amount, for either time or amount limitations on medical, or for the additional hazard involved in overtime work. A further obstacle arose when Compensation laws introduced different weekly limits dependent on the nature of injury or the dependency status. Such restricted payrolls would impose additional records on the assured, would involve more detail in auditing, and as they are not used for other purposes would not provide an external check.

In Employers' Liability Insurance restricted payroll is meaningless as there is no fixed wage that has a definite relation to the award. In Workmen's Collective Insurance the relationship would depend upon the agreement in the contract; probably it would be very much as in Compensation.

3. Man-Year. To measure Compensation exposure in man-year units—the exposure of one man for one year—would not reflect any variation in wages and for that reason would not be expected to vary as constantly with the losses as payroll exposure. In some occupations, e.g. aviation, where wages are so high that in almost every case the maximum weekly payments are made, a man-year exposure medium is more responsive to the indemnity losses than payroll. To account for differences in hazard due to a variation in the number of working days per week or the number of working hours per day, it is necessary to define the man-year unit in terms of man-days or man-hours. This would introduce no special difficulty aside from making the records somewhat more involved. In Employers' Liability there is presumably less correlation between wages and amount of award than in Compensation. For this reason the man-year medium as a basis of premium would be less objectionable here. It could not be expected to vary as constantly with the losses as payroll however. Man-year exposure would probably serve reasonably well in Workmen's Collective insurance, for the weekly payments usually do not vary much and the fixed amounts paid for permanent injuries do not depend on the wages received by the injured.

This exposure medium is the one best adapted for measuring accident frequency or weighted accident severity. Exposure on a man-year basis would be more difficult and costly to obtain as special records would have to be maintained for this purpose. These would not have the general importance of payroll, would probably be less accurate, and would not be subject to check from external sources.

4. Value of Product. The value of product or sales receipts is another medium that has been considered for measuring exposures. It would be difficult to ascertain to what extent the exposure on this basis would vary with the losses. A new system of classification would be required if this medium were used as it would be necessary to recognize the relative degree in which machines enter not on account of the hazard difference between machine and non-machine operations but on account of the additional exposure as measured through this medium, due to the greater production of machines. In these new classifications it would also be necessary to note the degree in which the raw and partially treated materials enter into the process. In insurance for contractors it would be necessary to distinguish between contracts covering all material and cost-plus contracts. The new classifications would have to be on an industrial basis so as to include those employees not engaged in producing a salable product. Some of the present classifications, e.g. public employees, would require some other procedure. In Employers' Liability and Workmen's Collective the same difficulties arise that appear in Compensation. This exposure medium wherever it could be used at all would generally be readily available and subject to check. Measuring exposure on this basis would not require undue effort.

There are certain factors whose existence is now more or less recognized as affecting the losses which are not reflected in any of the media for measuring exposure. The increase in the accident frequency during industrial prosperity and an increase toward malingering during depressions are factors of this nature.

III. Coverage to Assured for His Liability for Injuries to the General Public.

1. Manufacturers' and Contractors'.
2. Owners', Landlords' and Tenants'.
3. Elevator.
4. Teams.
5. Automobile.
6. Airplane.
7. Product.
8. Protective.

The injuries covered under Public Liability Insurance are those sustained by the public while on and/or off the premises from accidents arising out of conditions for which the assured is responsible. The hazards are peculiar to each of the several lines of insurance falling under this division. With respect to one element underlying the hazard, however, these lines of insurance are similar. That element is the evaluation standard used in reducing the severity of the injury to losses. In all Public lines the monetary measure of the injuries is determined by voluntary agreement or by court procedure. The attitude of the community and of the legal profession is an important factor in deciding whether there will be many requests for settlement of trivial, no-liability or even fraudulent cases, whether there will be voluntary settlements, or whether there will be lawsuits. If the last alternative is chosen, the jury selected from the community will determine the money value of the injury and any liberal or conservative viewpoint of the judges construing the law will be reflected in the losses. The attitude of the Community, the Bar, and the Court presumably will be reflected equally in all classifications, if not in all lines. No attempt is made to account for variations from these sources in selecting the exposure medium. These variations in losses are assumed to occur by districts and are provided for by establishing territorial differentials wherever there is a measurable deviation based on adequate data.

There is another factor underlying the evaluation standard which requires different treatment as it is not subject to territorial differentials. This factor arises out of the maximum limits imposed on the amount per injured and the amount per accident. These excess limits will be designated by a and b respectively. The

lines of insurance and also the classifications within lines are divided into a few groups according to the excess hazards. It is assumed that within each group the aggregate losses for any classification when evaluated with a/b limits will have a fixed relativity to the aggregate losses when evaluated under standard (5/10) limits. No effort is made to reflect variations due to different limits in selecting the exposure medium. The rates are quoted for unit exposure on a standard limit evaluation basis. If other limits are desired, the basic rate is modified by applying to the standard limit rate the excess factor corresponding to the desired limits which is taken from a table constructed for each group of excess hazard. The evaluation standard including excess limits has been eliminated in discussing premium bases for these lines of insurance.

1. MANUFACTURERS' AND CONTRACTORS' PUBLIC LIABILITY INSURANCE.

The hazard in this line arises from the contact of the public with the critical conditions of the assured's premises and operations. The problem here is to select an exposure medium which varies with the critical conditions and the number of the public who, by entering and passing, are subjected to the assured's critical conditions. Some of the exposure media that might be given passing consideration are:

1. Number of Public Admissions.
2. Payroll.
3. Man-Year.
4. Area and Frontage.
5. Value of Product.

1. Number of Public Admissions. It would be expected that the number of injuries and their cost would vary with the number of the public who enter or pass the premises or the place of operations and that therefore this number would make a good medium for measuring the exposure. An overpowering objection is that there is generally no record available and that it is quite impractical, if not impossible, to get one.

2. Payroll. Presumably the number of the public desiring admission to the manufacturer's and contractor's premises and place of operations, within a given classification, varies with

the size of the plants or operations as roughly measured by the number of employees or the payroll. Payroll exposure responds to the decrease or increase of the aggregate losses brought on by periods of depression and prosperity in industry. It has the practical advantage of being based upon long established records necessary for other purposes, so that it may be readily obtained and checked. The use of payroll records adds to efficiency for, as many risks are insured for Compensation and Public Liability by the same carrier, the same audit may be used for each of these lines.

3. Man-Year. A man-year exposure has the same merits that have just been ascribed to payroll as regards responsiveness to the variation in losses. It is not as practical as payrolls for it is necessary to establish a special record for measuring this exposure. Under present conditions at least this special record could not be used for determining Compensation exposure.

4. Area and Frontage. An area and frontage medium—area of assured's premises and length of premises adjoining public ways—might be used for measuring exposure in Manufacturers' Public Liability Insurance. It would be expected that the number of employees, the payroll, and the size (area and frontage) of the plant would vary in about the same ratio. The area and frontage medium would not respond to variations due to depressions and prosperity. This medium is practical in application as the exposure of manufacturing plants on this basis could be accurately determined with reasonable effort. It would not serve the dual purpose of measuring Compensation exposure at the same time.

The area and frontage basis is poorly adapted to measuring exposure for Contractors' Public Liability Insurance. Area and frontage exposure does not vary and it is fitted to measure only exposures which are continuous and constant. The exposure for a location under Contractors' Public Liability is variable. It begins below average, increases to above average, and then decreases, often tapering off to almost zero.

5. Value of Product. As the value of the product of a given manufacturing establishment reflects the activity it

seems not unreasonable to expect that this product value might serve as a medium for measuring Public Liability hazard. This exposure medium, as already stated under Compensation, would require some rearrangement of classifications, it would vary with the total losses under industrial depressions and prosperity, and it could be obtained readily from available records and checked.

For Contractors' Public Liability the equivalent of the value-of-product exposure medium would be the amount of the contract. Within each classification this may be expected to vary roughly with the payroll or with the man-year exposure. A rearrangement of classifications, taking into consideration the extent to which the cost of material is included in the contract, would be required. Exposure measured through this medium could be readily obtained from available records and checked.

2. OWNERS', LANDLORDS' AND TENANTS' PUBLIC LIABILITY INSURANCE.

Owners', Landlords' and Tenants' Public Liability Insurance is the term used for public liability insurance on assured's premises, other than Manufacturers' and Contractors', and Elevator Public Liability Insurance. As in Manufacturers' and Contractors' Insurance the hazard arises out of the contact of the public with the critical conditions of the premises. Presumably the classifications have been refined so that critical conditions are similar and uniform within the classification. The variations in conditions from classification to classification are so large, however, that no one exposure medium is adapted to all. The exposure media that will be considered are:

1. Area and Frontage.
2. Number of Admissions.
3. Receipts, Admission Charges.
4. Seat-Year.
5. Sales.
6. Rentals.
7. Payroll.
8. Unit-Year.

1. Area and Frontage. This is a dual basis of premium to account separately for the hazard which may be associated with the area of the premises and that which is related to the frontage along public ways. If the nature of the premises is such that there is no frontage, then the hazard there is zero and the dual exposure becomes a single exposure based on area alone. Presumably the accidents vary with the critical conditions and the number of the public coming in contact with them. Within the same classification the accidents probably vary somewhat directly with the inner area and the linear frontage on public ways. On this assumption, area and frontage exposure may be considered to vary directly with the hazard. This exposure medium is better adapted for hazards that are continuous and uniform, or, if varying by seasons, that average about the same from year to year. It is applied to classifications covering buildings of all kinds, signboards, country estates, cemeteries, etc., where there is little variation in critical conditions or in the number of people exposed year after year. The impossibility of concealing exposure on this basis and the facility with which it may be accurately determined give it an important practical advantage.

2. Number of Public Admissions. The hazard due to the number of the public subjected to the conditions of the assured's premises varies directly with the number admitted to the premises. Considered from this viewpoint this medium is a better measure of the exposure than area. It does not account directly for any outside frontage hazard and is adaptable only where the frontage hazard is negligible or bears a fixed ratio to the area hazard within the classification. It is responsive to changes in hazard due to depressions and periods of prosperity.

The number of admissions can be secured in a practical way in only a few classifications. At present this basis is used only for baseball parks. It might be used in amusement parks, theatres, concert halls, bathing pavilions, restaurants, skating rinks, dance halls, and public museums with turnstiles or admission charges.

3. Receipts, Admission Charges. The receipts vary with the number of admissions and thus with the hazard. Like the

number of admissions, this exposure medium reflects depression and prosperity. In classifications where there is no great range in prices this exposure medium might do very well. Where losses do not vary with the admission charge or where they may vary inversely to the charge, the medium is not so well adapted as the number of admissions. This basis is practical for certain classifications where the amount of receipts is more readily ascertained than the number of admissions and where the receipts are subject to check. It is used, at present, in concert halls, stadiums, bathing pavilions, skating rinks, and dance halls. It might be used also in baseball parks.

4. Seat-Year. In certain classifications that have a continuous exposure throughout the year, or, if variable, a consistant average hazard from year to year, the number of seats forms a reasonably good measure of exposure. This exposure medium does not respond to a temporary decrease or increase in hazard like the number of admissions or admission receipts. The basis is used for theatres and moving picture houses having regular shows where the number of people exposed during the year bears a reasonably constant ratio to the number of seats. Conceivably it might be used for commercial baseball parks and concert halls but it would not give much responsiveness to losses, for there is a large variation in the number of persons exposed within these classifications, at least as these are constituted at the present time. The exposure on this basis may be readily determined and cannot be concealed for fraudulent purposes.

5. Sales. The total receipts from sales might possibly be used as a measure of exposure with some of the O. L. & T. classifications. This medium would require a readjustment of some of the present classifications to make it applicable, and to some it could not be applied at all. In classifications like retail stores of all kinds (when properly subdivided), restaurants, hotels, etc., this premium basis might be used. The public liability hazard would be expected to vary with the number of patrons or purchases and these in turn with the amounts purchased. This exposure is readily ascertained for classifications involving sales.

6. Rentals. As the area is a fair measure of the hazard in connection with buildings, it would seem that the rentals of a building might be used as an exposure medium for buildings where all space is leased. The use of this medium would require some readjustments in those classifications where it is applicable, as the better buildings, which may be expected to have the higher rentals, would have the lesser critical conditions and consequently a smaller hazard. This exposure basis would be practical for only a limited number of building classifications.

7. Payroll. The risks of some of the O. L. & T. classifications have payrolls large enough to be reasonably stable. The payrolls of such risks would vary with the size of the risk when this is measured by other than payroll standards, and might be expected to be responsive to the losses. In classifications like stores, hotels, restaurants, etc., with possibly a few subdivisions, the payrolls would vary reasonably with the number of the public coming in contact with the critical conditions and might be used as an exposure medium.

8. Unit-Year. There are premises that are so nearly identical or that have so small a hazard per unit that for practical purposes all are considered alike. The exposure basis used is the unit-year, which means a flat charge per unit per year. This medium of exposure is simple and practical. It generally applies to things where the total hazard is small. This basis is used at the present time for automatic vending machines, bowling alleys, canoes, tennis courts, dogs, where these are additional hazards to insured premises.

Miscellaneous. There are certain classifications in which the hazard varies so widely within the class that it is impossible to select any practical medium as a reasonable measure of the hazard involved. Items coming under this designation are usually considered individually and a flat charge is given after the factors underlying the hazard have been considered in each individual case. Such flat charges apply to parades, pageants, races, celebrations, etc.

The preceding exposure media for O. L. & T. Liability Insurance may be divided into two divisions according to

whether they measure the exposure prospectively or retrospectively. Area and frontage, seats, and unit-years measure the exposure prospectively, while the number of admissions, admission charges, receipts, and rentals measure it retrospectively.

3. Elevator Public Liability Insurance.

The hazard covered in Elevator Public Liability Insurance arises out of the contact of the public with the critical conditions of the elevator. Presumably this hazard varies somewhat jointly with the critical conditions and the number of public passengers. The hazard also varies with the amount of use of the elevator and the efficiency of the operator. The latter, though probably one of the major factors affecting accidents, is not directly considered in selecting the premium basis. Operators are either considered unfit and rejected or considered qualified and accepted without further gradation. The elevators within classifications are graded to some extent through merit rating for special safety devices. Through proper equipment of elevators and selection of operators it is assumed that the critical conditions are approximately the same for individual elevators of a given classification. The possible exposure media are very limited.

1. Number of Passengers. Use of the number of elevator passengers as an exposure medium would give a variation reflecting continuity of use, and to a limited extent congestion, for the hazard in congestion increases in a larger degree than the increase in passengers. Whatever merit the medium may have in responsiveness to hazard is quite offset by the impracticability of getting an accurate measure of the number of passengers in elevators generally.

2. Elevator-Year. The elevator-year exposure medium does not reflect the number of passengers carried, continuity of use, capacity of elevator, average load, congestion, or the efficiency of the operator. It assumes that within a given classification, elevators are equipped approximately equally and average about the same year after year in the passengers carried. This basis is practical and it is in universal use at the present time for measuring the elevator exposure.

It is conceivable that in the modern large building the total elevator hazard might be measured by the factors and conditions used by building engineers to determine the number, the capacity, and the location of the elevators. From these conditions an exposure for the building independent of the number of elevators might be obtained.

4. TEAMS' PUBLIC LIABILITY INSURANCE.

Some of the critical conditions contributing to the hazard covered in Teams' Public Liability Insurance are:

1. Traffic congestion.
2. Nature of the operations.
3. Day or night operations.
4. Accessibility to public.
5. Efficiency of driver.
6. Demeanor of teams.

These are not all independent. The first four are interrelated and some would consider the fifth and sixth as interrelated. Variations in hazard for the first may be accounted for by territorial differentials and for the second and third by classifications. The fourth, fifth and sixth are assumed to be equal for different assureds of the same class. There is only one exposure medium that has been considered practical for application to Teams' generally.

Team-Year. This medium does not respond to any variation of hazard due to continuity of use during the year or the amount of daily use. It assumes that within classifications and territories these average about the same. It does not respond to differences in individual drivers aside from the group differences reflected in classification experience. The exposure medium is simple and its magnitude is readily ascertained.

No other practical medium has been evolved. Mileage, team-day, or team-hour media while responsive to certain variations in hazard are obviously impractical. Driver payrolls might possibly be used in a few classifications where risks have a large number of teams and drivers. Receipts might serve as a basis for risks of a trucking nature. All these media however are impractical for general application to Teams'.

5. AUTOMOBILE PUBLIC LIABILITY INSURANCE.

Some of the critical conditions that contribute to the hazard covered by Automobile Public Liability Insurance or that cause deviations in this hazard are:

1. The car—age, condition, etc.
2. Highways—road beds, curves, visibility, etc.
3. Traffic density.
4. Laws, regulations, and their enforcement.
5. Efficiency of driver—age, experience, habits, impairments, etc.
6. Mileage.
7. Speed.
8. Weather conditions.
9. Seasonal use of car.
10. Day and/or night use of car.

These are not to be considered a complete list, nor are they to be considered as independent of one another. Too little is known as yet about them to appraise the importance of each. From a casual survey, however, it would appear that (2), (3), and (4) are subject to treatment, if necessary, by territorial differentials. Any appreciable differences in (1) can be corrected through classification of cars. The degree to which (5) affects the hazard is not definitely known. It is probably one of the most important factors enumerated. It is generally recognized that the extremes in age, lack of self-control, and definite impairments disqualify a driver. The effect of the variation in hazard of accepted drivers due to the range of these qualities within accepted limits is not sufficiently known to be considered in determining exposure: The introduction of experience rating is an approach to recognizing these differences. It is generally accepted that hazards would vary approximately with the mileage, other conditions being the same. The extent to which the (7), (8), (9), and (10) contribute to the hazard is unknown.

Among the conceivable exposure media these might be considered:

1. Car-Year.
2. Mileage.
3. Car-Hour.
4. Fuel-Consumption.
5. Payroll.

1. Car-Year. This premium basis does not reflect the continuity of use or the total use of the car. Obviously, other conditions being equal, the hazard will vary with the total mileage of the car. The assumption underlying this basis is that, with proper classification of cars, the differences in the hazard are not large enough to warrant introducing a more involved exposure medium. The merit of this medium is its simplicity and definiteness in measurement which make it difficult to impose fraudulent exposures.

A variation of the car-year unit might be a car-life in which a car would be insured for life at a definitely fixed amount which would be incurred at the beginning, though not necessarily paid in one payment. Conceivably this would serve to promote care and safety as the long use of cars would mean insurance at low cost. It is also possible that such a plan would be adverse to public welfare by keeping old and unsafe insured-for-life cars on the highways. This premium basis probably would not appeal to an installment buying age. It would also fall heavily on car owners who lost their cars early.

2. Mileage. The mileage exposure medium is superior to the car-year medium in yielding an exposure that varies with the hazard, as it responds more to the actual usage of the car. The devices and records necessary for the introduction of this medium make it impractical under present conditions.

3. Car-Hour. A method that would measure exposure by the number of hours the car was operated, i. e., with the motor running, would yield a variation for use of the car, though probably not so responsive as mileage. This medium, however, is even less practical than mileage.

4. Fuel-Consumption. The quantity of fuel consumed as an exposure medium would reflect a variation in the use of the car under similar road conditions. It would, however, penalize the car on country roads as compared with the car on pavements whereas the hazards are just the reverse. Like the two preceding exposure media this would require such an accounting system and other devices that it becomes impractical under present conditions.

5. Payroll. Use of driver payroll as an exposure basis for assureds where several drivers use a variable number of cars

responds roughly to the usage of the cars, as wages are paid only for the drivers necessary to keep the cars in use. This basis is somewhat akin to a driver-year basis. There are a few classifications where assureds have several drivers for which this is practical.

This discussion of automobile exposure media has been directed to private passenger and commercial cars. If the passenger hazard of public automobiles is considered, the capacity of the car becomes an important factor. As possible exposure media for the passenger hazard of public automobiles *number of passengers*, *passenger-mile*, and *receipts from fares* should be considered.

The introduction of a mileage, car-hour, or fuel-consumption exposure into rate making would require the prior development of experience on these media. The car-year is the only one of the enumerated media which measures the exposure prospectively, the others require a final adjustment which would be determined retrospectively.

6. Airplane Public Liability Insurance.

In this line of public liability insurance, as in Automobile Public Liability, there exists a natural division of the hazard into passengers and the general public. The hazard of the passengers assumes a greater relative importance than in automobile insurance. Among the more important critical conditions contributing to the hazard are:

1. Plane—type, condition, etc.
2. Use of plane.
3. Capacity of plane.
4. Weather conditions.
5. Topography of country.
6. Efficiency of pilot.

It is hardly to be expected that in this early stage of aviation the available records would be adequate to permit a proper appraisal of these factors. Of these conditions, (1), (2), and possibly (3) may be considered subject to treatment through refined classifications. Conditions (4) and (5) might be recognized to some extent by territorial differentials. The variations in hazard due to them might possibly be somewhat

equalized through regulations. The distances covered by planes obviously decreases the effectiveness of territorial differentials. Condition (6), which is probably the most important of all, is not considered after pilots have been approved.

The possible exposure media that will be considered are:

1. Plane-Year. In using this medium for exposure it is assumed that within the classifications the hazard of the planes will average about the same over the period of a year. This medium does not respond to variations in the use of the machine. Accidents presumably vary somewhat with the extent of use of the machine. This medium is simple in application and quite practical.

2. (a) Flying-Hour, (b) Mileage. These media are in some respects similar. Both reflect the use of the machine and probably are more responsive to the losses than the plane-year. They are not as simple in application as the plane-year though they are not as impractical as the corresponding bases for automobile exposure.

3. Number of Flights. Should experience reveal that the hazard connected with the take-off and climb of a flight and the descent and landing is considerably greater than that during the intervening period, then the number of flights might be more responsive to the losses and a better medium for measuring exposure than either of the preceding media. In simplicity this ranks below the plane-year but above either flying-hour or mileage media.

4. (a) Passenger-Hour, (b) Passenger-Mile, (c) Fare Receipts. These media, which are somewhat related, are responsive to the public passenger hazard. They do not respond directly to the hazard of the general public. Although not as simple in application as the plane-year, they are not impracticable, in view of the records available.

5. Number of Passengers. Should the conditions referred to under medium (3) prevail, then the number of passengers carried would be more responsive to the public passenger losses and a better medium for measuring exposure than passenger-hour, passenger-mile, or fare receipts. This medium

is not responsive to the hazard of the general public. In simplicity of application it ranks with fare receipts.

7. PRODUCT PUBLIC LIABILITY INSURANCE.

Product Public Liability Insurance covers the liability of manufacturers for accidents to the public, arising out of their products. The critical conditions consist in defects in the products, including packing. If the products have been divided into homogenous classifications it may be expected that the critical conditions are somewhat uniformly distributed. These exposure media will be considered:

1. Quantity of product.
2. Units of product.
3. Sales.

1. Quantity of Product. The hazards within a homogeneous class may be considered to vary with the volume on the assumption of a uniform distribution of critical conditions. This quantity exposure medium is probably the best basis in its responsiveness to the hazard. It is not as readily ascertained however as the cost or sales receipts of the products.

2. Units of Product. In responsiveness to hazard this exposure medium stands between quantity of product and sales receipts. It does not reflect variation in hazard due to different sizes of the units within the same classification. The measure of the exposure on this basis for most classifications is not as readily ascertained as that based on the quantity or the value of the product.

3. Sales. An exposure expressed in the medium of receipts from sales would vary approximately with the hazard, for there is a direct relation between sales receipts and volume. If the classifications contained wide variations, the high-priced as compared with low-priced goods would be penalized, for it would be expected that the more costly articles would be the better prepared and the less hazardous. The basis, however, is quite practical, as accurate sales records are essential to sound administration and are found in every line of business.

8. Protective Public Liability.

This coverage is given to owners, landlords, tenants, and contractors for their liability for injuries to the public on premises or operations which have been leased or contracted to others. The critical conditions and injurable objects are generally the same here as under the direct public liability of the lessees or sub-contractors. It is assumed that this secondary liability bears a constant ratio to direct liability and it follows that the exposure media should be the same as under direct liability. This is the procedure followed at present for Landlords' Protective Liability and Tenants' Protective Liability.

In Owners' or Contractors' Protective Public Liability a different exposure medium is used. As the coverage extends to injuries in connection with all material as well as the actual building operations it is believed that the use of the total cost of labor, material, and equipment as exposure medium gives greater responsiveness to losses. It is also recognized that this is in part a defense policy against attack on the owner or contractor in case the financial position of the party assuming direct liability precludes his paying a large verdict. This defense element of the hazard decreases as the financial position of the party assuming direct liability increases, or generally as the size of the contract increases. The ratio of the total hazard under protective liability to the total hazard under primary liability decreases with an increase in the size of the contract. As there is no practical expression which represents such a function, an approximation is made through graded charges, i. e. by charging one rate for a cost up to a fixed amount, then a smaller rate up to another fixed amount, and thereafter a still smaller rate. This is equivalent to decreasing the magnitude of the exposure by a fixed ratio in the second and third intervals. Such graded charges also might be applied to other media, e. g. payroll.

IV. Coverage for Liability for Professional Acts.

1. Physicians and Surgeons, Dentists, Optometrists, and Druggists.

2. Hospitals.

Under this form of insurance the injuries of clients arising out