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Final report of the Committee on Depreciation; Dissenting opinion to the final report of the Committee on Depreciation

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Final Report of the Committee on Depreciation

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FINAL REPORT OF THE COMMITTEE ON DEPRECIATION[1]

Depreciation, as ordinarily considered in the valuation of utilities, covers all of the losses in value that occur in the plant and property, or parts thereof, from all causes whatsoever. There are, therefore, a great many considerations entering into the total allowance for depreciation as above defined.

Losses of value which are complete, and fully demonstrated by proper abandonment or necessary replacement of the whole or a unit part of a property, are a matter of history and fact, and require only proper accounting to determine their occurrence and amount.

Losses of value, which are partial or incomplete, always require prophecy as to future need, usefulness, and service, in order to properly divide that portion of the value which still exists from that which is lost. This function necessitates much more judgment than accounting. It requires the careful analysis of a broadly trained, experienced, and practical mind, thoroughly familiar with the business in question.

For convenience in reasoning, the main losses of value in an ordinary property may be divided into four groups. These are briefly described as follows:

1. Operating maintenance and repair. A part of the inevitable loss of value of any operating property consists of ordinary wear and tear. This loss can and should be continuously made good in large part by the upkeep and renewal of minor parts, paid for month by month as necessary, and should be charged to operating maintenance account. Thus accounted for and cancelled, it does not again appear as a liability.

In valuing utility plants, maintenance conditions at date of valuation should be noted. In well maintained plants, neglected repair is small; if considerable, deferred maintenance should be estimated and charged. Repairs are usually going on in the or-

[1] Written discussions of this report may be sent to the Secretary, J. M. Diven, 47 State St., Troy, N. Y., for presentation at the next annual convention.

dinary operation of a property continuously, In some forms of utility plants, ordinary and rapid loss of value, which is made good by maintenance and repair, is a very considerable portion of the total depreciation to date, such, for instance, as in steam railways or electric lighting plants with heavy wear or short-life units. In other kinds of utilities, such as water works, it is comparatively small.

Examples of the more rapid type of depreciation are found in the wearing out of bearings on equipment, the replacing of small parts, re-roofing, repainting, and other miscellaneous care and expense which is constantly being made. During the many years that utilities have been operating, this loss of value has been paid for and accounted as operating maintenance. The future must be cared for in the same manner. It must not be overlooked that while this short-term replacement is paid for month by month in a well maintained plant, it is in reality a part of the whole lessening value factor, and should be so considered in the final summing up of the depreciation total.

2. Past renewals of major units. Even though the ordinary repairs are made continuously, as above described, there has been going on from the beginning a further decline in value, largely due to accumulating unfitness and changing needs to such extent that even certain major units have been in the past or must in the future finally be replaced. This culmination in larger units is reached only at long intervals, and, therefore, requires a different kind of accounting from operating maintenance.

It is known from experience that in different types of structure or machines, the useful life varies, and this can only be judged by the experience of trained appraisers. Thus useful life may be as low as five years for some kinds of electric equipment, or as high as one hundred years or more for well laid cast iron pipe under good service conditions, and it would perhaps be even longer for certain very permanent earthwork construction if future needs could be reasonably foretold. The inability of the most experienced to properly prophecy for as much as or for more than one hundred years must usually limit us to that extreme age as being all that it is wise or conservative to predict usefulness for in any case.

Where obsolescence in the past has been made good by replacement or enlargement, it, of course, should be paid for and cancelled. Like the prior item (1), we should not lose sight of it as part of the total plant depreciation, although we do not have to again consider it in depreciation deductions yet to be made.

3. Contingent depreciation. There is sometimes an unusual drop in value in plant units on account of contingencies which were not foreseen in the past, and cannot be foreseen in the future, and, therefore, cannot be more than generally provided for in the operating revenues of a property. These losses, while usually of infrequent occurrence, are particularly trying, because almost always unexpected.

Causes which contribute to this type of depreciation are commonly accidents, such as floods, fires, tornadoes, special kinds of unusual destruction, unexpected deficiency of supply, high operating prices which affect methods, sudden changes in the art, new inventions, war effects, extraordinary droughts, personal injuries, litigation for the protection of the property, and many varieties of sudden emergency.

When these kinds of contingencies have actually occurred in the past, they have ordinarily been paid for and cancelled. Where they are recent or operative at the date of a valuation and uncompensated for, they should be subject to careful inquiry, and a special allowance made, if necessary, in addition to the regular amortization allowances hereafter explained. For the future of the property, such losses can only be met by regularly setting aside a sum annually, which experience has shown will, in a general way, cover them properly.

4. Useful life or growing functional depreciation or decrepitude. Useful life, or functional depreciation in its completed form, has already been considered in (2) "Past Renewals of Major Units." From the standpoint of upkeep accounting, we must again consider it in its uncompleted aspect. As has been said, functional depreciation describes the growing inability of the structure or equipment to adequately fulfill the changing requirements which it must meet. Functional depreciation, however, practically covers almost all of the causes which tend to shorten and limit useful life. Chiefly, these are improvements in the arts, changes in demand, discovery of more economical methods, and changes caused by growth of business. Accelerated loss of value will often be found in a utility in a rapidly growing community, where larger buildings, plant, and equipment will be required long before the original installation is worn out or would naturally be displaced. Necessary changes often occur even when the original design and installation of the plant are still of the very best.

The service usefulness of a machine or structure rarely declines uniformly with advancing age. It often keeps well above that ratio. Also, the effect of increasing age cannot be made uniformly apparent as a fixed ratio from month to month, as is often the case with ordinary operating maintenance, but only becomes conveniently determined by special investigation at considerable intervals of some years apart, and by careful technical analysis and economic review.

This general loss of value, therefore, has been operative in the past, fractionally exists at the present, and will continue in the future until it is completed.

The above forms of loss of value from (1) Repair and Maintenance, (2) Past Renewals of Major Units, (3) Contingent Depreciation, and (4) Useful Life or Growing Functional Unfitness or Decrepitude, may be roughly divided into two classes, depending on the condition of the depreciation account, whether already determined and paid for, or as yet undetermined and unpaid for.

The First Class. Those accounts which have been determined, met, and paid for because they were visibly apparent from time to time at short intervals. This includes:

1. Past operating maintenance and repair, or such costs as have been met month by month, paid for, and charged to operating maintenance and repair account. Also contingent losses, such as have in the past occurred, been determined, and paid for.

2. Past renewals of major equipment, such as large structures or machines, the obsolescence of which took place over a considerable number of years, but when finally apparent, caused renewal or replacement, which were paid for and charged to general plant depreciation (often improperly added to Capital Account).

The Second Class. Those accounts which have not been determined or paid for, because not fully apparent. Such losses in value can only usually be determined by special investigation, as in a valuation investigation. These include:

3. Undetermined contingent loss at present operative, that is, the determination of the proper proportion of any considerable accidental or unusual loss of value still opera-

tive or recently revealed, and as yet not corrected, which has taken place in important structures or machines.

4. Useful life or growing functional unfitness or decrepitude, that is, the present fractional part of the final complete loss of value based on the past age and remaining expectancy of useful life of the larger machines and structures.

Obviously, these latter two classes (3) and (4) require careful analysis and final determination so as to fractionally separate the amount of value remaining from the amount of value which has disappeared. The determination of value remaining always requires prophecy as to future usefulness. There is no escape from this difficult duty.

METHODS OF DETERMINING INCOMPLETE LOSS OF VALUE

The best method of arriving at the just and proper division of completed and uncompleted loss of value in plant units as yet serving some useful purpose, has been much discussed among appraisers, and pretty generally agreed upon by those who are familiar with the subject from a practical standpoint.

For Contingent Losses which are complete but as yet undetermined, it is pretty generally conceded that the cost of replacement or repair, or the cost of any unusual losses that are met with, may well be used as a guide if proper and prudent management has obtained. Where contingent losses in value are of a character that they are insidiously operating at the present time, it requires some degree of skill to properly analyze what should be determined. Reasoning deduced from cost to replace, or the use of more fit methods or up-to-date machines or proper economic balance should be applicable, and empirical decisions should be avoided if it is at all possible to carefully reason out in economic detail any of these abnormal losses of value.

LOSSES DUE TO AGE

In Growing Functional Unfitness or Decrepitude we have properly to look into the question as to how the present age and probable future useful life of a unit affects its value, and this compels us to look into all the causes which may in the future increase or lessen the need for its service.

A few appraisers insist on jumping empirically to a hasty conclusion as to future life in terms of absolute percentage without much reasoning or a proper forecast of the causes tending to maintain or destroy values. Inexperienced appraisers are hardly equipped to make a reasonable forecast at all. Such results are, of course, unsatisfactory, and do not stand the tests of analysis or cross-examination. Some appraisers, from the desire for simplicity or from motives of prejudice, attempt to assign the fractional values on the basis of the proportional life lived to the probable secured complete life, on a system of what is called "straight-line depreciation." This, of course, is a step in advance over the first crudity, but it does not yet satisfy the conditions reasonably, for, as a matter-of-fact, if the age is known and the total useful life properly agreed upon, the problem becomes a question of practical financing, modified only by a review of other factors which affect the result at the present time.

STRAIGHT-LINE DEPRECIATION

Now, so-called straight-line depreciation, or direct apportionment on the ratio of age to life, is a rough method sometimes properly used to approximate what loss of value may be allowed, particularly in very short-lived and inexpensive property, such as tools and floating equipment not worth minute analysis or careful computation, but it is obvious that with the more important and valuable structures and machines, the lives of which extend over a period of years, not only are more careful methods warranted but we must also take into account, as a practical matter, that the yearly increment set aside out of earnings for this purpose will earn interest which can be added to the principal. Certainly, in ordinary experience, annual reserve increments to a replacement fund covering years in its operation will not be put into a safety vault or a stocking.

We are, therefore, of the opinion that straight-line and sinking-fund methods of finding present worth of life expectancy are not two alternative methods, which may be selected at the option of the evaluator and indiscriminately applied to the whole problem of depreciation, but that each has its proper place and function in different fields in the same appraisement.

In life expectancy the sinking fund methods should always be applied to determine the amortization rate of important and valuable units, the useful life of which extends over a series of years. Such annual payments for renewal are naturally kept in reserve funds, and properly invested so as to earn interest until needed, the interest logically and properly reducing somewhat the annual payment needed for final replacement.

Straight-line depreciation, on the other hand, is an approximation only, and only has excuse when the life of the unit to which it is applied is so short, or its value so small as to not warrant careful computation on the sinking-fund principle, except that the aggregate of a large number of such items may be averaged on the sinking fund basis when possible.

Thus, most operating maintenance items paid for from month to month, or tools and supplies and possibly some shortlived units having a life of, say, five years or less, may, with judgment, be estimated on the straight line or short-cut principle without serious injustice.

It should be pointed out here that in all valuation and rate regulation questions, straight-line depreciation applied to long-lived structures is very unjust to the public, for the reason that the public in the end pays the entire depreciation bill, and if that bill is computed by methods which ignore interest, and thus set aside more annual replacement funds than are really necessary, the public will suffer the difference.

When once the important matter of determining the future useful life has been properly settled, the matter of providing for the final replacement of important structures by equal annual payments really logically draws us into the computation of an insurance policy and the determination of its present worth.

If our future useful life is correctly judged, the present worth of such an insurance policy will, in many cases, be as good an assumption as we can reasonably make for the fractional loss of value we must assign to the structure or machine for its life expectancy, especially if there is no unusual special loss (contingent depreciation) operating. It is most important to carefully determine the proper estimate of future useful life, because however the intermediate values may vary from the sinking-fund accumulation, in the end both will be practically alike if the judgment of the valuer is reasonably correct, or is kept correct by repeated reviews at suitable intervals. Future life cannot be predicted with accuracy, even with all the recorded experience available, but this uncertainty can be practically eliminated by the correction from time to time or a re-investigation and adjustment every few years.

The majority of engineering opinion leans to the determination of losses of value arising from age and future useful life as best reasoned out from the basis of the present worth of a sinking fund, but modified by any special considerations which may exist in each special case.

A correctly computed sinking-fund consists of an amount annually paid in to a depreciation reserve account, which, with its interest increment from year to year, will serve to renew and replace each structure or machine at the end of its probable useful life, and the present worth of the fund is usually assumed to roughly measure the loss of par value in a structure or machine due to elapsed life, or at least be a basis for further reasoning. Such a reserve fund is usually not actually kept in hand, but is often replaced by the owner in the property as needed. When it is made an actual fund in fact, such actual fund is really a part of the property of the utility, although it must not be forgotten, a somewhat easily detached item.

FINDING THE DEPRECIATION AT ANY GIVEN DATE

In view of the foregoing outline of the problem before us, we may suggest briefly the necessary steps in finding the depreciation of a property, it being assumed that appreciations or gains in value which would offset depreciation or losses in value are not treated of in this report.

First. Inspect the plant to see that the operating maintenance is not neglected. Where it is evidently below what good practice would require, the neglected or deferred maintenance should be estimated.

Second. Although not absolutely necessary, yet it is desirable, as a part of the work of ascertaining the full, true depreciation up to date to determine the operating maintenance account of the plant from its beginning. This account should include contingent depreciation, as herein described, wherever paid for, it being understood that in reality both items have been met and cancelled in the past.

Third. Also the replacement of obsolete major units, paid for in the past, should be audited and totaled in a similar way.

Fourth. The existing property should be reviewed to see if there are any special and unusual losses in value in any of its units at present or recently operative and unaccounted for. Where special losses in value are reasonably found to exist, they should be estimated and deducted from the unit in question before proceeding to determine its age expectancy and compute its amortization fund.

Fifth. The depreciation on small items having short lives of less than, say, three to five years, may usually be arbitrarily estimated on a straight percentage basis without much injustice, owing to the small effect of interest on the annual increment.

Sixth. In all longer-lived and important units, it is customary to determine the age to date and decide on the reasonable future life from experience with other properties and similar units elsewhere, combined with an outlook on the probable future usefulness in the case in hand.

With these data, determine the annual amount which, if set aside from the date of original installation, would, with its interest, replace the property at the end of its useful life. This annual amount will be the yearly amortization charge, and its accumulation to the present time will give a sum which, if no special circumstances argue to the contrary, may usually and properly be assumed, from the financial point of view, to be the accrued loss by age alone. Finally, review the loss of value thus determined, and, all things considered, see if it is reasonable.

Seventh. Ascertain if an actual depreciation or reserve fund exists with the property under investigation. If so, find its amount and compare it with the computed amortization plus all unpaid losses of value. If it is too large, such fund should be gradually reduced in the near future; if it is too small, it must be increased annually until a reasonable balance with the investigated and determined loss of value is approximated.

Eighth. To find the true total depreciation of a property to date, add (1) The Neglected or Deferred Maintenance, if any, (2) the Operating Maintenance Account from the beginning, (3) the Sum of all the Major Replacements of the past, (4) the Unusual or Contingent Depreciation, if any, as determined at date, and (5) the sum of the Accrued Amortization Funds of all the units of the property at the present time.

This is the true loss of value, in part based on fact and in part based on the judgment of the investigator, and the total thus found should theoretically approximate the total of (1) the cash paid out in the past for operating maintenance (plus contingent depreciation), (2) the cash paid out for actual replacement, and (3) the present proper cash reserve or amortization fund of the company, if any.

Ninth. If no cash is actually on hand or is being accumulated, then the unbalanced portion of the computed depreciation, i.e., that which has not been met by cash outlay, should be deducted from the reproduction cost new, in order to get properly the present net cost of reproduction; that is to say, the reproduction of a property that is not new.

Tenth. If an amortization or reserve fund has been accumulated with a property to be used, with its increments of interest, for renewals or replacements (outside of operating maintenance), such fund should be considered as a part of the property, and should earn, in addition to its own interest increments, a general fair return from revenues, for the owner of the property derives no return from the reserve fund except as it keeps the investment at par value, a condition to which he is entitled prior to the computation of fair return.

PROVISIONS FOR TAKING CARE OF FUTURE DEPRECIATION

It is a well-recognized principle in the operation of public utilities, that the investor, whether a private corporation or a municipality, must be allowed to keep the original investment and its additions intact. Unless this principle governed, it would be impossible to secure additional capital for plant additions. It is necessary, therefore, to allow earnings to be realized which will pay all ordinary operating costs and make good all of the other losses of value above described, and, in addition, earn a fair net return upon the investment.

The determination of the proper and correct amount to be set aside in a reserve fund must always be somewhat a matter of some intelligent forecast, but, as a practical administrative matter, it is always possible to make re-adjustments from time to time as will keep the reserve fund practically just what is actually needed for the purpose of replacement.

The true total future reserve or depreciation fund should theoretically include the operating maintenance account, but, as previously explained, this is usually financed directly month by month out of operating expenses, and if it continues to be so financed it does not have to be considered in fixing a rate for future depreciation.

Provision for caring for depreciation should, therefore, be as follows:

First. Provide for all ordinary, more or less continuous maintenance as an ordinary operating charge.

Second. Create, where possible, a separate reserve fund for depreciation, sufficient to cover all losses in value other than those covered under ordinary maintenance. Such fund should earn interest and is subject to withdrawal for replacement when needed from time to time.

Third. Test the adequacy of the reserve fund by careful technical appraisal and review its sufficiency once, say, every few years, and adjust its annual increment as seems to be necessary.

COMPUTATION OF PRESENT WORTH OF AMORTIZATION OF LONG-LIVED UNITS

The method of computing the present worth of an amortization or sinking fund for long-lived units is greatly facilitated by the use of either of the two diagrams here shown. Knowing the present age, and judging the assumed useful life from experience with other similar cases or conditions, a line leading from their intersecting lines produced downward will indicate the percentage of the accumulated amortization fund to date in terms of par value, or, in other words, the present worth of a life insurance policy for the unit under consideration.

When other influences than age are operating, they should be further considered and may cause a shorter life to be assumed than would normally be the case, or in some cases they clearly denote that it is necessary to arbitrarily lessen the par value before future life is predicted or amortization computed.

One of the diagrams presented herewith is based on a uniform interest of 4 per cent for both long and short lived structures, and has been used by many of the Utility Commissions. A 5 per cent rate has been recommended to the American Society of Civil Engineers, and may become necessary if money rates are materially or permanently raised by the war.

The other diagram is based on what is known as the "sliding scale," which takes into account the idea that the certainty of in-

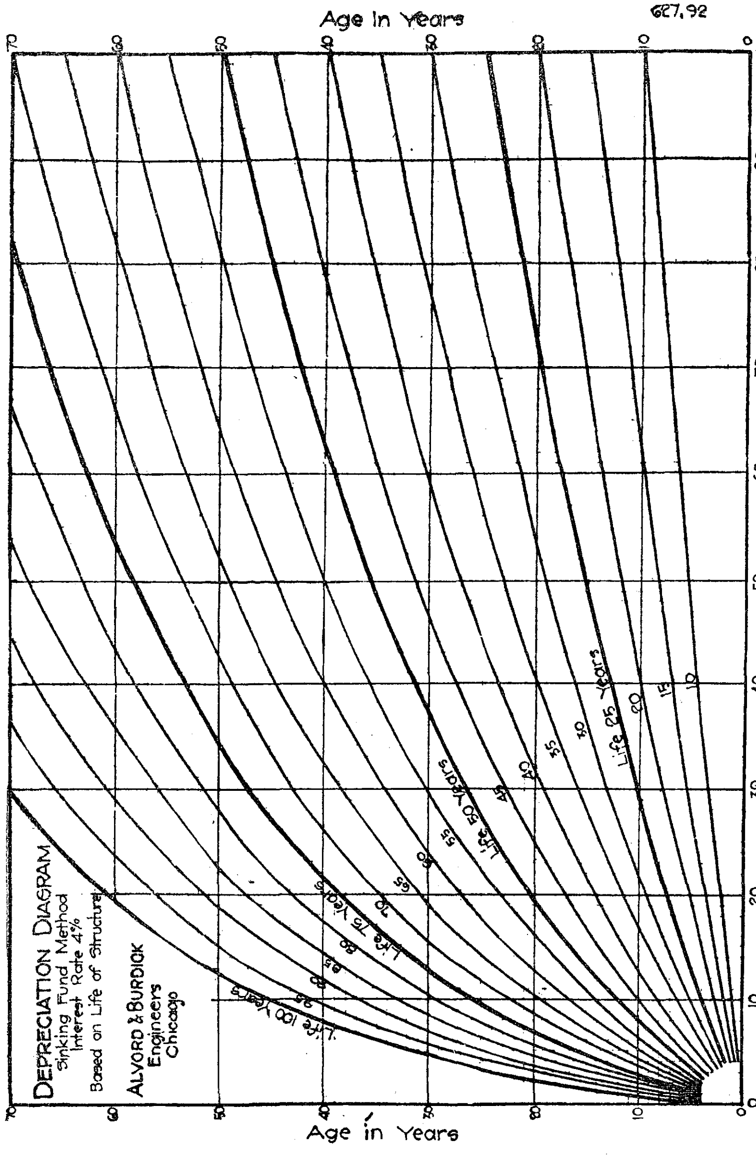

FIG. 1. DEPRECIATION DIAGRAM, 4 PER CENT INTEREST

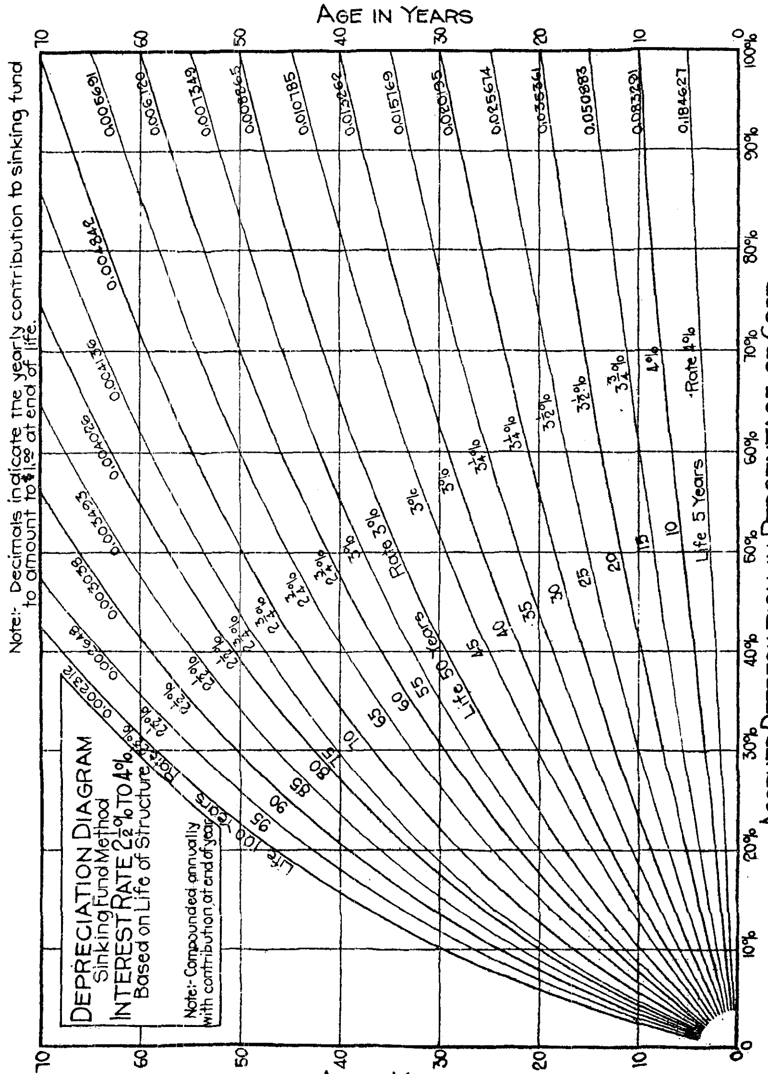

FIG. 2. DEPRECIATION DIAGRAM, 2½ TO 4 PER CENT INTEREST

terest rates is not so well assured over very long periods as it is over comparatively short periods, and that long-lived structures are amortized on some less interest rate than are short-lived structures. This scale was first introduced in the Omaha appraisal, and has been often agreed to by water works engineers, but has not found favor with the Utility Commissions.

The effect of a small interest rate is to slightly increase the amortization fund and the annual payment thereto.

It is observed that the amount which is set aside annually from earnings is lowered by the compounding effect which the sinking fund enjoys. In the early years of an installation, it is usually observable that the loss of value, and especially loss of service value, is relatively small. The sinking fund in such cases tends, in a way, to follow this general condition.

The financial methods necessary to replace or amortize a structure through a sinking fund must not, however, be confounded with the service usefulness of a unit, which may in some cases keep well up to par during useful life, and in other cases rapidly drop after installation owing to poor judgment in purchase, as in contingent depreciation already discussed. The amortization fund measures only one kind of loss of value, that due to mere age, and it may differ from service value, just as service value may differ from price value or scrap value.

When useful life is correctly known, age is usually the greatest factor of value loss. But it sometimes occurs that service value loss is greater at date of valuation than life expectancy loss. When this condition exists, it is obvious that we must consider service value loss as a special contingent depreciation (as heretofore discussed) before determining life expectancy loss.

Some valuers prefer to deduct final scrap value from par value before determining life expectancy loss, or amortization. This may be done where desired, but in view of the inadequacy of the data for future scrap value, it seems to be a refinement that is hardly warranted. In extreme cases the variation of a year or two in assumed life will operate fully as well to express the judgment of the evaluator.

The estimation of the probable future life of the various parts of a plant is the real test of the judgment and experience of the estimator, for it involves an extended knowledge of the lives of similar structures under all kinds of operating conditions, as well as a local study of the property in question. The lives of different structures vary with the class of property or equipment, the character of construction, the care with which they are operated, the thoroughness with which they are maintained, the wisdom with which the investment was originally made, and, above all, the probable changes in the future needs of the public which is served. To illustrate this, the life of boilers depends somewhat upon the quality of the water used, but more upon the future requirements for steam. The length of time which water mains may remain in service depends upon the kind of water passing through them, the character of the soils in which they are laid, the effects of electrolysis, and other physical considerations, but more than these influences is the effect upon their useful lives of the growth of the community, its drift, and the requirements of its future supply.

It is obvious that the determination and control of depreciation reserves and the proper accounting of depreciation is vital to general knowledge of the success or failure of any business in its ultimate analysis, and that the proper determination of depreciation losses, especially those requiring prophecy in the future, is a difficult and technical judicial review, which cannot be properly or justly determined by those inexperienced in water works management, operation, maintenance, and financing.

The correct determination of depreciation is, after all, a matter of sound judgment, common sense, and logical reasoning. All the aids herein outlined and suggested are only to be used with judgment to aid good judgment, but so used they are extremely valuable and helpful.

As has been stated in the beginning of this report, the determination of losses in value requires prophecy into human needs of the near future, for human needs create and maintain all values, and absence of human need destroys and depreciates all values. To prophesy future needs is not always possible, but it is more and more possible as one relies on extended past actual experience as a guide to the future.

Respectfully submitted,

John W. Alvord, of Chicago, Ill., *Chairman.*
Prof. Daniel W. Mead, of Madison, Wis.
C. B. Salmon, of Beloit, Wis.
W. F. Wilcox, of Ensley, Ala.

Dissenting:

James Nisbet Hazlehurst, of Atlanta, Ga.

APPENDIX I—NOMENCLATURE

It has become increasingly necessary in valuation literature to explicitly define the meaning of words commonly employed, because a considerable number of readers are ordinarily careless about exact definition. As an instance of this carelessness, many beginners thoughtlessly associate depreciation almost wholly with wear and tear, due to the fact that that phase of the subject is most apparent and the most frequently assigned, when, as a matter-of-fact, competent authority defines depreciation as loss of value arising from any cause whatever.

The following definitions will be helpful in studying and understanding this report:

1. Property. That which is owned; that which belongs exclusively to an individual; that to which a person has a legal title (whether in his possession or not); the exclusive right of possession, including all the rights which accompany ownership and is its incident.

2. *Value.* The property or properties of a thing which render it useful, and enable it to fill a human need.

3. In political economy, value is distinguished as intrinsic and exchangeable. Intrinsic value is the measure (usually in money) of the supply required for a human need.

4. Exchange value. Exchange value is the adjustment of two services, i.e., as between a willing seller and a willing buyer under open conditions of competition.

5. Need. A state that requires supply or relief; pressing occasion for something; necessity; want. (Webster.)

6. Intrinsic value. Inward; internal; hence; true; genuine; real; essential; inherent; not apparent or accidental. (Webster.)

7. Cost. The actual outlay of money, or its equivalent, for a property, structure, or machine.

8. Past cost. The amount of money, or its equivalent, actually expended in the past in creating and building up a property.

9. Investment. The amount of capital, or its equivalent, actually expended for a property in the past.

10. Reproduction cost. An estimate of the cost of recreating a property at the present time under conditions that are humanly possible and practical.

11. Franchise. A grant by the public of the necessary rights to do a specific business.

12. Public utility. A business supplying a public need, and based on a public grant.

13. Monopoly. A business having exclusive power of dealing in a service, and thus conducted without competition.

14. Depreciation. (1) The act of lessening or bringing down price or value.

(2) A fall in value; reduction of worth. (Century Dictionary.)

15. Obsolescence. The condition or process by which units gradually cease to be useful or profitable as a part of a property on account of changed conditions.

16. Appreciation. The increase in worth of a property, structure, or machine due to its increasing use, strategic location, the increasing need for its service, or other like influences.

17. Maintenance (operating). The act of maintaining; supporting; upholding; defending or keeping up; sustenance; support; defense; vindication. (Webster.)

18. Repair. To restore to sound or good state after decay; injury; dilapidation or partial destruction, as to repair a house, a wall, or a strip. (Webster.)

19. Renew. To make over as good as new; to restore to former freshness or perfection; to give new life to; to rejuvenate; to restore; to reëstablish; to recreate; to rebuild. (Webster.)

20. Functional depreciation. Depreciation due to inadequacy, obsolescence, and supersession.

21. Contingent depreciation. Loss of value arising from unforeseen contingencies, accidents, emergencies, and adverse and destructive tendencies exterior to the property.

22. Physical depreciation. Loss of value due to wear and tear under operating conditions, or action of the elements in non-operating conditions.

23. Deterioration. Reduction in the quality of a property unit, or in its efficiency for service due to its physical condition.

24. Accrued depreciation. Depreciation which has taken placc; the completed loss of value as separated from that which is yet incomplete, usually limited to existing structures.

25. Amortization. The repayment of an original investment or debt by means of sinking funds, or other moneys set aside from time to time in expectancy of obsolescence.

26. Sinking fund. A fund created and systematically added to for sinking or paying a debt, or meeting expected losses of value. (Webster.)

APPENDIX II—THE DETERMINATION OF PROBABLE LIFE OF UNITS

The Committee have spent much time in the past in an effort to compile a card index list of known useful life of water works units, but the results have not been entirely satisfactory, and, on the whole, it is believed that it is not useful to publish this information in detail, because much of the data is obviously incomplete, inaccurate, and misleading. The Committee have therefore concluded to summarize the information only in a general way.

In fixing useful life of plant units for the purpose of amortizing their cost, it is well to remember that as the public must reimburse the utility for this loss of value before the computation of fair rates can be ascertained, there is no real dispute over the matter except to get at the facts correctly. Unreasonably large depreciations make for unduly high rates. Unduly small depreciations make for insufficient revenue. No one can be permanently interested in either of these mistakes.

Among other considerations, in fixing upon probable life it is also well to remember that prudence and conservatism suggest that, if anything, we underestimate life somewhat rather than overestimate it, especially in short-lived units, which cannot be readjusted from time to time. The prudent owner will never unduly magnify his future stability of plant endurance, a very common optimism which often leads to serious embarrassment and even disaster.

It is further desirable to note that human needs even of the most fundamental kind, cannot be successfully predicted for more than a century, or at the utmost a century and a half ahead. In valuation work, it is always the future need of the public served that makes utility value, and this need must therefore be predicted as carefully as possible, but we are not warranted in predictions that are not reasonable in the light of past history.

The greater portion of the water works of this country has been built since 1870, a period of less than 50 years. The life of a water supply or any of its parts should not, as a matter of prudence, be estimated at too long a life; first, because it can be amortized in about a century without burden, and, second, because to predict the needs of human civilization farther than this would be to tax credulity.

With these generalizations, it is interesting to note in some detail the effect of past experience in some of the major units that enter into water works property on the probable future length of usefulness.

The following are the general conclusions of the Committee:

STORAGE RESERVOIRS AND HEAVY EARTHEN OR MASONRY DAMS, LARGE MASONRY CONDUITS AND TUNNELS

Physical. All structures of earth or earth and masonry are very durable, and in some cases reservoirs, aqueducts, and dams have lasted thousands of years. Undoubtedly such construction well-maintained is ordinarily good for some hundreds of years, physically often far outliving their functional usefulness.

Functional. All structures holding or conveying water are subject to accident from rupture, floods, burrowing animals, ice pressure, windstorms, leaks, insecure foundation, polluting influences, and malicious destruction.

Physical and contingent losses of value will be made good ordinarily by operating maintenance. This being thoroughly done, such structures should, in addition, be amortized about as follows:

Large storage reservoirs, well located............................75 to 150.
Heavy earthen or masonry dams................................75 to 150.
Large masonry conduits and tunnels............................75 to 150.

CONDUITS AND DISTRIBUTION PIPE OF CAST IRON OF LARGE DIAMETER

Cast iron pipe coated and buried in the ground is a very durable structure. We have little knowledge of its final effective life from a physical point of view. There are some instances of two hundred years' life for uncoated pipe. Largely, we must amortize such durable material, kept clean and well maintained, again by consideration of the possible changes in public need, functional usefulness, and the burden of a reasonable amortization, say..75 to 125.

CONDUITS AND DISTRIBUTION PIPE OF WROUGHT IRON OR STEEL OF LARGE DIAMETER

Thickness of shell and sensitiveness to a greater range of deteriorating influences must of necessity bring the life of wrought iron and steel physically below that of cast iron, and in many cases below functional considerations, 35 to 75.

CONDUITS AND DISTRIBUTION PIPE OF WOOD STAVE OF LARGE DIAMETER

Ultimate experience somewhat limited, but thought to be about in same class as steel, when well protected and constantly saturated........30 to 60.

DISTRIBUTION PIPE OF SMALL DIAMETER

a. Cast iron. Limitations of size increase difficulties in interior cleaning and maintenance. Such smaller mains are at times removed in rapidly growing cities to make way for larger pipe, Often, they are only supplemented, 30 to 70.

It should be noted that in slow growing and smaller cities small mains are less liable to be outgrown than in larger cities....................50 to 90.

b. Wrought iron and steel mains. Affected by kind of water carried, soil, and coating. Liability of replacement probably greatest influence in shortening useful life..25 to 40.

c. Services

Wrought Iron and Steel..................................15 to 30.

Lead..40 to 80.

Of services, it should be noted that character of water carried, soil, and coating are influential, but changing needs are also important.

SMALL DISTRIBUTION RESERVOIRS

Physically, these structures are very permanent. Changing needs often destroy or impair their usefulness and value; they are often surrounded by growing population and increasing land value, which, in connection with decreasing need, make it desirable to abandon them. They sometimes lose value on account of need for increased head.......................50 to 75.

STANDPIPES

Are affected by most of the influences mentioned above, and lose value in rapidly growing towns by insufficient proportional storage capacity with increased consumption. They often have value as regulators, however, long after their storage usefulness is diminished.

Wrought iron and steel..30 to 60.

Reinforced concrete...50 to 60.

VALVES

Valves physically should be amortized on the basis of the life of the valve body, the working parts being subject to operating maintenance. Fundamentally, they are more subject to change and improvement than the pipe in which they are set, and therefore should have shorter life.........40 to 60.

HYDRANTS

Theoretically should have the average physical life of the hydrant body, the same as valves, but being in part exposed and more liable to accident and injury, and more often operated, may be considered to have somewhat shorter life than valves..30 to 50.

METERS

Physically they should be amortized on the basis of the life of the meter casing, the working parts being subject to renewal and repair, chargeable to operating maintenance. Fundamentally, being of delicate construction and of necessity exposed to frost, clogging, and other adverse influences and often renewed, suggested life..20 to 30.

PUMPING MACHINERY

Pumping machine units are functionally sensitive to changes in consumption, growth of population, improvements in the art, influences affecting source of supply, amount of use, character of water, etc., and these are the conditions that ordinarily fix their useful life.

Where function does not control physical life for amortization purposes, it should be predicated on the probable useful life of the stationary and heavier castings, all working parts being cared for annually by operating maintenance.

High duty large units..35 to 60.
High duty small units (say, below 6,000,000 gallons per day capacity.
25 to 50.
Ordinary direct-acting..20 to 40.
Centrifugal, not geared..20 to 30.
Centrifugal, geared..15 to 25.

Boiler feed and auxiliary pumps usually take the life of the units to which they are attached.

STEAM ENGINES

About the same considerations as above........................20 to 40.

BOILERS

Are affected by water used, care and attention, changes in station, and changes in pressure. They may often have a long period of usefulness in reserve..15 to 30.

ELECTRIC GENERATORS AND MOTORS

In general, follow the reasoning on pumps, but are shorter lived..20 to 30.

FILTER PLANTS

Now well standardized. Life should be predicated on general usefulness of station and source, as well as function of the filters themselves.

Masonry filters..30 to 50.
Wood filters..15 to 30.

BUILDINGS

Must be reviewed in the light of the probable life of the station as a whole. In rapidly growing towns they are frequently outgrown, but can often be enlarged. They lose value often in a general way because of changes in the style of architecture. Where function does not control their lives physically, it should be based on masonry walls, foundations, and roof supports; all other parts being removed from time to time by operating maintenance account.

Masonry..30 to 60.
Wood..20 to 40.

STACKS

Are limited in life to conditions of power production directly; somewhat affected by style and general appearance.

Masonry..25 to 50.
Steel...10 to 25.

APPENDIX III—SHALL DEPRECIATION BE DEDUCTED FROM COST NEW?

The economic fallacy that loss of value should not be deducted from the cost new today of an old property as a guide to finding fair present value for rate-making purposes has been recently promulgated by a few advocates, but in the face of the fact that settled practice, following earlier discussions, has agreed with the courts in always making the deduction of loss of value in old plants when valued new as of today, it would appear fair if we add the gain in value of old plants when found, to likewise deduct the loss of value in old plants when found, either from original investment or cost new as of today.

The proposition, however, has found certain favor, especially with those newly studying the art of valuation, who argue that certain utilities have different status from other utilities, but they have not yet been shown that fundamental principles of valuation differ or can differ. It is true, certain kinds of utility may have month to month replacement of short-lived units to a greater extent than some other kinds of utilities, but this does not alter the principle that losses of value should be considered as well as gains in value.

The fundamental fallacies underlying this point of view seem to be:

First. The idea that depreciation is limited to physical wear and tear, which can he made good by operating maintenance to the extent that no other kind of loss in value need be considered.

Depreciation, as shown in this report, has no such limited meaning, but covers all kinds of losses of value, such as style, changing ideas, depopulation and resulting cessation of demand for service, decreasing plant fitness as a whole. Properties are constantly rising or falling in value, and as ultimately they all die, either by parts or as a whole, it is this fact that is the most important to remember in considering depreciation.

Second. The idea is current that, in public utility valuations, it is an original investment and its additions from time to time that is being protected in an accounting fashion by the courts and commissions, rather than a review of the present status, usefulness, and need-supplying ability of the utility.

If this statement were true, then there would be no hazard to the utility business, for eventually the State, through the utility regulation, would logically and finally have to guarantee every investment against loss, dissipation, or extinction. This is not only against public policy, but it can easily be shown that it would be economically unsound and irrational for the public to undertake.

It being true, then, that depreciation covers all kinds of loss of value, including lessening need for plant service, and also true that we are not protecting an original investment mathematically, but are engaged in the more practical and useful inquiry of finding the present intrinsic value of a property today, regardless of its first cost or investment account, it follows that if we fail to follow either of the formulae for finding value:

(1) Original Cost + Appreciation − Depreciation = Present Value; or,

(2) Reproduction Cost + Appreciation − Depreciation = Present Value we vitiate our equation and render our answer worse than useless, because it is inaccurate and misleading.

Loss of value, therefore, wherever it can be logically made apparent in old properties, must be deducted from cost new of a property as of today to find present value, just as gains in value of an old property must likewise be added to find its value now. If, in the first formula given above, the gains in value are largely lacking and have to be found and added, and in the second formula the losses of value are the most largely lacking and have to be found and deducted from cost new, it does not alter the conclusion, which ought to be the same in both cases, to be just and fair. Correct reasoning requires all losses and all gains in value to be found and added to the base cost, whether that base be past cost or present cost new. Without much hard thinking this ought to be clear as a fundamental principle of valuation and depreciation.

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DISSENTING OPINION TO THE FINAL REPORT OF THE COMMITTEE ON DEPRECIATION

In presenting a substitute to that portion of the Depreciation Committee's report referring to methods of determining incomplete loss of value, as set out in paragraphs discussing "Loss Due to Age and Straight-Line Depreciation," I desire to subscribe in the main to the report as formulated by this Committee after four years of continuous effort, and it is with extreme regret that I feel forced to dissent from the belief of the Chairman and the majority of its members, and here and now to part company from so distinguished and representative a body of engineers and experts in appraisal work.

Before expressing this difference of opinion, permit me to voice my admiration for the masterly presentation and summation of ideas submitted by the committee members and as formulated by the Chairman.

METHODS OF ACCOUNTING

As an economic law, not to be successfully contended, all depreciation due to service must be met by the public some time, some place, somehow. This law is also written into the statutes (U. S. 212 1, 181).

To determine depreciation in all of its phases is not easy. The life of the parts of a water works property, or as a whole, can be approximated only and by those whose past experience and practice in engineering and management have permitted a broad experience.

A conscientious, painstaking, honest and accurate examination by a qualified observer should come reasonably near the truth. His efforts and labors will be facilitated by useful life tables compiled from past records under average conditions, contributed by acknowledged experts or from personal knowledge of the observer.

Depreciation should be spread equally over the entire life of the property and must be measured by some standard.

While several methods have been evolved, two have generally been regarded as best and simplest in practice. These are the "sinking-fund" and "straight-line" methods.

The sinking-fund contemplates payments by the customers to the company each year of such a sum as will, when invested at compound interest, amount with accretions at the end of the estimated useful life of the property in service, to the sum originally invested.

The straight-line method is simply the payment or allowance to the company each year of a sum equal to the investment divided by the number of years estimated as the life expectancy of the property.

LEGAL DIFFERENTIATION

In the valuation of the physical property of a public utility for transfer, as in purchase or sale, a conspicuous contrast is presented to its application for rate making purposes, and when so compared both in equity and in law, there is a recognized and sharp distinction.

Referring briefly to legal decisions touching this question, there is small reason to doubt that in rate cases, at any rate, the general rule seems to approve the sinking-fund method of treating physical and sometimes functional depreciation deduction.[1]

Where depreciation is one of the things to be considered in franchise tax cases, the straight-line, rather than the sinking-fund method has been prescribed by legal authorities.[2]

As a factor in accounting, some of the most advanced regulating bodies, for instance, the state of Wisconsin, have in most instances applied the straight-line plan.[3]

Besides these specific legal determinations, in purchase or rate cases, it has been said:[4]

[1] San Joaquin and Kings R. C. and I Co. vs. Stanilaus Co. (1911), Fed. 875, 881.

Cumberland Y and T Co. vs. City of Louisville, (1911), 187 Fed. 637.

Spring Valley Water Works vs. City of and County of San Francisco (1911), 192 Fed. 137.

People ex red. Kings Co. Ltg. Co. vs. Pub. Serv. Comm. (1913), 156 N. Y. App. Div. 603.

[2] Cumberland Tel. and Tel. Co. vs. City of Louisville (1911), 187 Fed. 637, 655.

Louisville and Nashville R. R. Co. vs. R. R. Commrs. of Alabama (1911), U. S. Circuit Court, Middle Dist. of Alabama, Report of Wm. A. Hunter, Special Master in Chancery.

[3] Regulation of Railroads and Public Utilities in Wisconsin; Fred L. Holmes, p. 92.

[4] Jacob H. Goetz, Council Pub. Service Commission New York; the Utilities Magazine, Vol. 1, No. 3, P. 109.

The question of what method should be adopted in calculating the depreciation is not discussed in the purchase and condemnation cases, perhaps because the courts have used the same method that was used either by the public utility or in the decisions involving depreciation in relation to rate determination. A recent English case, after discussing the question, adopted the straight-line method.[5]

Thus it would seem that there is a distinct necessity for differentiation between the several purposes to which depreciation is to be applied, which does not seem to have received recognition in the report of the Committee on Depreciation.

From the numerous decisions cited, it can hardly be maintained that the courts more generally and widely use the sinking-fund method of figuring depreciation than any other; nor does this statement seem to square with the position taken on this subject by some of the most progressive commissions.

Attention is called to the fact that not only have the courts observed fundamental differences, but that these utility commissions have recognized the need of distinguishing or differentiating, as evidenced by excerpts from recent correspondence between the Railroad Commission of the state of California, March 7, 1916, and the speaker:

> This Commission has not provided definitely for uniform use of either straight-line, sinking-fund, or so-called equal annual payment method of determining accrued depreciation.
>
> In general the Commission is now, in establishing rates, endeavoring to provide interest upon the reasonable investment for the service rendered and a sinking-fund theoretically sufficient to replace the property when that becomes necessary. In determining value for transfer of properties or as a security for issuance of bonds or stock, the straight line method has generally been used.

Thus, under date of March 7, 1916, the Public Service Commission, Second District, state of New York, writes in part as follows:

> The Commission has not as yet standardized methods of reckoning depreciation, but while requiring that depreciation should be accounted for by the companies under its supervision, it leaves to their discretion the method by which depreciation, obsolescence and inadequacy are to be estimated and taken upon their books. The Commission's recent practice, however, in cases where it seemed necessary to compute a theoretical accrued depreciation, has been to use rates for each class of depreciable property in the form of a per-

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[5] Natl. T. Co. vs. His Majesty's P. M. General (1913), 16 A. T. and T. Co. L 491, 538.

centage of its book cost based upon the average length of life in service under the most favorable conditions. In other words, it practically always uses the straight-line method for estimating both accrued depreciation up to any given date, and future annual depreciation charges.

As recently as April 30, 1917, in answer to the question as to "Depreciation, and how it should be accounted," the Railroad Commission of Georgia, referring to a late decision, replied in part as follows:

You will note that this Commission has approved the straight-line method. This method has been used by the Commission in practically all of the Georgia rates cases that have been up for decision within the last several years. I know of no instance in which the Commission has used other than the straight-line method.

Indeed in answer to a recent query as to how depreciation was estimated, it seems that the straight-line method has been adopted by the regulating bodies in the following states: Arizona, California, Georgia, Illinois, Idaho, Kansas, Missouri, Nevada, New York and Oregon.

The state of Wisconsin sometimes prefers the sinking fund method of determining depreciation, while Indiana is the only state where it seems to be used without qualifications.

Further, in May, 1915, these commissions were represented with the railroads in conference with the Division of Valuation, Inter-State Commerce Commission. In reply to the question by the director as to "How shall depreciation be determined," the various commissions and railroad officials, through the Hon. Milo R. Maltbee, answered as follows:

Deferred maintenance, if any, should first be determined. Age to date of appraisal and scrap value shall be ascertained and stated. Expected life shall be determined after inspection, examination of records and consideration of all factors that affect the period of usefulness. The accrued depreciation shall then be ascertained by ratio which age bears to total life applied to cost less scrap value. Deferred maintenance, if any, shall be added to this amount.

INTERSTATE COMMERCE COMMISSION

In November, 1915, the Engineering Board of the Division of Valuation, consisting of five members, at least one of whom was a practical water works operator and engineer of wide experience in such utility appraisals, submitted to the director a memorandum (No. 226), in which Depreciation is defined as the lessening worth of physical property due to use or other causes and to be determined by a consideration of observations of actual conditions of the property and mortality statistics of similar property in like use applied when practicable on the straight-line basis.

Under date of May 4 last, Director Prouty advised the speaker that:

> The straight-line method of depreciation is employed by the Commission in stating the depreciation of railroad property under the Valuation Act.

This decision is of momentous importance considering the gigantic work of valuating the railroads of the country.

While admitting that state regulating bodies have all sorts of utilities to deal with, and that railroad property in general should be differently classed from water works plants, yet the significance of the answer given by the Director and its application to water works properties controlled by the state or in miniature along the railway lines, supplying shops and terminals, must have been understood.

OPERATORS ACCOUNTING

That operators and accountants of water works use the sinking-fund method, generally, can hardly be admitted or conceded. Is it not, as a matter of fact, the practice of prudently operated utility plants to lay aside out of earnings the cost of operation, including maintenance; to provide for interest and perhaps sinking fund for hired money; to pay in dividends a reasonable rate per cent? And any surplus is not hid under a mattress nor put into a stocking, nor as a rule, is it even prudently invested in a savings bank at low interest rate, but such earnings over fixed charges and operating expenses are generally spent in plant betterment.

At the time of valuation for rate making, capitalizing or purchase and sale, an accounting would naturally show that both the original investment and this surplus increment have been made in physical property, which will have visibly depreciated to an extent approximately to be determined by experts. At such times it seems reasonable to first consider that the machine whose serviceable life is half gone is worth only one-half what it was when installed new, although in point of service it may be in continuous and efficient and economical use. Such consideration means that accrued depreciation shall be ascertained by the ratio which age bears to the total life—or the straight-line method.

ENGINEERING EXPERTS

Certainly, engineers differ radically as to the methods which should be adopted in measuring depreciation and as to how it should be accounted. In December, 1916, the Committee on Valuation of Public Utilities, appointed by the American Society of Civil Engineers, from amongst its most distinguished and expert members brought in their long-looked-for report. Their labors extended over five years, during which time forty-eight joint meetings (some of them consisting of three sessions) were held, and a voluminous correspondence filed. In presenting this report the Committee referred to the fact that the art of valuation was still in formative condition, evidenced by the conflicting views expressed or principles enunciated even by the higher courts. Referring to the matter of depreciation, the Committee says:

"Perhaps there is no single subject in connection with Valuation that has caused more trouble than Depreciation." And after discussing fundamental principles and illustrating methods of accounting, the Committee suggests three methods of measuring Depreciation as follows:

The Straight-Line Theory,
The Compound Interest Theory,
The Replacement Method,

as being three of the more generally used. Summarizing, the Committee was of the opinion that the several methods described are respectively more particularly applicable as follows:

The replacement method is applicable to those short-lived properties or parts of properties made up of a large number of items, the replacement or retirement of which proceeds after a time with fair regularity and causes no troublesome variations in return or service rates.

The straight-line method of accounting applies to any property units having more than a year of service life which are assumed to depreciate according to the straight-line theory.

The compound interest theory applies similarly to property units assumed to depreciate according to the compound interest theory.

Under either method it may be necessary to maintain a fund not invested in the property itself, as when the property is stationary or consists of only a very few large units of long life. For such properties, the sinking-fund method of accounting could be adopted if the compound interest theory is held to apply, provided it is fully understood and correctly applied, but it is not recommended.

The great discrepancy in growth of depreciation of long-lived units, under the straight-line and compound interest theories, should be carefully noted when determining which theory to use.

A CASE IN POINT

To emphasize this latter point, in a recent arbitration in which two members of this Committee participated, the depreciation of the property considered as represented by the straight-line method amounted to $743,159, while according to the compound interest curve with four per cent allowance, $394,183 marked the accrued depreciation, there being a difference in this single property of $348,976, notwithstanding the fact that there was no dispute over the items of the physical property, their condition at the time of valuation, their life expectancy and cost new. In this particular case, where the speaker represented the city, he dissented then as he does now from the application of the sinking-fund-method to continuously operated plants where sale and purchase are being considered.

OTHER PRECEDENTS

That other engineers have held similar views may be inferred from the report on the Queen's County Water Company's entire plant useful for water works. Hon. Delos F. Wilcox, Deputy Commissioner, with plant valuation $1,713,499, reported in part as follows:

Depreciation has been figured on the straight-line basis on the theory that this particular plant has reached the stage in its development where the replacements required from year to year will constitute a relatively constant item of expenditure which should be met out of an annual allowance taken from earnings rather than be charged to capital account, as has been done heretofore.

The controlling considerations in adopting the straight-line rather than the sinking-fund method in this case are, in the first place, simplicity of accounting, and in the second, the fact that the plant will never have to be renewed as a whole and can never be brought much above, and need never be permitted to fall much below, the standard of practical efficiency now maintained. In other words, there is no call for the extremely complex and futile computations which would be necessary if we were to assume that a fund must be set aside for each individual unit of the plant sufficient to replace the particular unit when worn out or obsolete. Replacements will have to be made from time to time and although they will doubtless fluctuate considerably, perhaps even sharply, from year to year, the general average will maintain. This makes the use of our straight-line method of charging depreciation as easy as it is appropriate.

The equal-annual-payment method of charging depreciation, which has recently received considerable theoretical support, is altogether too complex to be applied to an old plant like that of the Queen's County Water Company, with an irregular past development and great uncertainty in regard to investment details.

DISCREPANCY AND COMPENSATION

While in general accord with the experience of every practical plant operator that the straight-line method is open to the practical and theoretical objection that it is not in general agreement with actual experience in the life history of water works structures other than those of very short life—its application giving considerably higher allowance for accrued depreciation in the early years of the life history of the plant than is justified by the usual actual condition of the structures—structures generally suffering small depreciation and maintaining high service value during the early years of their installation and depreciating more rapidly during the later years, the straight-line depreciation allowance method can be applied in figuring accrued depreciation upon old and well-established water works properties without injustice, and justice may be done in its application to newly organized properties, if through the agency of rates, it is possible to earn a depreciation allowance, so figured without temporary injustice to the users of the service, growing out of the fact that during the early formative years, incident to the development of the business of such new enterprises, it necessitates laying aside the larger depreciation allowance resulting from the application of this method; therefore, the effect of depreciation on plant value must be considered upon the general property rather than upon its elements. "Going Value," the cost of establishing or attaching the business, is one of those elements where cost is now generally determined along with the physical items of the works.

On the several units constituting the plant, depreciation in the earlier years is certainly negligible, while the cost of developing the business is admittedly greater, and perhaps these discrepancies may be best harmonized by a larger contribution from the consumer in the earlier years than would be actually justified if only physical depreciation was insisted upon and allowed.

EQUITY

Having dealt with questions of law and precedent, it now remains to consider the equities upon which both law and precedent must ultimately rest.

In the sinking-fund method of depreciation treatment it is assumed that the actual contribution by the customers through rates is to be set aside by the operator for the purpose of keeping the plant intact for the investors and to efficiently serve the public.

To carry out mutual obligations, it is obvious that what may be considered annual contributions to a trust fund should be prudently and productively employed with the end in view of conserving the property and performing the service at a minimum of expense.

Where this is done, accounting, rate making, or purchase cases are simply disposed of, the reserve fund with its accumulations being audited, a proper accounting in rate or tax cases can be made, or the reserve can pass with the plant to the prospective purchasers, or if retained by the utility operators, may be utilized to liquidate with the investors, the value being deducted from the property when transferred.

When simply a matter of rates, the consumer is not especially concerned with what is done with his annual contribution, especially if he is assured or assumes the rates reflect accretion, while the investor is generally satisfied to receive his annual interest with the knowledge that depreciation is being compensated for through rates.

Unfortunately, the management, called here the stockholder, is a third element in the triangle. Responsible for his own affairs and trustee for others, too often a selfish and short-sighted policy insists that private gain is not concerned in keeping up the property to a high efficiency on the one hand, or of providing adequate service at a minimum of expense on the other. Historical records are too full of unscrupulous dealings and high finance resulting in wrecked properties and depleted service to finally terminate in enforced utility regulation by many states, some of which require that a "Depreciation Account" shall be opened as a part of the operating expense to which shall be charged monthly, crediting to the depreciation reserve an amount equal to one-twelfth of the estimated capital in the services of the utility (Wisconsin).

With such reserve to be accounted for annually, the investor and the public would naturally expect and demand that it be prudently and productively invested, and any perversion would undoubtedly be checked by the state, as contrary to public policy, if not actually dishonest.

Where such reserve is not required by law or created as a matter of sound economy by those interested in the property, it is easy to conceive that to pay dividends or to bolster fictitious stock or bond issues, improvident or dishonest operators might pervert this fund to their own use without protest so long as interest on loans was met and a fairly satisfactory service performed under a reasonably acceptable rate.

ACTUAL CONDITIONS

But a very different condition is created when at the end of any contract period, the public determines to assume ownership by purchase or condemnation. Up to this time the operating company, called the stockholder, hiring the capital from the investor for the services of the consumer, is in fact the agent of those parties at interest to whom now must be rendered an accounting of his stewardship.

Too often this settlement reveals the fact that, although collected for such use, no reserve or depreciation fund was ever put aside and that there are no accretions. To cover this admission and explain the deficit, an ingenious evasion is the assumption by those authorized to represent the management that a deduction of a hypothetical depreciation fund would entirely satisfy the demand at the time of the accounting.

If we appeal to the law, we learn from Mr. Justice Moody, presiding in the celebrated Knoxville case, that true values "cannot be enhanced by a consideration of errors in management which have been committed in the past," the decision being an estoppel of an attempt to create a value which should have arisen from sound financing, when the initiative by the management is proven to have been lacking or where the facts are fairly conclusive that this trust fund, instead of having been productively used by those to whom the reserve has been committed, had been misapplied to their own selfish ends, either as stock dividends or to inflated capital issues, no part of which have been returned to the property.

ILLUSTRATION

A somewhat analogous and familiar illustration of the working of these fallacious principles may be afforded by conceiving that the nominal owner and manager of mortgaged property had been required by the investor to collect from the tenant an annual sum sufficient to protect the building and contents from fire, but, while receiving from the source a sum equal to the annual risk, the manager had misapplied these contributions to his private use instead of taking out an insurance policy as stipulated by the investor and meeting the premium that had been advanced by the tenant.

So long as nothing happens, there is no complaint, but when the crisis comes and a fire loss must be met, the now anxious investor and tenant find that the property is uninsured. That the manager then insists that the full amount of the insurance should be credited in the settlement after deducting the premiums paid and the accretion that had not been earned on the reserve, would hardly satisfy either investor or tenant, and such application of this hypothesis to water works transfer case is no more convincing to others. Therefore the writer is constrained to dissent emphatically from the viewpoint of the majority members of the Committee touching such cases.

COMMITTEE REPORT

In that portion of the Committee's report dealing with "Loss Due to Age" the following is in part asserted: "Some appraisers from the desire for simplicity, or from motives of prejudice, attempt to assign fractional values on the basis of the proportional life lived to the probable assumed complete life, on a system of what is called 'Straight-line Depreciation.'" Again, referring to a few appraisers who insist upon "jumping to a hasty conclusion as to future life in terms of absolute percentage without much reasoning or a proper forecast of the causes tending to maintain or destroy values," the inference is that such "inexperienced appraisers" are hardly equipped to make a reasonable forecast at all, and coupling those individuals with those who use the straight-line process, the distinction is that the last "is a step in advance of the first crudity."

Most emphatically does the speaker protest against the assertion that the straight-line method is only *used for its simplicity*, while it is little short of an insult to those distinguished jurists, publicists, accountants and engineers who have been quoted as preferring the straight-line method under certain conditions to impugn their motives or for a moment suggest that they used this method of accounting depreciation through motives of prejudice.

Therefore substitution in the final report of the Committee on Depreciation, for the paragraphs in the section on "Methods of Determining Incomplete Loss of Value," relating to *Losses Due to Age* and *Straight-Line Depreciation* of the following is recommended:

GROWING FUNCTIONAL UNFITNESS OR DECREPITUDE

In growing functional unfitness or decrepitude all causes affecting longevity, life expectancy and future needs for particular machines or structures, as influenced by local conditions, should be reviewed as a means of determining present fractional loss of value.

Depreciation thus considered extends over the entire life of the parts constituting the property, and must be measured by some standard. Of several criterions now in general use, the two most favorably regarded by recognized authorities in valuation work are commonly known as the "sinking fund" and the "straight-line" methods. While either method may be selected, provided only that under the circumstances it is legal, safe and fair, the great discrepancy in the growth of depreciation of long lived units under these two theories should be carefully noted when giving a preference to the use of either.

The Sinking Fund contemplates annual contributions of such sums as will, when prudently invested, amount with accretions at the end of the useful life to the original sum expended.

The Straight-Line theory is an assumption of payment or allowance each year of operation, of a sum equal to the total investment divided by the number of years of actual life or expectancy, and generally expressed as a percentage of the whole; it is the direct apportionment on the ratio of age to life. This yardstick measuring depreciation is universally serviceable and approximately accurate for determining loss of value of short-lived or inexpensive units of a public utility works and may be used with discretion under certain other conditions, and may apply especially to such as depreciate with uniformity from the beginning to the end of service lives.

In transfers of property by condemnation or sale, where depreciation has been a factor in determining the net income representing a rate return, and when depreciation is one element to be considered in franchise tax cases and even for public accounting, the courts and regulating bodies have sometimes permitted or prescribed the straight-line method.

In the actual operation of a public utility the use of this method is open to the theoretical and practical objection that it is not in substantial accord with actual experience in the life history of units assembled in such works, other than those of exceptionally short life. Its application under such conditions gives considerably higher allowances for accrued depreciation in the early years than would be justified by the real condition of units under consideration. These in the main suffer only slight deterioration while maintaining high service value at first and depreciate more rapidly during the last of their life cycles; nevertheless, in old and well established properties when replacements constitute a relatively constant expenditure, the application of the straight-line principle is possible without doing violence to the equities and is not against public policy in such cases. Moreover, justice may be done to all interests where the straight-line practice is observed for measuring the depreciation of even newly organized properties, if through the agency of rates an allowance to cover is permitted and earned without prejudice to the users of the service.

This is true for the reason that during the early formative years the development of the business requires larger proportionate contributions from customers although the physical depreciation during the corresponding period is admittedly less. Now, since, the cost of establishing the business must be paid by the public some time, some place, some how, discrepancies between these two operating costs may thus be substantially reconciled. For actual operation, such allowances might be prudently invested and in this event it takes on the characteristics of the Sinking Fund, being in fact a reserve productively used.

The Sinking Fund provision, with the use of the compound interest curve, is of especial application to rate cases, offering a convenient and reliable method of accounting, fully justified as well by both law and precedent.

When the age of any part of a plant can be determined and its useful life agreed on, the problem becomes one of practical finance, modified by special influences at the time of consideration.

With the more important items whose life expectancies cover considerable periods of time, precise methods of accounting are highly desirable, and in such cases economy demands, business prudence requires and courts have decreed that an annual increment shall be set aside out of earnings through the agency of rates as a reserve or "sinking fund" whose purpose is to replace no longer useful parts at the end of their natural lives, thus insuring continuous and efficient service while keeping original investments intact.

To make these provisions the sinking fund method seems best in both theory and practice.

For a clear conception of its functions, the familiar insurance policy, its purposes, its computation, its annual payments and every day determinations of its present worth may be cited as a preliminary basis for reasoning. Considered an insurance against loss, a correctly computed sinking fund consists of an amount annually paid into a reserve account which with its interest increment from year to year should serve to replace the structure or machine at the end of its probable useful life, and the present worth of this fund in some cases may be assumed to measure the loss of par value in such unit.

While such a reserve fund need not always be kept as cash in hand, and indeed may often be more productively invested in plant betterment, it is part of the property being considered and where so found will offset to the extent of the audit any depreciation in plant value, but when neither present as a cash asset nor returned to the plant as a betterment, no legerdemain of high finance or tricks of bookkeeping should becloud the issue, since true values can "not be enhanced by a consideration of errors in management which have been committed in the past," and no deduction of a hypothetical depreciation fund will satisfy the demand at the time of the accounting.

Therefore, where a property is being appraised for transfer of ownership, equity seems to demand that depreciation shall be ascertained by ratio which age bears to total life applied to cost, less scrap value; and deferred maintenance, if any, should be added to these amounts, or should be recognized and allowed for in general terms.

Since depreciation is the act of lessening or bringing down price or value, resulting in a reduction of worth, in such cases the lessening worth of physical property can best be determined from visual knowledge of actual conditions tested by mortality statistics of similarly circumstanced property, applied where practicable on the straight-line basis.

JAMES NISBET HAZLEHURST.

DISCUSSION

CLINTON S. BURNS: The writer is pleased to acknowledge his appreciation of the very thorough work of the Committee on Depreciation as manifest by its final report. The writer sees but little to add to this report in the way of discussion, but takes this occasion to emphasize one of the points mentioned in the Committee's report in substantiation of its reasons for adopting the Sinking-Fund Method in preference to the so-called Straight-Line Method of depreciation.

It seems to the writer that the principal stumbling block in the way of the universal acceptance of the Sinking-Fund theory of depreciation is perhaps the fact that the relationship between finance and depreciation is not always clearly understood. The fallacy in the straight-line theory of depreciation is that it ignores one of the elements of cost, namely the cost of money, and this forms a vital part of every business transaction.

The determination of the physical condition of the property is but one step in computing its present value; those who stop there are content to rest with the unfinished problem. Beyond this step comes the problem in finance, to compute the relationship between physical condition as determined by age and life and the present value as determined by the laws of finance. A property having 50 per cent physical condition may not have a 50 per cent financial value, and in fact never does, unless it is a property that can be paid for on the installment plan in direct proportion to its use, at the same price as though paid for in advance. This is a fundamental principle of finance, but appears to be a stumbling block sufficient to baffle the advocate of the straight-line theory of depreciation.

If pumps, engines and other property could be purchased at their cash price, and paid for annually in proportion to their use, then the straight-line theory of depreciation would be correct; but for all property that must be paid for cash in advance, or its equivalent, physical condition does not measure present value, but bears a certain relationship thereto, that can be computed by applying the necessary financial factor to complete the problem.

Now, to make this point more apparent, suppose that in the appraisal of a water works property that it be found that the pumps, engines, pipes, buildings and other physical structures are one-half worn out, that is to say, their physical life of service is half expired at the time of appraisal, and suppose that among the items of property there be found a life insurance annuity likewise one-half paid out, that is to say, its physical useful life is half expired. Now every one familiar with problems of finance would immediately turn to his annuity tables, in order to compute the present value of this life insurance annuity. For example, if it were an annuity having forty years to run, bearing 4 per cent, and it were not half paid out, or in other words twenty years of its life were expired, it would be found from the annuity tables that the present value of this policy is 69 per cent of its face value, that is to say it is only 31 per cent depreciated.

Now suppose the next item of property were a pump having a life of forty years, twenty years of which had expired, can there be any possible reason to urge that a different formula should be applied to determine the value of this pump from what has just been applied to determine the value of the life insurance annuity? Both are items of property and the relationship between physical condition and financial value is in both cases the same, the only difference being that in the case of the insurance annuity the rate of interest and the total life were both definitely predetermined, while in the case of the pump the length of useful life and the proper rate of interest to apply are left to the discretion of the appraiser.

If those who have difficulty in understanding the fundamental principles and the justice of the Sinking-Fund Method of computing depreciation will keep clearly in mind the fundamental relationship between finance and depreciation as demonstrated in the example given above, of the life insurance annuity, all of their doubts and misunderstandings will immediately be removed, leaving nothing in the way of the universal adoption of the Sinking-Fund Method.