# BUILDING FOR PROFIT

"The process of accumulating floor area on one site"

# BUILDING FOR PROFIT

PRINCIPLES GOVERNING
THE ECONOMIC IMPROVEMENT
OF REAL ESTATE

BY

REGINALD PELHAM BOLTON

AUTHOR OF "POWER FOR PROFIT," "ELEVATOR SERVICE"
MEMBER OF THE AMERICAN INSTITUTE OF CONSULTING ENGINEERS

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TO THE THIRD EDITION

THE absorption of two editions of this work, and many expressions of a desire for its re-issue in a third edition, indicate that it has rendered practical service to those interested in real estate. Its presentation of the subject proved of value in the discussions of the methods and effects of the zoning system and its application to the City of New York, a system by which some of the unregulated and ill-considered building operations, to which attention was directed, are now considerably and beneficially restricted.

Since the second edition of "Building for Profit" was issued, the real estate and building interests have passed through the disturbed and inflated conditions resulting from war, and have entered upon a course of slow readjustment. The cessation of new construction brought about a shortage of available space in all types of building, and a general increase of rentals followed. Many unremunerative properties thus became self-supporting, and others exchanged ownership at substantially advanced prices.

While these results afford the appearance of an advance in the value of improved real estate, the actual effects demand careful consideration and analysis. The expense of operation and upkeep of buildings also increased very largely, while the cost of mortgage money as well as the prevailing rate of interest upon investments moved to higher levels. Such conditions, however, are subject to reaction, and deflation has already commenced. The figures of rents, operating costs, and values which were used in this book to illustrate the fundamental principles which it sets forth, have not been altered in this edition, as they still retain their value for comparative purposes. Moreover, re-computation of these illustrations on present prevailing rates, prices, and costs, demonstrates that the same principles hold good under existing developed conditions.

In this edition foot-notes have been added to direct attention to the effect of such changes as have taken place. The interested reader, with a knowledge of any prevailing prices or values, can make deductions applicable to existing conditions.

Certain new elements have entered into the operation of improved real estate, to which attention is drawn in new material added to this edition. The income tax has now made it necessary to give consideration to depreciation and obsolescence as determinable elements in the cost of operation. The relatively short period of economic life of modern buildings, to which particular attention was directed, has been demonstrated by many illustrative occurrences. The large increase in the cost of materials and labor affecting the operation and upkeep of buildings has had a beneficial effect in directing the attention of owners of buildings to the subject of economy, and the reduction or elimination of the burdens of gratuitous services afforded to tenants. The principle of payment for services supplied has been widely applied to electric light and power.

Substantial economies have been developed by the abandonment of power-generating apparatus and by the reduction of mechanical and heating apparatus to the simplest elements. The difficulties which have thus been solved in this manner may prove of permanent benefit to both the owners and occupants of buildings.

## *Introduction*

The ownership of residential property, particularly multi-family buildings, has become involved in legislative restrictions and is now subject to responsibilities which appear to be permanent. Personal liability is now incurred by owners in the maintenance of services and adequate upkeep and repair.

Rentals are subject to court review, involving careful ascertainment of expenses, costs, and property values by which fair rates of rent are determinable. To these new problems as well as to those of old standing the third edition of "Building for Profit" will, it is hoped, bring intelligent consideration, helpful suggestions, and practical solutions.

R. P. B.

# I

## RELATION OF SITE AND BUILDING

A BUILDING is a mechanical composite construction of various materials, serving the purpose of shelter for its contents and occupants.

The interior is its utilizable portion. The primary object of its exterior is to resist the ingress of the atmospheric elements, though it is secondarily utilized and extended for decorative, esthetical, or advertising effects. Such additions to the exterior and to the interior are economic only to the extent to which they contribute to induce a higher value to be placed upon the use or occupancy of the structure.

The materials forming the exterior construction or decoration are subject to special physical deterioration, due to exposure to atmospheric action.

A commercial building is one the object of which is to produce, by a rental paid for its occupancy, a return or percentage upon its cost and upon the value of the site which it occupies.

The value of the land or site on which any building is erected may appreciate, but such appreciation is of no present value to the owner unless the building returns an interest upon such increased value; thus any increment in value of land, unaccompanied by proportionate income from the building, is reducible by such a rate of interest upon the increment as would be earned if it were sold and the money invested elsewhere.

The value of the site, unimproved, is that which some purchaser may be willing to place upon it, by reason of its desirability, its local surroundings, or its effect on other structures. It is not mathematically determinable unless improved by a building upon the site, the earnings and life of which decide the actual financial value of the site.

The fundamental form of real estate improvement is a habitable structure of one story occupying the entire area of the site. When the site, by reason of the scarcity of other available land, or by the effect of contiguous developments, becomes so enhanced in marketable value as to require a return in the way of interest exceeding the renting capabilities of such a limited structure, it becomes commercially necessary to increase its rentable area by the addition of other stories.

Modern facilities of construction in the direction of height place in the power of a single property-owner the ability to create a disproportionate competition affecting neighboring properties. Whereas, in bygone times one building was customarily or perhaps necessarily of height similar to its neighbors, it may now vastly exceed them, and may introduce into their immediate vicinity a disproportionately large addition to the habitations of the neighborhood, increasing the local competition for tenants, and tending to lower the prevailing rate of rentals, either by directly reducing the rate, or by involving the current rate in the costs of conveniences or inducements offered as part thereof.

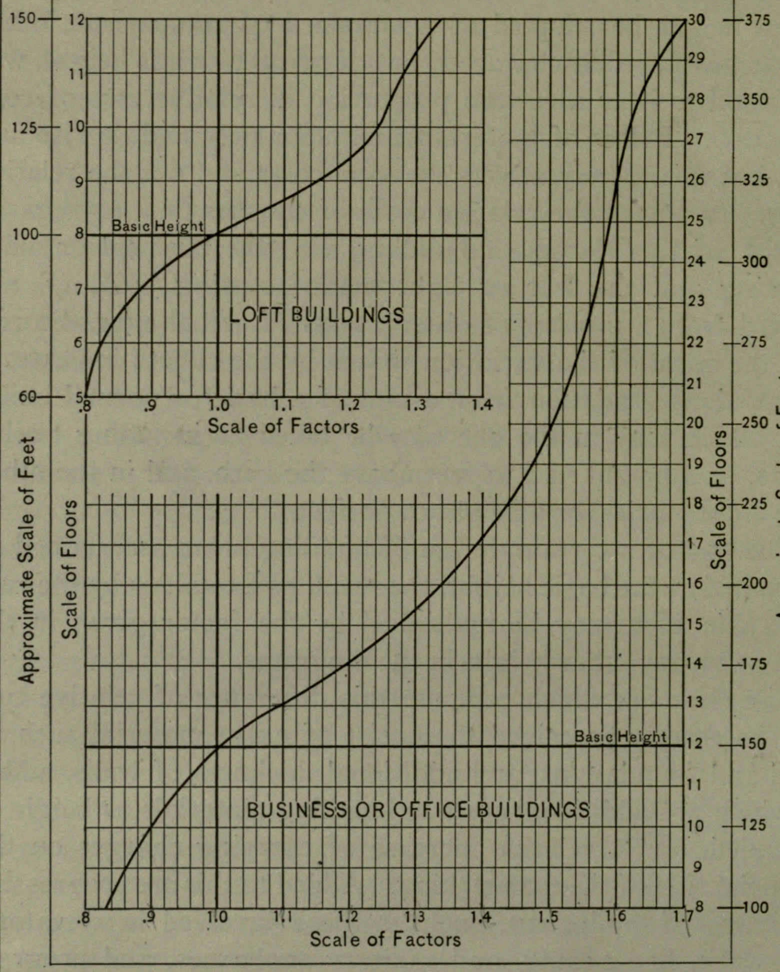
While the process of accumulating floor area on one site can, by modern methods, be extended to an almost unlimited height, the addition of height to the structure is accompanied by a relative increase in cost, which involves a progressive relative increase of earning capacity, and acts as an economic restriction.

Comparisons of cost of construction of modern buildings are conveniently based on computation of their cubical contents, and this may then be utilized to compare relative costs. The elements composing the cost are many and varied, yet for any given set of surrounding or local conditions the variation of values relative to height will be found to follow practically similar relations. Thus, if a typical or normal building of a given height be adopted as a standard of comparison, other buildings of similar character, but of greater or less height, will be found to bear a certain proportion in relative cost of construction. Prices of materials and labor may and do rise and fall, but this merely affects the total costs and not the relative costs. In Fig. 1 the relative costs of construction, as regards height, of two classes of building, viz., the business or office building and the loft or light manufacturing building, are plotted from a number of observations of actual expenditures, and the form of the variation shown by the curves indicates a harmonious gradation from a unit of a basic or normal building, which may in the one case be taken as including twelve floors, or a height of 150 feet above the curb, and in the other case eight stories, or a height of 96 feet.

The cost of a certain design of building being ascertained or estimated at the basic height, the result as a total, or by the rate per cubic foot, may be multiplied by the factor given in the curve, for any other height in the diagrams.

The elements which compose this difference of relative cost will be readily perceived to consist of extra material such as steel and foundations, and additional thickness of walls, added to which are additional costs in handling materials as height is extended, and a relative increase of carrying charges on the financial side of the undertaking. Added to this are progressive additions of equipment, such as those involved in elevators, stairways, fire-escapes, and sanitary appliances, and progressive additions to the proportions of heating, water, sanitary, electrical, and other systems of piping and conductors. All these elements render construction relatively more expensive as height is added, so that in the result a cubic foot of business

Fig. 1




RELATIVE COSTS OF CONSTRUCTION

building construction in a building of the basic height of 150 feet will be found to have increased, at double that height, to 1.575 of the basic price.

Furthermore, an increase of area by vertical addition involves cumulative expenditures in upkeep, maintenance, and operation, and these tend to increase at an increasing ratio, as compared with the addition to the height.

The addition of height to a building does not necessarily involve a multiplication of tenancies, but usually does so. Any subdivision of tenancy involves the ownership or control in responsibilities not only for the provision, but for the operation of conveniences common to all the inhabitants of the building, the cost of which then becomes a fluctuating element of expenditure and reduces the value of the rentals obtainable.

The economic addition of height in a building on a given site is that which will, upon a certain obtainable rental, return a market interest upon the value of the land and upon the cost of the structure, and it follows that the relation between the merchantable value of the site and the average rentals obtainable in its locality establishes, at any given rate of interest, not only the height, but the justifiable expense of construction of that height.

The net earnings may be conveniently considered in two parts, one of which is to provide the interest upon the assumed value of the site, and the remainder to make a suitable return upon the cost of the building.

As modern methods of construction are now well established, as regards both cost and space available for occupation in various types of buildings, it becomes practicable to lay down a mathematical relation between any land value and the economic building upon the site which will produce a predetermined rate of interest upon the site and upon the building. Such a method is given in the following formulas, by which for any value of land or any cost of building, and for any proportion of rented area to area of the site, and for any relation of net income to total rentals, the rate may be established for rentals per square foot per annum which must be obtained in order to maintain a given rate of interest upon the engagement of capital.

This method of computation is based on the "Elementary Building" shown in Fig. 2, a vertical section of a building one square foot in plan area, occupying the whole or a less part of the site, and having a certain proportion of each of its floors occupied as rentable space. This unit affords a direct relation between proportion of site, building, and rented areas and between their respective monetary relations, and these being established can be multiplied by the total of each item in any particular instance.

*No. 1. Rate of rental per square foot of net rentable area required to produce interest on value of the site:*

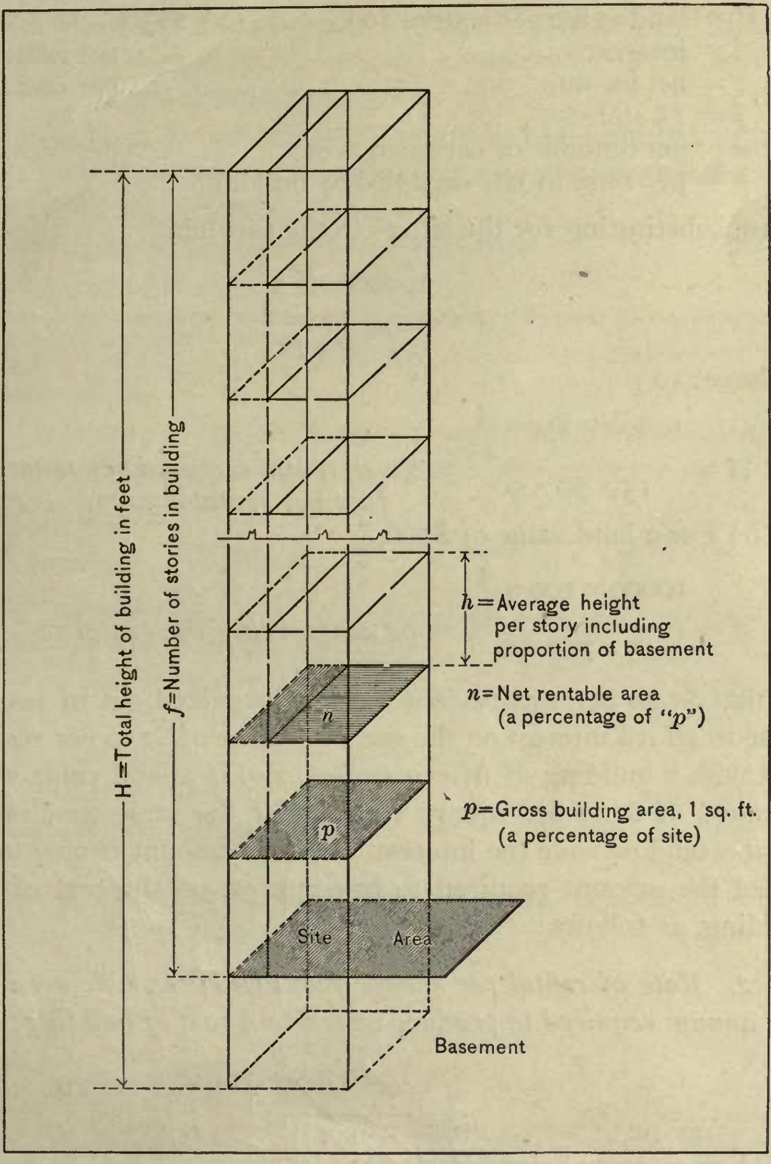
$$A = \frac{10000 \times V \times \frac{i}{r}}{f \times n \times p}$$

$V$ = value of site per square foot.
$i$ = rate of interest on investment.
$r$ = ratio of net income to total income.
$n$ = per cent. of occupied or net rentable area to gross area of building floors.
$p$ = percentage of site occupied by building.
$f$ = number of stories in building.
$A$ = rent per square foot required in dollars.

EXAMPLE:

*Question:* What rental per square foot per annum is required to produce an interest of 4% on the investment in the site under the following conditions?

FIG. 2


H = Total height of building in feet
f = Number of stories in building
h = Average height
per story including
proportion of basement
n = Net rentable area
(a percentage of "p")
n
p = Gross building area, 1 sq. ft.
(a percentage of site)
p
Site
Area
Basement

*Answer:* Assuming—

| | | |
|---|---|---|
| $V$ = land value per square foot | (a) \$150 | (b) \$100 |
| $i$ = interest | per cent. | 4 |
| $r$ = net income | per cent. | 45 |
| $f$ = 15 stories | | 15 |
| $n$ = net rentable or occupied area | per cent. | 70 |
| $p$ = per cent. of site occupied by building | | 90 |

Then, substituting for the letters in the formula

$$A = \frac{10000 \times V \times \frac{i}{r}}{f \times n \times p}$$

we have: (a)

$$A = \frac{10000 \times 150 \times \frac{4}{45}}{15 \times 70 \times 90} = \textit{\$1.40 rental required per square foot net rentable area,}$$

or (b) For a land value of \$100,

$$A = \frac{10000 \times 100 \times \frac{4}{45}}{15 \times 70 \times 90} = \textit{94 cents, being the rental required.}$$

So that \$1.40 per square foot must be provided out of net income to afford interest on the site of a value of \$150 per square foot with a building of fifteen stories, and if a land value were assumed of \$100 per square foot, under the same conditions, \$0.94 would provide the interest. To this amount is now to be added the amount required to pay interest on the cost of the building, as follows:

*No. 2. Rate of rental per square foot of net rentable area per annum required to produce interest on cost of building:*

$$a = \frac{100 \times v \times \frac{i}{r}}{f \times n}$$

$h$ = average height of stories.
$f$ = number of stories.

$H = h$ multiplied by $f$, or height of building in feet.
$c =$ cost in cents of construction per cubic foot of building.
$k =$ carrying expenses during construction in per cent. of cost of construction.
$v =$ value of building, or $H$ multiplied by $c$ plus $k$.
$n =$ per cent. of net rentable area to gross area per floor.
$i =$ rate of interest.
$r =$ ratio of net income to total rentals.
$a =$ rent per square foot required.

NOTE: Assuming a gross building area of 1 square foot, then the contents in cubic feet corresponds to the height ($H$) in feet. See Fig. 2.

EXAMPLE:

*Question:* What rental per square foot per annum is required to produce an interest of 4% on the cost of the building?

*Answer:* Assuming—

| | | |
|---|---|---|
| $f =$ building of . . . . . . . . . . . . | stories | 15 |
| $h =$ average height per story . . . . . . | feet | 12.52 |
| $c =$ cost per cubic foot . . . . . . . . . | cents | 50 |
| $k =$ carrying expense . . . . . . . . . | per cent. | 10 |
| $n =$ net rentable or occupied area . . . | per cent. | 70 |
| $i =$ interest . . . . . . . . . . . . | per cent. | 4 |
| $r =$ net income, of rentals . . . . . . . | per cent. | 45 |

Then, substituting for the letters in the formula

$$a = \frac{100 \times v \times \frac{i}{r}}{f \times n}$$

we have:

$$a = \frac{100 \times 10340 \times \frac{4}{45}}{15 \times 70} = \textit{86.4 cents, rental required.}$$

NOTE: The cost of basement is included in $h$ by adding a proportion of its height to the average height per story, and thus the rental required on the stories $f$ includes basement rental as a part of first-story rental.

The two foregoing results combined thus aggregate $2.26, which is therefore the average rental per square foot per annum on all floors which is necessary to produce 4% on the investment in the land valued at $150 per square foot and in the fifteen-story building which has been assumed to be erected thereon, or on land valued at $100 per square foot the rental would be $1.80 per square foot per annum.

It will be observed that if the land should increase in value after the foregoing conditions are established, then the average rentals thus ascertained must be raised, or the rate of interest upon the land part of the investment will decline.

Inversely, if the rate of interest on the entire investment be stationary or should it decrease, then any increment in the value of the land becomes unremunerative, in the same manner as vacant land would be, and from any assumed increased value of the land there must annually be deducted the interest thereon, at the rate which the land is actually earning.

The rate of annual net return upon the building should be such as to include in itself an amount which at compound interest will return the value of the building within some space of time, since appreciation of rentals cannot be assumed with certainty, or if assumed they may be accompanied by relative increase in cost of operation.

This is what occurred as a result of the shortage of new buildings during the disturbed period—1917–20—when the greatly enhanced cost of operation of buildings was accompanied by a large and not always proportionate increase in rentals, both being still further affected by the decrease in the purchasing value of the dollar and resulting rise in the price of money, reflected in higher rates of interest on mortgage and investment.

"The rate of appreciation in value of any land is affected by a variety of exterior conditions"

## II

## APPRECIATION OF VALUE OF LAND

IF the earning capability of a building should, for any cause, fall below the point where the return upon the invested value is less than market rate, then the only means of rehabilitation of the impaired capital, or provision of security for the investment of further capital in reconstruction or alteration, is to be found in some increase or appreciation in value of the site, or what is commonly referred to as the "unearned" increment of land value.

This is the commonly stated and usually assumed remedy for any anticipation of a decrease in its earning ability, and it is a usually accepted excuse for evading the necessity for a provision in advance for the gradual aging of the structure.

As a solution of either anticipation it is wrong in principle and uncertain in effect.

The rate of appreciation in value of any land is affected by a variety of exterior conditions, but there is always a probability that the same conditions which adversely affect the building may similarly affect the land, while, on the other hand, those that beneficially affect the demand for the land may be adverse to the conditions of the building upon it.

An assumed appreciation is not always realizable as an actual asset, and the most that can be made of it may be to borrow upon its security.

Appreciation of the land may not be realizable unless the building be first removed and a different improvement erected.

The rate at which appreciation proceeds is not independent of other property in the same locality. One site cannot be unduly forced forward in the march of enhancement, in face of the competition of others. The investment of disproportionate capital in an improvement, in the expectation of thereby establishing an enhanced capitalized value of the site, is unsound practice, equivalent to placing gold upon a piece of land in order to increase the value of the combination.

If there be a real appreciation it will be due to a legitimate demand for such a site, or for occupancy of a building upon it. Such a demand will naturally and properly take the form of a higher rate of rental, which will return upon the building and the increased value of the land the established rate of interest.

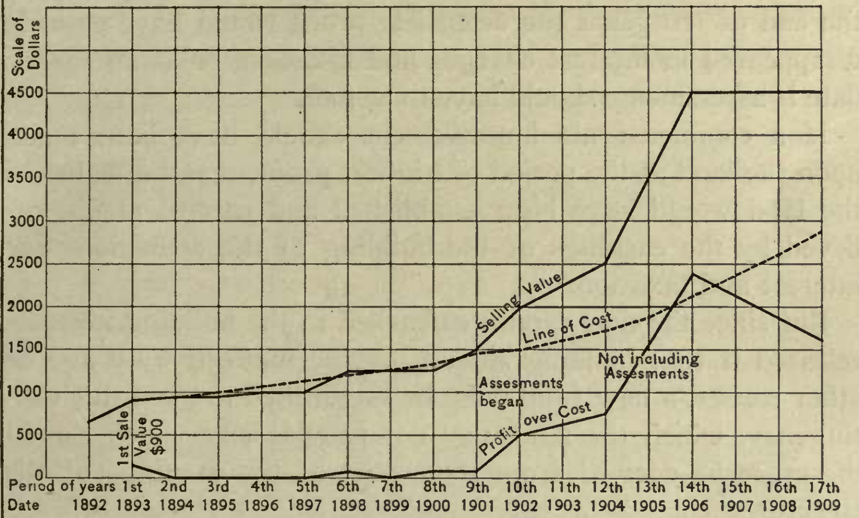
As has been already pointed out, the appreciation must either be established or capitalized by a commensurate return from the building, or it becomes unproductive, and if interest upon its realizable value be considered, it may become stagnated or discounted to a loss. "Unearned increment" is a favorite phrase with those who have made little study of real estate conditions, but it is often far more correctly to be described as "unearning increment," bringing only an increasing burden of taxation.

The rate at which increment proceeds is usually paralleled by the accumulation of interest charges upon the realizable value and of taxes and assessment, the earning power of which is nil.

If such matters be considered it will be found that some of the large apparent increments in land long held in one possession really represent nothing but past outgoings or the loss of interest on a lesser value which might have been realized at some opportune period of demand for that property.

Take, for instance, a series of figures of values of a plot of land in the Bronx which were published in 1909 by Mr. J. Clarence Davies, which are plotted in Fig. 3. The purchaser of this plot in 1892 could have sold it the following year for a

FIG. 3




Increase in Value of lot sold at auction in 1892 showing interest and Taxation on Increasing value over and above the first selling value after purchase.

profit of 25%, but thereafter the interest upon that value, and the taxation, kept equal pace with the selling value, so that a sale at a market price during the succeeding eight years would have yielded practically no further profit.

The general development and improvement of the locality, which began at the end of the eighth year, rapidly advanced the value, but it must be assumed that it also brought with it a parallel advance in taxation, as well as the payment of assessments.

The advance in value continued for five years, and reached the highest point of profit in fourteen years from the original purchase; but there the advance in value ceased, a result due to the settlement of its capitalized value, in company with others, by the development of improvements erected in the vicinity.

The owner or the purchaser who continued to hold such a property at this price without improvement would find that at the end of ten years the ostensible profit would have entirely disappeared in interest charges and taxation, or at an earlier date if assessments should have to be met.

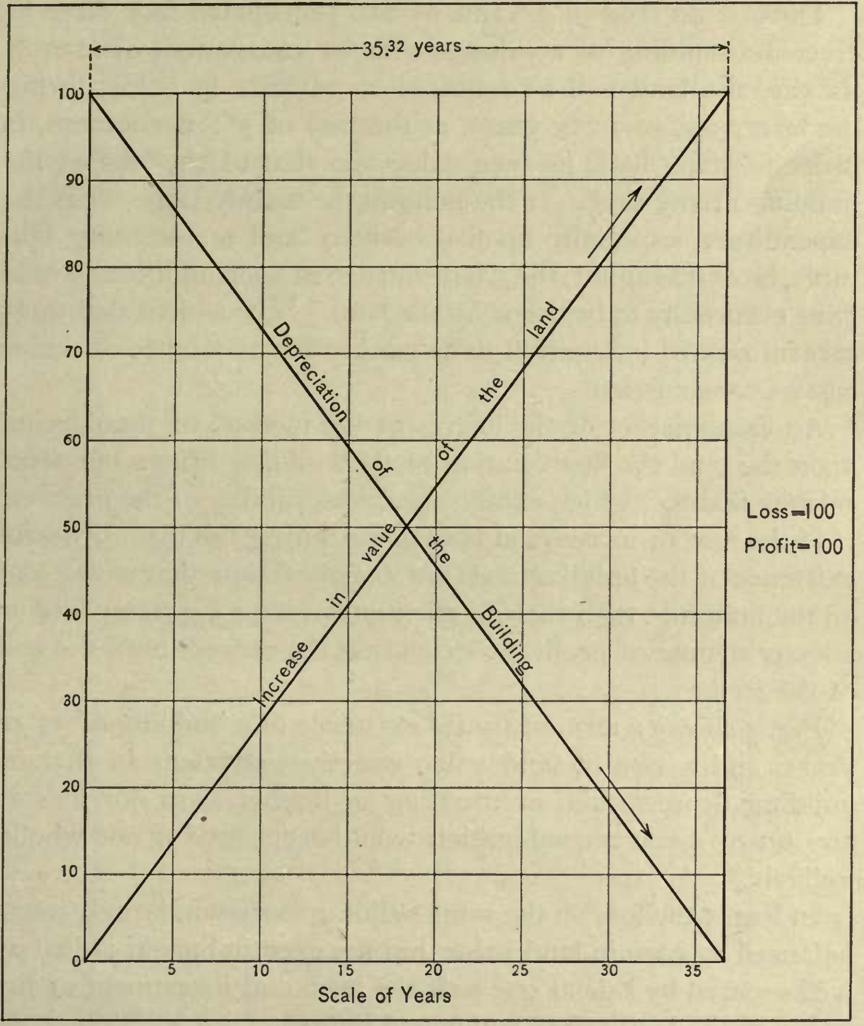
If a commensurate improvement should have been made upon the land at the period of highest profit, then the value of the land would have been established and carried along, relieved by the earnings of the building of the deductions for interest and taxation.

But since the new capital embarked in the building must be released if that building should become ineffective by age or other causes, a new fund must be established to meet this contingency, which the land may not provide and which should therefore be derived from some part of the earnings of the structure.

It must be conceded that the annual setting aside of a proportionate percentage of the value of a building is likely in many cases to be a heavy charge upon net income. Thus, on a property returning a net 5%, the building being two thirds of the whole, the setting aside of a sufficient sum to cover thirty years of life at 4% compound interest involves a reduction of the return upon the investment of 1.068%, reducing a 5% investment to a 4% basis.

But unless a regularly invested and proportionate sinking-fund be maintained, an inevitable dependence must be placed upon the speculative increase in land value to offset the eventual loss of the building. The burden of the entire original cost of the building is then laid upon the land, the increment in value of which is expected to respond to the demand. As buildings of a permanent character usually cost more than the value of the land they occupy, it follows that within the term of their useful existence the land is required to increase at a ratio com-

FIG. 4




Loss on building exactly balanced by gain on land. Neither loss nor gain at any part of term mensurate not with its own value, but with that of the expenditure on the building.

Thus, if on land of a value of $10 per square foot there be erected a building of a value of $20 per square foot of area of its site, the land will be required to advance in value during the term, say, of forty years, at the rate of 5% per annum, in order to bring back its own value and that of the loss on the building at any time. If the building be unduly large, or if the expenditure, especially upon decorative and non-earning features, be extravagant, the whole burden of such additions would have eventually to be borne by the land. It is evident that most careful regard is required to be paid to the avoidance of undue cost of construction.

An examination of the effects of the method of shouldering upon the land the depreciation of the building brings out some curious features which exhibit the undesirability of the practice.

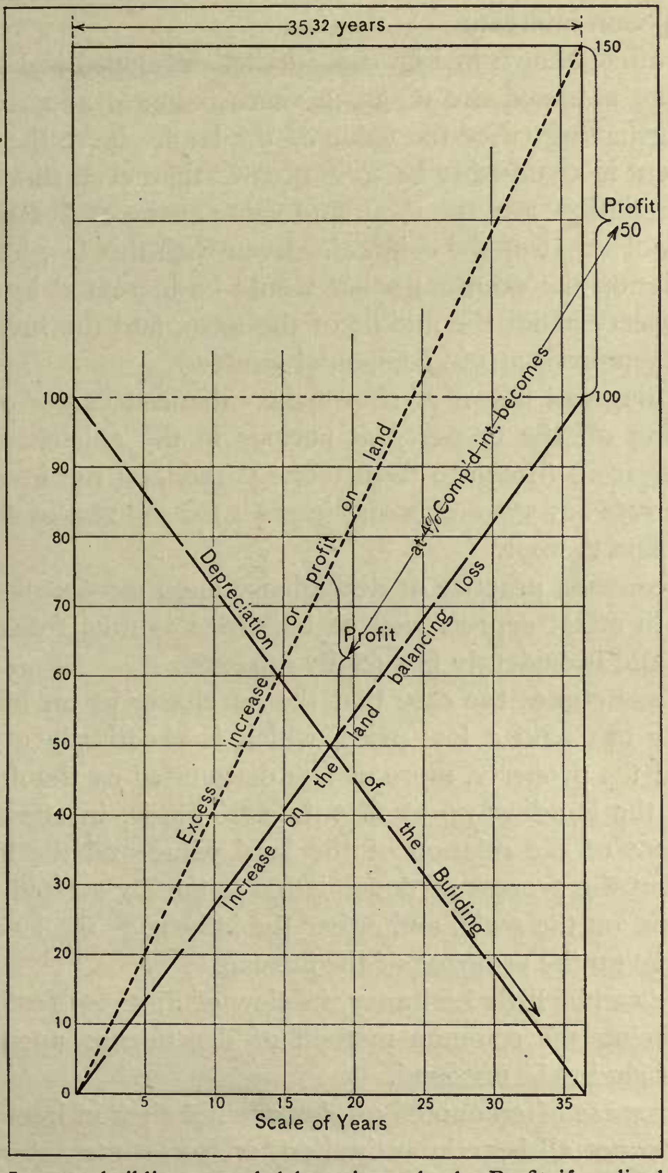
If the rate of increase in land value during the time of useful existence of the building does not *exactly* follow that of the loss on the building, then there is eventually either a greater loss or a lesser degree of profit, by extending the process until the end of the term.

Fig. 4 shows a term of useful existence of a building of 35.32 years, and a rise in land value exactly equivalent to that of building depreciation, eventuating in neither gain nor loss at any time. Such a combination would seem rare if not wholly unlikely.

In Fig. 5 the loss on the same building is shown, largely overbalanced by gain in land value, but the eventual profit is just as well secured by sale at one half the term and investment of the profit on the land at 4% compound interest.

In Fig. 6 the land fails to respond to the depreciation of the building, and an eventual loss must result. This may, however, be minimized substantially by cutting the loss at half the term

FIG. 5




Loss on building exceeded by gain on land. Profit if realized at half of the term produces equal result and investing the proceeds of the then increase of the land value at compound interest.

The effect shown in Fig. 6 is further developed in Fig. 7, in which an assumed life of 35.32 years is again adopted for a building having twice the value of the land. Here the rate of increment is assumed to be 50% greater than even this amount of depreciation, and the total land value at the end of the term to be 400% that of the original. Even with this large ratio of appreciation the eventual profit would be increased by sale of the property about the middle of the term, and the investment of the then profit at 5% compound interest.

The diagonal line *P K* shows the enhanced values obtained by selling off the property at periods in the existence of the building from fifteen to twenty-one years, and the investment of the profits at 5% compound interest for the rest of the term or any part thereof.

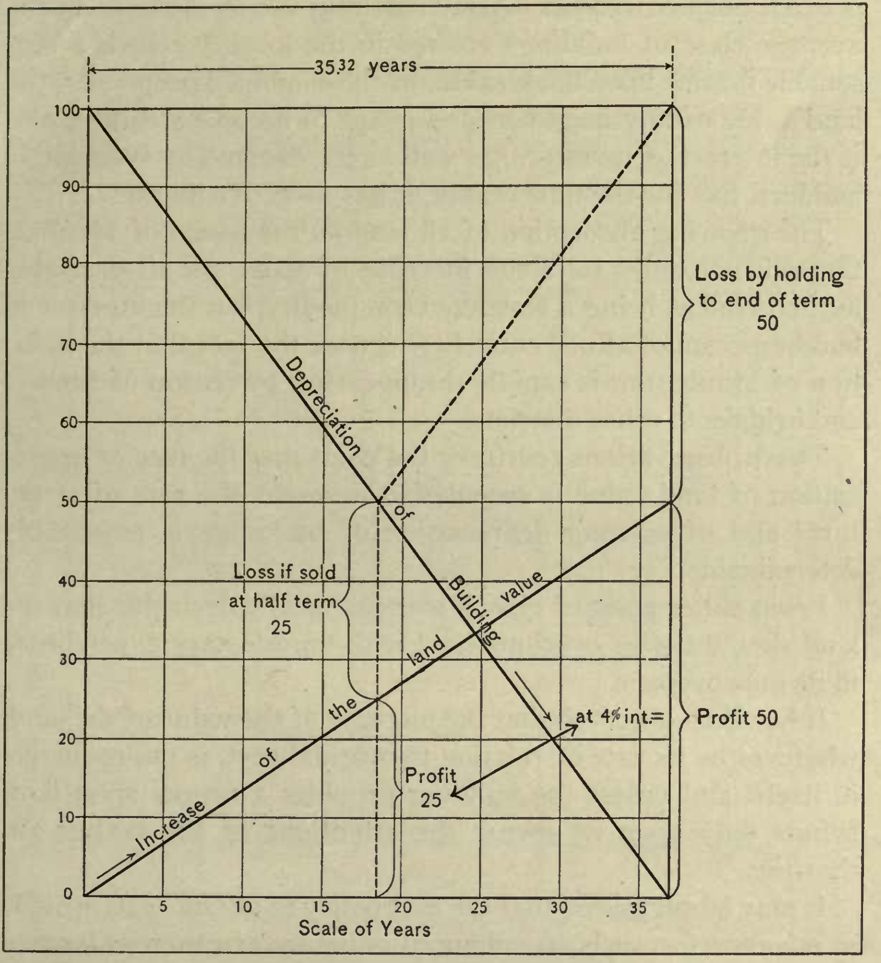
The common practice of dependence upon increment of land values to offset depreciation of buildings is thus found to be erratic and is evidently financially unsound.

It is sometimes the case that the purchaser of an improved property has paid a low price, which is practically a market value of the property, more or less discounted by the depreciation of the building up to that date. This is, in effect, a resettlement of the relation of the land value and the building value, but the process of depreciation is merely started from a new point on the scale, and either the income or the land value must take up the progress of the burden.

There can be little hesitancy, in view of all these features, in pronouncing the common method of dependence upon rising value of land to be unsound.

Figures are often quoted of phenomenal rises in land values. These do not all bear investigation, or, sometimes, show that, with enhanced taxation and long lack of earnings, the property

FIG. 6




Gain on land less than loss on building. Loss reduced by sale prior to end of term might have represented a better result if realized at some prior date.

The reason for such failure to realize at the opportune time is often not far to seek. After reaching the level at which the average class of buildings erected in the locality return a reasonable income upon book values of the combined properties, the land value of any neighborhood is apt to become steadied, and if the interest of investors, as well as the demand by speculative builders, has for the time ceased, it has no active market.

The growing absorption of all land on the island of Manhattan will naturally set some increase of value on all desirably located land as being a restricted commodity, but the investor in buildings cannot afford entirely to ignore the fact that the isolation of Manhattan is rapidly disappearing by reason of tunnels and bridges to other districts.

These observations reinforce the point that the rate of appreciation of land value is speculative, whereas the rate of structural and of earning depreciation of buildings is reasonably determinable.

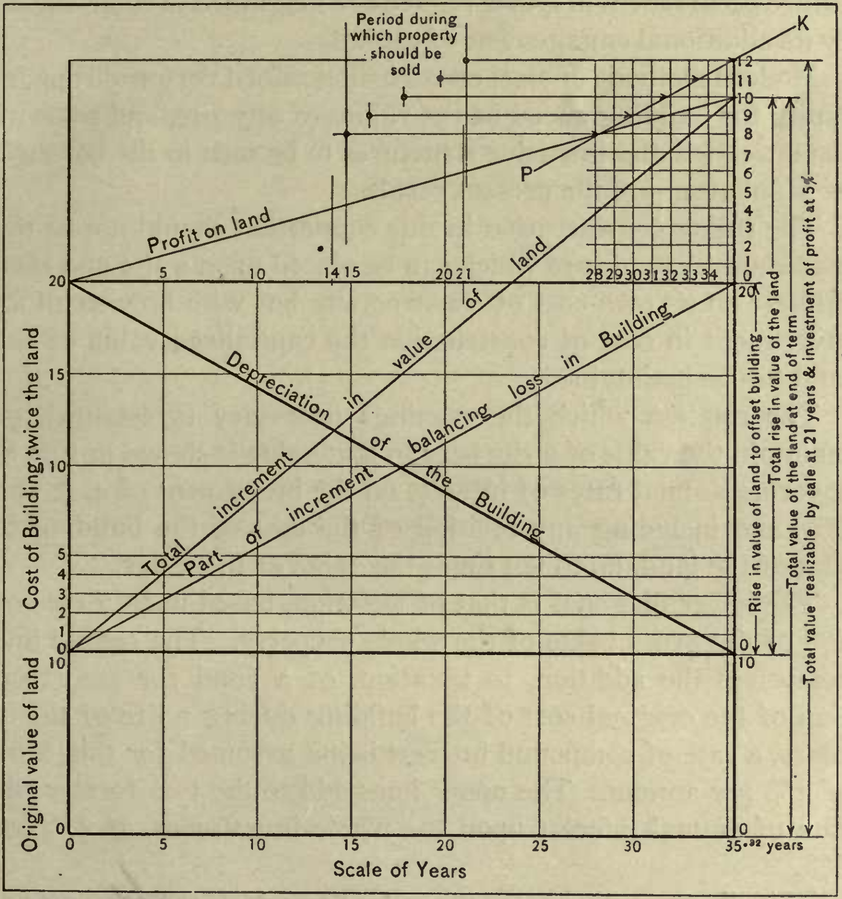
From either point of view it is economically desirable that the land should not be overburdened with unnecessary expenditure in its improvement.

It has been observed that the increase of the value of the land, whatever be its rate or relation to original cost, is unproductive in itself, and unless the building provides a return upon it, it brings only upon its owner the attentions of the taxing authorities.

It may be suggested that the best policy to pursue is to provide in advance for such an enhanced value by erecting so large a building that its net returns will capitalize the increase as time proceeds. Such a suggestion looks like a short cut to an entire disposition of this question, but in reality it offers only a partial solution of the problem even when very conservatively practised.

The cost of construction of a tall building is relatively greater than a lower one, and there are relatively greater burdens im-

FIG. 7




Showing the effect of a gain in land value in excess of the depreciation on the building, when a greater return is secured by realizing profit before the end of the term of existence

mediately set up by its additional value, in taxation and assessments and its own depreciation. Not only so, but it will offer a greater obstruction to future improvement after its maximum effect has been reached. Its investment constitutes a pledge upon the ability of the land to maintain its desirability and of the locality to maintain a rate of rental, and any untoward future occurrences in either regard are magnified in their effects by its additional engagement of capital.

Modern methods of steel construction afford very wide opportunity for building ahead of the values of any site, and some of the unrelated and intrusive structures to be seen in the borough of Manhattan are the present result.

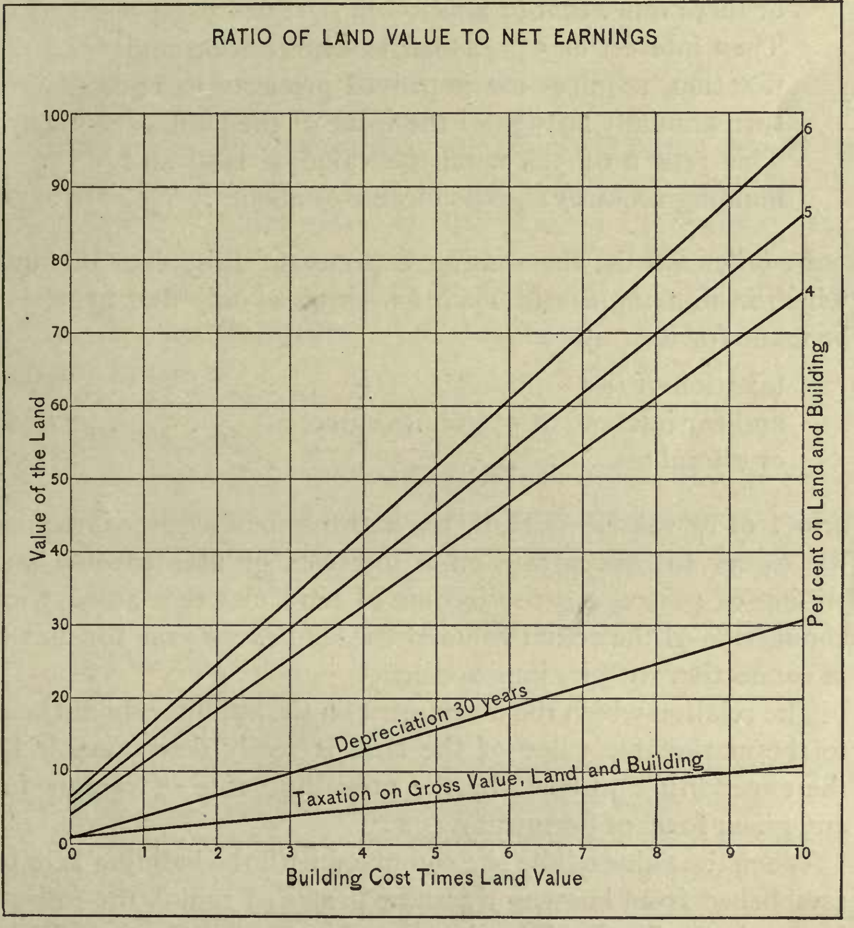
The ruling consideration in this connection should not be the maximum expenditure which can be placed upon a site and earn interest on its own cost of construction, but with how small an investment in cost of construction the capitalized value of the land can be maintained.

The relation which the earnings necessary to establish or maintain the value of a site bear to that value is shown in Fig. 8, covering annual rates of interest on the investment of 4, 5, and 6%, and including any relation of the cost of the building to that of the land, up to ten times the value of the latter.

The lower diagonal is that of taxation, based upon a rate of 1% of the gross value of the whole property. The second line comprises the addition, to taxation, of a fund for amortization of the original cost of the building during a life of thirty years, a rate of compound interest being assumed for this fund of 4% per annum. The upper lines add to the two former the rate of annual interest upon the whole investment, at 4, 5, or 6%.

This diagram illustrates the extent to which the earning capacity of a site may be pledged or overburdened by excessive building. In the extreme case of a building costing ten times the value of the site, an amount practically equaling the entire value of the site must be earned every year in order to maintain its value as a 6% investment.

FIG. 8


RATIO OF LAND VALUE TO NET EARNINGS
Value of the Land
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
Building Cost Times Land Value
Per cent on Land and Building
6
5
4
Depreciation 30 years
Taxation on Gross Value, Land and Building

EXAMPLE:

| | |
|---|---|
| Land value $8 per square foot, or . . . . . . per city lot of 2500 square feet. | $20,000 |
| Cost of a building assumed to be . . . . . . . . or three times that of land. | $60,000 |
| Then interest at 5%, added to depreciation and taxation, requires the improved property to return annually 29⅓% of the value of the land, or | $5,870 |
| This return of 5% upon the value of land and building requires a gross income of about . . . | $12,000 |

In other words, the renting capacity of this piece of land, which in its unimproved condition requires only that provision be made for its

| | |
|---|---|
| taxation of say . . . . . . . . . . . . | $200 |
| and for interest, at 5% on its value, of . . . . | $1,000 |
| or a total of . . . . . . . . . . . . . . | $1,200 |

or 6% of its value, would, by the improvement assumed, require the owner to concentrate on it interests or uses capable and willing of paying a gross income of ten times that amount, or about 60% of the actual value of the land every year for its use in connection with its improvement!

The relation which the investment on the building should bear to the marketable value of the land is really determinable by the expenditure justified by the prevailing rate of rentals for any given form of occupancy.

When the value of the site combined with the building is to be established from known or assumed rates of rental, the following method will afford the means of determining the established value at any desired rate of interest:

$$T = \frac{S \times n \times r \times f}{100 \times i} \times b$$

$S$ = rate of rental per square foot occupied or rentable area.
$n$ = per cent. of net rentable area to gross area of building.
$r$ = ratio of net income to total income.
$f$ = number of stories in the building.
$i$ = rate of interest, per cent. per annum.
$b$ = area of the building in square feet.
$T$ = total invested value of site and building.

From the result of such a computation the actual cost of the building may be deducted, when the value established for the site remains. If this value be largely above the existing marketable value, then too great an investment in building has been assumed to be made, a result which may be exemplified by the following examples of the application of this method to a comparison of values.

EXAMPLE I:

It is proposed to erect either (1) an 8-story or (2) a 12-story housekeeping apartment-house upon a certain plot, the rentals in which will be \$1500 per annum for a suite of 1120 square feet, or an average of \$1.34 per square foot per annum. What will a net return of 5% per annum justify for the value of the land plus the cost of the building?

$S$ = rate of rental . . . . . . . . . . . . . \$1.34
$n$ = ratio of net rentable area to gross building area 60%
$r$ = ratio of net income to total income, with allowance for 10% vacancies, or . . . . . . . . 35%
$f$ = (1) 8 stories, (2) 12 stories.
$i$ = interest . . . . . . . . . . . . . . 5%

Then, substituting for the nomenclature in the formula, we obtain for $T$, or the total investment on which the returns would pay interest:

(1) $T = \frac{1.34 \times 60 \times 35 \times 8}{100 \times 5} =$ \$45.02 per square foot of building area.

(2) $T = \frac{1.34 \times 60 \times 35 \times 12}{100 \times 5} =$ \$67.50 per square foot of building area.

Assuming the proposed structure to be erected upon a plot, say, 75 feet by 100 feet, of which the building occupies 80%, the area of the building will be 6000 square feet.

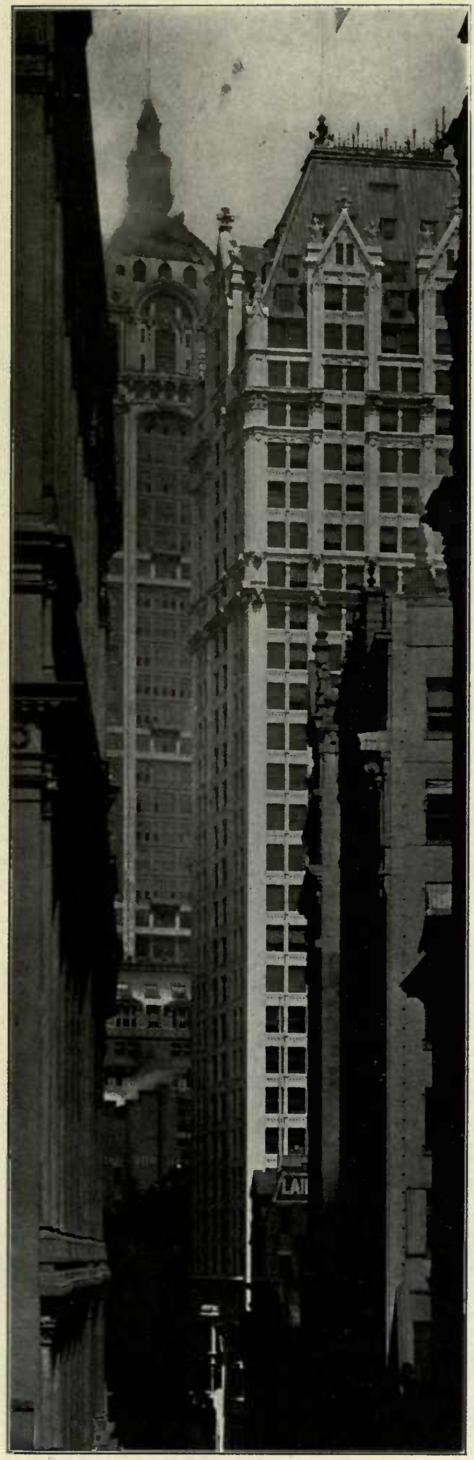
(1) Then the 8-story building would justify a total investment of \$45 × 6000 square feet, or . . . . . . . . . . . . . . . \$270,000

(2) The 12-story building would justify a total investment of \$67.50 × 6000 square feet, or \$405,000

These, then, are the total values established by the respective buildings in the land and the structure.

The cost of an 8-story building may be estimated at 30 cents per cubic foot and its height at 96 feet, so that the total cost would be . . . . . . . . . . . . . . . . . \$172,800
This cost would then establish the value of the land at \$97,200
out of a total investment of . . . . . . . . . . \$270,000
The cost of a 12-story building taken at 36 cents per cubic foot and a height of 144 feet would be . . . \$311,000
which would establish the value of the land at . . . . \$94,000
with a total investment of . . . . . . . . . . . . \$405,000
There would thus be no advantage in the erection of the 12-story building.

Let it be assumed, however, that the larger building might be built for 33 cents, or a difference in cost of only 3 cents, per cubic foot, in which case it would cost only . . . . \$288,000
This would leave for the land value . . . . . . . \$117,000
or an apparent advantage in favor of the 12-story building of . . . . . . . . . . . . . . . \$20,000



"Over-investment involves an additional pledge on the part of the land to maintain its attractiveness as a site, and of the building to continue to fulfil its original purpose"

It is noticeable, however, that in order to secure this addition to the invested value of the land of . . . . . . . . $20,000
an increased investment in the building has had to be made of . . . . . . . . . . . . . . . . . $105,200
and the depreciation upon this increased cost at thirty years' life at 5% compound interest would be 1.5% on difference in cost, or . . . . . . . . . . . . $1,578
which would use up more of the returns than would pay the interest of $1000 upon the additional value established for the land.

Therefore, these results show that a 12-story building would not be a really remunerative investment as compared with the more moderate expenditure upon the 8-story building, at even so small a difference in cost as 3 cents per cubic foot.

EXAMPLE II:

It is proposed to erect (1) a 12-story or (2) a 20-story building for office purposes on a certain plot, the prevailing rate of rentals in the surrounding vicinity being an average of $1.75 per square foot net rentable area; investment at 4%; building area, say, 5000 square feet.

$S$ = rate of rental . . . . . . . . . . . . . . $1.75
$n$ = ratio of net rentable area to gross building area, say . . . . . . . . . . . . . 65%
$r$ = ratio of net income to total income, with allowance for 10% vacancies, or . . . . . . . . . 45%
$f$ = (1) 12 stories, (2) 20 stories.
$i$ = interest . . . . . . . . . . . . . . . 4%

Then

$$(1)\quad T = \frac{1.75 \times 65 \times 45 \times 12}{100 \times 4} = \$153.60 \text{ per square foot of the building.}$$

Therefore, 5000 square feet × \$153.60 = say, total investment of . . . . . . . . . . . . . . . \$768,000

or

(2) $T = \frac{1.75 \times 65 \times 45 \times 20}{100 \times 4} =$ \$256 per square foot of the building.

Therefore, 5000 square feet × \$256 = total investment of \$1,280,000

12 stories, cost 37 cents × 144 × 5000 = \$266,400, leaving a land value of . . . . . . . . . . . . \$501,600

20 stories, cost 54 cents × 240 × 5000 = \$648,000, leaving a land value of . . . . . . . . . . . . . \$632,000

Increased apparent value of land by 20-story building is \$130,400

But increased investment in building is . . . \$381,600

Income on \$130,400 at 4% is . . . . . . . . \$5,216

But loss by depreciation on excess cost of building is, at 4% compound interest on 30 years' life . . . . \$6,792

Therefore the 12-story building is the better investment by . . . . . . . . . . . . . . \$1,576 per annum

*at a difference in construction cost of 17 cents per cubic foot.* And should the difference be reduced to 14 cents per cubic foot, then the two proposals would stand on an equality as regards net rate of returns; but the larger investment would still load the land unnecessarily.

Such unnecessary expenditures, while they may be and are assumed to be remunerative to the extent of a return of annual interest, are speculative risks upon the ability of the building to maintain them. As has been previously remarked, over-investment of any kind involves an additional pledge on the part of the land to maintain its attractiveness as a site, and of the building to continue to fulfil its original purpose for the full term

Assuming an increase of 60% in the cost of building construction and a rise in the prevailing rate of interest to 7%, it will be found that the rentals assumed in these illustrations are practically doubled. But by such an advance in rental the value of the site has not been affected.

of a period in which its value shall be offset by the land appreciation or by a fund out of net earnings.

If either pledge should fail, as in the recent instance of a 17-story office building, then the property suffers by the premature removal of the too costly structure, which has really hastened its own demise, while the failure or even the over-success of a more moderately proportioned building, which might bring about its removal in the same time, would do so with a justifiable and reasonable loss.

The erection of steel-framed buildings of one particular height cannot fit in with all values of the sites they occupy, especially on narrow plots in side streets, where great dependence must naturally be placed on the temporary conditions obtaining prior to similar improvements of contiguous properties. Some of the tall, narrow buildings thus located are of the nature of excess investments, or are indications of too great an expenditure in the site. Such buildings, while they temporarily enjoy superior benefits of light and air, derived from their location among smaller neighbors, are bound to lose much of this advantage later, but anticipation of this contingency is very commonly ignored or subordinated to the demand for returns on all the area possibly to be crowded on to the site.

It is an open question whether a large variety of buildings would not gain by a substantial reduction of their floor areas, whereby an increase of the access of light and air to their interiors may be secured.

There is a special value to be attached in certain cases, for mere advertising purposes, to those spaces in a building which front on a street, which advantage is not possessed by rear spaces; but the main asset of street frontage is light and air, for which additional rentals are obtainable.

Direct and abundant light and access to wide unoccupied space increase the rentable value of any part of commercial buildings, over any other part not equally advantaged. Those portions in a building which are more or less deprived of air and light make so low a return as to become unremunerative, constituting a mere burden on the building, reducing its average of rentals. Mr. F. H. Heywood has recently stated, as a result of wide investigation, that the value of court offices decreases 10% per floor from the rental of the floor at the top of the court.

Equal expense is, however, involved in the construction of each part of the structure, and if this feature be carefully considered at the outset, it may be found that some large proportion of the building could be omitted with advantage, reducing the total cost of the building, and raising the rentals of the rear or poorly lighted parts by affording space for light and air, approximating that of the most open or best-lighted space, such as the street frontage. It is better to have a small building all of which produces a high rate of rental than a large building rented at high rates in front and low rates at rear, averaging the same as the smaller building.

The following illustration, based on a scale of 100 parts, brings out this consideration.

| Example | Lot | B'l'ding | Cost | Occupied area | Net area | Rent front | Rent rear | Average rent | Total income | Exp. | Return | Interest on cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 100 | 80 | 800 | 80% | 64 | 1.25 | 0.75 | 1.00 | 64 | 50% | 32 | 4% |
| B | 100 | 60 | 600 | 80% | 48 | 1.25 | 1.25 | 1.25 | 60 | 50% | 30 | 5% |


"There is a special value to be attached in certain cases, for mere advertising purposes, to those spaces in a building which front on a street"

## III

## VALUES ESTABLISHED BY BUILDINGS

The foregoing considerations have shown that the efficient existence of a building must be measured and may be limited by its capability to make a reasonable return upon the original investment, and have indicated that the result should be accomplished in addition to maintaining or building up a fund sufficient for its own reconstruction at some future period. A building which, under these conditions, does not make a net return equal to current market rates for thoroughly sound investments cannot be considered a satisfactory equivalent for investment in other forms of security, and the extent of its failure in the return must be charged against any assumable appreciation of the value of the site on which it stands, and may be regarded as an index of a shortened term for its existence.

In determining the extent of expenditure which is justifiable in the improvement of real estate, as has been done herein, use has been made of a percentage of the gross rentals as a basis for the financial return which commercial buildings may be expected to make in order to establish certain capitalized values in the site and a commensurate return upon their own cost.

This return is the result of two elements—the rentable value of a square foot of space prevailing in that locality for any specific class of occupancy, and the proportion of expenses for the operation of the building and for the payment of fixed charges thereon.

Rates of rentals do no doubt vary with locality and differ from those which at present prevail in New York City, as shown in table A. But the ratio of the expenses to the rentals may be expected to remain similar for any specific type of building and character of operation.

A prevailing rate is not always to be enhanced or beneficially affected by inducements such as elaborate ornamentation or imposing exterior appearances in new buildings, nor can a permanent dependence be placed on increased rentals obtainable by reason of novelty in construction or even by internal conveniences. Even the one definitely valuable asset or influence of the possession of ample light and air can only be permanently secured by the ownership of contiguous property or exceptional surrounding circumstances, or by the devotion of part of the site to this purpose.

It is unquestionable that certain beneficial effects result from dignified appearance in buildings, particularly as regards their entrances; and reasonable excess expenditures are justified in decorative effects which may be attractive to prospective tenants, but such matters need more than haphazard consideration. Imposing and elaborate cornice decoration accompanies gloomy recessed court entrances of some recent designs of apartment-houses, and these and other expenditures require to be directed with judgment.

There was recently published an account of a business building on the street front of which were erected solid columns of selected granite, the cost of each amounting to $7500, exclusive of their capitals and pedestals.

Interest upon the cost of these features would involve the entire earning capacity of one floor of the building, which may, therefore, be regarded as having been constructed solely for the purpose of justifying the investment upon the columns. As the cost of this additional floor added relatively to the total cost of the building, the whole building was also involved to some extent in the work of paying interest on the columns, the attractiveness of which to tenants would thus have to be very substantial to justify their existence. It is doubtful whether much dependence can be placed upon the future value of elaborate exterior decoration or expensive interior construction such as have accompanied the erection of a number of large business buildings.

In the case of office buildings it is to be noted that mortgage money may be obtainable thereon at rates considerably below those current for other classes of buildings, and that the interest return upon the equities may be acceptable at correspondingly moderate rates. If, however, the return upon the equity does not equal or exceed the rate upon which the mortgage is placed, the building could not be considered to be effectively productive, because the investor would naturally do better at equal rates by investment in a first mortgage or a bond upon the property, thereby obtaining a first lien upon its earnings, with entire freedom from all responsibilities and anxieties as to the details of operation.

Figures from a large office building of very successful character, twenty stories in height, may be taken as an illustration. With an invested value exceeding $6,000,000 in land and building, the gross rentals are 9.3% of the capital value, and the operating cost is (without provision for vacancies) 41.6% of the rentals. This cost does not include provision for depreciation of the building or of its equipment, so that the ostensible return of 5.5% upon the investment will be reduced by allowance for those elements to a rate of approximately 4%.

For so important a building, this is evidently a satisfactory result, and as a mortgage is placed upon the building at that rate of interest, the equity or remainder stands upon the same basis of interest as the mortgage. But it is to be noted that while the interest upon the mortgage would be secured as a prior lien upon the income, the remainder or equity would depend for the stability of its revenue upon the maintenance of the present rates of rentals, of taxation, and of other elements included in the cost of operation.

Another illustration may be taken from the results afforded by an office building of nearly equal size, but of only sixteen stories height, the appraised value of which, with its site, is $5,000,000. The rates of rental in this building are not nearly so high as in the foregoing instance, and so the proportion which the actual rentals bear to the gross value is only 7.7%.

Out of the income there is set aside a fund for depreciation, and the expenditures are economically maintained at 40% of the net income, partly by reason of the simple character of the equipment and the absence of generating machinery. Under these circumstances its return of 4.7% upon the invested value makes it an effectively productive investment, as a mortgage at the same rate as in the foregoing instance would leave an attractive return upon the equity.

An instance of a return of a rate less than current mortgage interest is that of a high-class office building, twenty stories high, of a total appraised value of $4,500,000, the total rentals of which are, however, only 7% of the appraised value. This building has a complete power-generating plant, and is operated at a cost of 48% of its income, returning upon its capitalized value only 3.6% interest.

A smaller modern office building of about one third the size of the foregoing, of fourteen stories height, having an appraised value of $600,000, brings a rental of 10% thereon, and returns a net interest upon the investment of 4.8%, in spite of a proportion of expenditure to income of very nearly 50%.

A still smaller building, thirteen stories high, about one fifth of the size of the first instances above referred to, of an appraised value of $500,000, brings in a rental of 9% thereon, and returns upon the investment 4.25%. This building is served

"It is an open question whether the majority of city buildings would not gain by a substantial reduction of the ratio of the area of the building to the area of the lot"

by public supplies of power and heat, and is operated for a total proportion of 47.5% of the total rentals.

These instances appear to indicate that in certain cases the relation of the building to the land, both as regards height and as regards expense of construction, has not been happily proportioned, and thus the return upon the total invested capital has been proportionately reduced. But where the initial cost has been moderate, and unnecessary expenditures in construction, in equipment, and in operation have been avoided, the net returns upon such investments, while they may be less than those afforded by other classes of buildings, are acceptable to conservative investors, in view of the attractive solidity of the investment.

Passing to other classes of buildings of which similar statistics are available, it will be found that the returns are somewhat more irregular than in the case of office or business buildings.

Where buildings combine simple character, moderate cost of construction, and moderate extent of mechanical service with a location in which land values are comparatively low, we may expect to find a growing advantage as regards the net return upon the invested value. This is usually the case with loft buildings of simple semi-fireproof construction, generally situated in neighborhoods off the main arteries of traffic, and equipped with very simple forms of conveniences. In such properties the gross rentals approach one tenth of invested values, and, with expenditures below 40% of rentals, will show returns exceeding 5%.

The following are four scattered instances with varying rates of rental, all located in Manhattan:

| | | | | |
|---|---|---|---|---|
| Rentals per square foot | 42 cents | 51 cents | 60 cents | 70 cents |
| Operating expense . . | 37% | 39% | 36% | 39% |
| Rentals of value . . . | 8.5% | 9% | 9.8% | 10% |
| Returns on investment . | 5.4% | 5.57% | 6% | 6.1% |

To maintain the book value of the properties cited, at a rate of return of 8%, with operating expense not exceeding 50% of gross income, the rent must be raised to 63 cents, 73 cents, 83 cents, and 92 cents respectively.

An instance which differs from the foregoing is the following:

| | | |
|---|---|---|
| Rent | per sq. ft. | 63 cents |
| Operating expense | | 43% |
| Rents to value, only | | 7% |
| Return on value, only | | 4% |

The invested value is too high for such a class of property, but on looking into details we find the cause in great part to be that the building is overtaxed, paying 20% of its gross rentals in taxes. If this expenditure were reduced to the level of others in a similar class of property, say 14%, the return would be raised to 4½%, but the invested value might still be scaled down about 12% to make a return of 5%.

The term "loft building" has been extended to include the modern class of 12-story fireproof building occupied chiefly as warehouses, show-rooms, or for very light manufacturing purposes. These buildings are attractive for such purposes, by reason of their superior light, generally gained by their location in neighborhoods occupied by buildings of a few stories; an advantage which is frequently liable to be discounted by the growth of neighboring buildings of equal height. As it is, they secure rentals on a somewhat higher scale, and having the same characteristic of moderate cost and operation, they show very gratifying returns.

A recently completed building of this order is leased to one tenant at a rental equivalent to 11% of invested value, and, with operating expense of 40%, will show a return of 6½% on the investment.

In the residential class of building we find a set of conditions differing from both of the other classes of commercial buildings.

An overwhelming tendency has brought about a demand for apartments, which has been responded to by an almost confusing variety of forms of structure. In certain favored localities a fashionable demand has forced the marketable value of land upward, and in others the mere crowding of population has effected the same result. The class of building erected on these sites is, however, very different, in the one case being an expensive construction with expensive accompaniments of operation, and in the other the cheapest class of construction and almost entire absence of conveniences.

VALUES AND EXPENDITURES OF TENEMENTS OR FLATS

NEW YORK CITY

| Location | Rent per gross sq. ft. cents | Rent to value % | Operating expenses % | Return on investment % | Remarks |
|---|---|---|---|---|---|
| 6th Street | 53.7 | 9.55 | 35.0 | 6.20 | Stores and cold water |
| Rivington St. | 55.4 | 10.20 | 38.0 | 6.30 | Stores and hot water |
| 26th Street | 46.9 | 9.55 | 37.0 | 6.01 | Hot water |
| 71st Street | 33.1 | 9.00 | 35.5 | 5.80 | Stores and hot water |
| 88th Street | 35.2 | 9.30 | 36.0 | 5.95 | Hot water |
| 101st Street | 33.5 | 9.40 | 35.0 | 6.11 | Stores and hot water |
| 118th Street | 42.7 | 8.53 | 43.0 | 4.95 | Steam heat and hot water |
| 135th Street | 43.0 | 9.60 | 42.8 | 5.50 | Steam heat and hot water |
| 140th Street | 42.5 | 10.00 | 44.5 | 5.55 | Steam heat and hot water |
| Averages | .... | 9.50 | .... | 5.80 | .......... ........ |

At the lower part of the scale, the so-called "cold-water" tenement has attracted a vast number of small investments, on which the returns have been attractively high, and the demand for accommodation so great as to insure regularity in tenancies.

The relation of rentals to invested values is generally over 9%, and the operating expenditures, if taxation does not exceed 12% of the rentals, are about 36%, making returns of about 6%. The convenience of hot-water service only slightly affects

Large advances in the cost of operation and taxation have substantially raised the general level of rentals on this class of property. Their invested value will not be maintained unless the rents provide for a higher rate of return upon the investment to meet prevailing conditions in the money market.

this return, but the addition of steam heat makes a decided reduction.

The elevator apartment-house is in course of development, and it is difficult to define the controlling conditions at present, since the recent course has been one of over-production, resulting in large proportions of vacancies and reduction of rentals, and an appraisal under such conditions would scale down their value.

When fully occupied and divested of the prevalent concession of free rents, such properties may show returns upon moderate values of land exceeding other classes of buildings.

RENTALS IN FASHIONABLE APARTMENTS, WEST SIDE

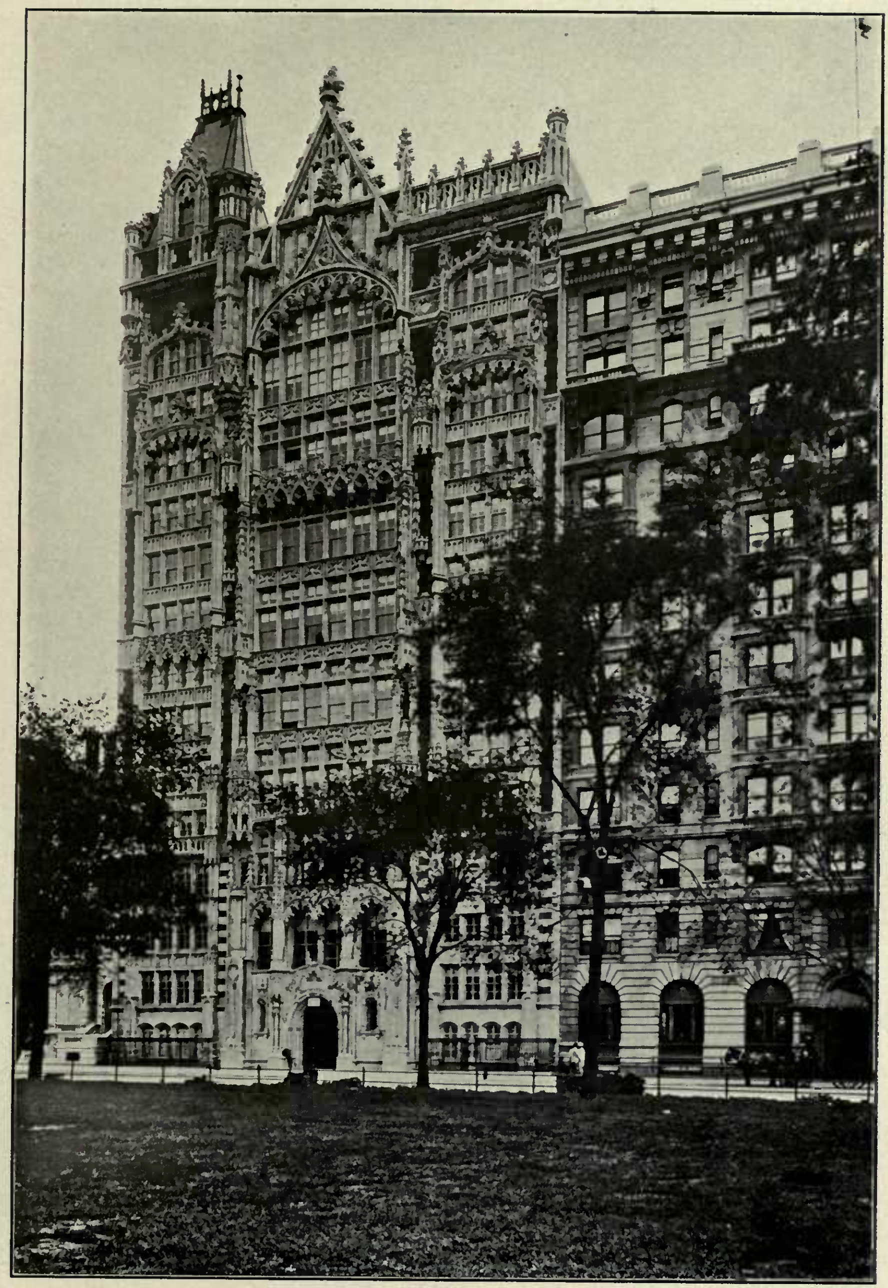
BOROUGH OF MANHATTAN

| Location | Stories | Elevators | Rooms per suite | Rent per room per month | Rent per gross sq. ft. per annum |
|---|---|---|---|---|---|
| 93d Street . . . . . | 12 | 3 | 8 to 10 | $25–26 | 81 cents |
| 108th Street . . . . | 12 | 3 | 6 to 8 | 16–23 | 76 " |
| 116th Street . . . . | 10 | 2 | 7 to 8 | 18–21 | 74 " |
| West 55th Street . . | 11 | 2 | 8 to 8 | 19–28 | 73 " |
| 113th Street . . . . | 12 | 3 | 6 to 9 | 16–18 | 70 " |
| 111th Street . . . . | 8 | 1 | 3 to 7 | 15–16 | 69 " |
| 130th Street . . . . | 6 | 1 | 4 to 7 | 9–11 | 46 " |

The annual rentals paid for residential apartments appear large, but when reduced to the basis of the occupied area they present a very moderate comparison with the rents paid in other classes of buildings, in which the conveniences included are less in number and in cost, and where the occupancy of the space is restricted to a much shorter daily period.

Thus a fashionable apartment-house renting suites of eight rooms at $2000 to $2500 per annum is bringing in an average of less than 75 cents per square foot of building per annum, or

See additional observations on residential properties in Chapter VIII, p. 119.



"Reasonable excess expenditures are justified in decorative effects which may be attractive to prospective tenants"

about the same rate as that of a high-class loft, and much less than the lowest rate for an office building. Rentals of older apartment buildings located in the immediate vicinity of lower Fifth Avenue are found to vary from 72 to 81 cents per square foot per annum, and the higher rate is paid on the same street and block as the lower.

The six-story elevator apartment on the upper West Side, with modern conveniences, rents for rates less than 50 cents per square foot, which is less than the rent paid on the lower East Side for space in a "cold-water" tenement.

Such diverse figures are only apparently contradictory, as the rents are really controlled by the value of the land, for residence upon which the tenant is paying, and which is therefore the element fixing the rate of rental.

The square foot of high-class apartment building, burdened though it be with additional costs of construction and of operation, is located on land of less present value, and the total investment per square foot is therefore less than in the cheaper building on land of high value.

Operating expenses of such buildings are relatively high, especially where electric lighting and refrigerating services are afforded gratuitously. Without this accompaniment, the average proportion, when taxation does not exceed 13% of rentals, would be near 51%, and with lighting and refrigeration added, about 65%.

Rentals being approximately 13 or 14% of invested values, the return may be 6½ to 7%; and as mortgages upon such properties are commonly based upon interest rates of 5 to 5½%, the net returns upon the equities, while showing considerable variation due to the irregularities of occupancy and expenditures, are attractive.

All these instances lead naturally to the conclusion that the true values of improved properties are those at which the inter-

When rates of interest on good investments exceed 7 to 8% the present scale of expense, taxes, and interest on mortgage money require the gross income from modern flats, "walk-up," and elevator apartments to be 18 to 20% of the marketable value.

est returned by the building will equal or somewhat surpass that of a mortgage or bond issue upon similar property.

If a higher appraised value is to be maintained, some appreciation of the value of the land must be annually assumed to exist to the credit of the equity, and the amount of such appreciation must equal the difference between the real return and the market return, but it is evident that such a method would be problematic and indefinite. The appraised value not infrequently represents actual outlay on the property, and in the cases above cited is not in excess of commonly accepted appraisals based upon the gross incomes.

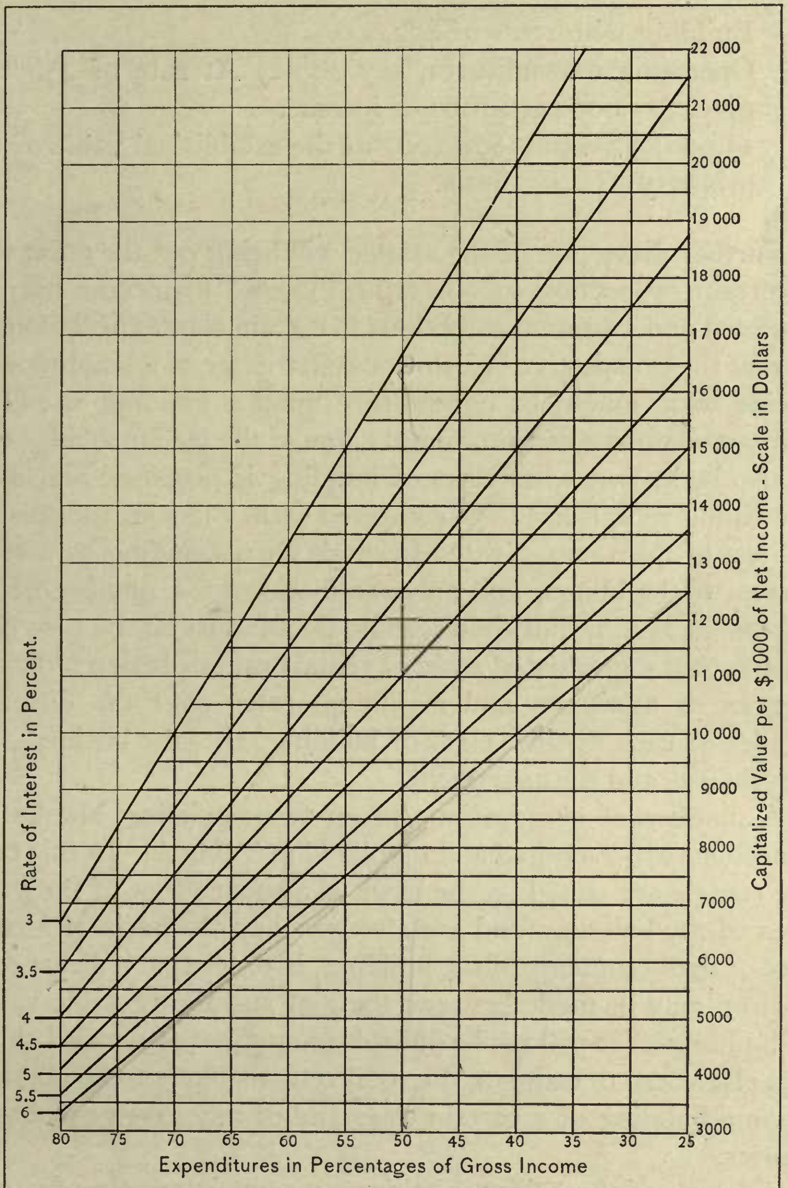
As an instance may be cited the recent purchase of a fine modern business building on Fifth Avenue, bought specifically for investment purposes at a price nearly eleven times the rate of its present earning capacity.

It is clear, therefore, that a direct relation exists between the earnings of any building as reduced by its expenditures, and the capitalized values of the land and the building upon which interest is paid by those earnings, so that where the relation of expenditure to income is known or may be reasonably estimated, the relative capitalized value of the property may be readily established. Relations so established are shown in a convenient form in the accompanying diagram, Fig. 9, at rates of interest varying from 3 to 6%. In this diagram the horizontal scale is that of the expenditures out of the total income, and the vertical scale is that of capital value per $1000 of gross income.

Reading up from any point of relation or percentage of expenditures to the diagonal line of desired rate of interest, the horizontal line to the right gives the capital value thus established.

Or, reading from any assumed invested value to its intersection with the desired rate of interest, a vertical line from that point will show the percentage of gross income within which all expenditures, other than interest, must be limited.

Fig. 9




Capitalized Value

This diagram can be utilized for higher rates of interest by proportionate division; thus at 7% interest the results are one half those shown at 3½%.

Example:

Building with rents of $52,000.
Operating expenditures, say 40%. At rate of 4% this gives $15,000 per $1000 of income.
15,000 × 52 equals $780,000 as the established value of the property on a 4% basis.

Further dissection of the matter will bring out the point that a certain proportion of operating expense to income may be expected under present conditions in certain classes of buildings, so that the prospective investor or constructor of a building may decide what extent of expenditure upon a building would be warranted upon a certain capital value of the land, provided that it also be known what class of building is proposed and what prevailing rentals are to be competed with. This introduces the subject of the average rate of rentals corresponding to various classes of buildings, and an examination of a number of instances in Manhattan shows, as no doubt must be the case elsewhere, that a graduated scale of rentals ranges between defined figures of minimum and maximum rates over the different grades of each distinct class of building, viz., the business, the warehouse, and the apartment.

A number of observations taken from existing Manhattan conditions are averaged and tabulated in Table A. In this table the rentals are stated on the basis of a square foot of the gross area of the building, and are also given on the basis of a cubic foot of gross contents of the building, in order that a direct comparison may be made between the cost and the rentable values of buildings. It will not be difficult from these or parallel statistics elsewhere to estimate the total returns likely to be obtained from a building of a certain class and of any given number of stories.

Analysis of these figures brings out some interesting features

| Type of building | APARTMENTS | | | | | | | | | LOFTS | | | | | | OFFICES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flats | | | Medium | | | High-Class | | | Light Manufactur'g | | | Warehouse or Mercantile | | | | | | | | | | | |
| Height in stories from street | 4 to 6 | | | 6 to 8 | | | 9 to 12 | | | 5 to 8 | | | 9 to 12 | | | 8 to 12 | | | 13 to 17 | | | 18 and Over | | |
| Height per story in feet | 11.83 | | | 12.0 | | | 11.75 | | | 11.83 | | | 11.91 | | | 11.91 | | | 12.83 | | | 12.83 | | |
| Rate | Low | Aver. | High | Low | Aver. | High | Low | Aver. | High | Low | Aver. | High | Low | Aver. | High | Low | Aver. | High | Low | Aver. | High | Low | Aver. | High |
| Rentals per sq. ft., net area | 53 | 68 | 90 | 80 | 100 | 135 | 96 | 115 | 150 | 52 | 78 | 104 | 97 | 120 | 156 | 150 | 179 | 200 | 175 | 203 | 250 | 200 | 250 | 300 |
| Rentals per sq. ft., gross area | 33 | 42 | 55 | 50 | 63 | 85 | 60 | 72 | 94 | 40 | 59 | 80 | 75 | 92 | 120 | 105 | 125 | 140 | 122 | 140 | 175 | 140 | 175 | 210 |
| Rentals per cu. ft., gross contents | 2.8 | 3.5 | 4.6 | 4.2 | 5.2 | 7.0 | 5.1 | 6.1 | 8.0 | 3.3 | 5.0 | 6.8 | 6.2 | 8.0 | 10.0 | 8.8 | 10.5 | 11.7 | 9.5 | 10.9 | 13.6 | 10.9 | 13.6 | 16.3 |
| Construction cost per cu. ft., gross | 18 | 24 | 28 | 30 | 33 | 36 | 32 | 35 | 38 | 18 | 22 | 26 | 26 | 30 | 34 | 29 | 33 | 37 | 37 | 44 | 51 | 50 | 54 | 58 |
| Relation of rent to construc'n cost in % | 15.5 | 14.6 | 16.4 | 14.0 | 15.7 | 19.4 | 16.0 | 17.4 | 21.0 | 18.3 | 22.7 | 25.3 | 23.8 | 26.6 | 29.4 | 33.4 | 31.8 | 31.6 | 25.6 | 24.7 | 26.6 | 21.8 | 25.2 | 26.1 |

TABLE A

## APPROXIMATE RENTALS AND COSTS OF CONSTRUCTION IN VARIOUS TYPES OF BUILDINGS

NEW YORK CITY

All costs and rentals are in terms of cents

The height, the rentals, and the costs include a proportion of a basement

The figures in the table were those well established prior to 1917. Although construction costs and rents have increased, the original figures serve to illustrate the relation of rentals to height, and through that to cost of construction.

For conditions prevailing in 1922 it may be assumed that rentals average 80% increase, and that construction costs have advanced not less than 60%. But such rentals and costs of construction still increase with height of building.

bearing upon the nature of the earning capacity of the several classes of buildings. The ratio of income to cost of building is highest in the case of office buildings of moderate height, and decreases with height in excess of twelve stories. The ratio is much higher in the case of lofts and warehouses than in the case of apartments. The land value in each case varies and really follows these returns.

It will also be noticed how the rate of rental follows the height of the building, indicating the necessity for higher rentals in those buildings which are combined with high ground values.

This is a natural outcome of an increase in the number of floors, which involves greater relative cost of construction of the whole building, and greater relative expenditures in operation.

At any rate of rental, repetitions of the site or additional floors can, by metal frame construction, be carried to a height where the interest on the cost of construction and the cost of operation would absorb all the return and leave nothing to support the value of the land.

The rate of rental must therefore to a certain extent follow the height of the building. If tenants are willing to pay higher prices for accommodations a certain distance vertically from a desirable center, rather than for equal accommodations in some other building at an equal horizontal distance, the upper levels of sky-scrapers may show a profit, and the process may be extended to the construction of towers without limit as to height.

Unless higher rental be paid, however, excessive height constitutes a burden on the returns from the lower part of the building. Thus towers may form part of a larger and lower building, returns from which may cover the deficiency resulting from the tower, and make it an apparent financial success.

In these average rentals it may be assumed that the ground-floor rents raise the general average.

In a building on a commercial thoroughfare, the ground floor, with the use of the basement, will usually bring in, for business purposes, the highest rate of rental. This rental being averaged over the whole rented area, it follows that the higher the building the less will be the influence upon the average of the rate of the ground floor and basement.

Thus in a six-story building, the ground floor being rented at $4 and the upper floors at $1 gives an average of $1.50 per square foot. But if the building be twelve stories, rented on upper floors at the same rate, then, to bring the average to the same amount, the ground floor must be assumed to be rented at $7.50 per square foot, otherwise the general average will be but $1.33 per square foot.

Basements with direct access from the street are of course of greater value than those which are suited only to serve as an adjunct to the ground floor.

The recent large advances in rentals, even if they should prove to be permanent, cannot be assumed to have increased the book value of properties unless they return a net income upon the original book or invested value at a prevailing rate of interest. Nor is it to be assumed that the increased cost of new building construction has advanced the value of existing buildings, particularly as construction costs are not fixed.

## IV

# DEPRECIATION OF THE VALUE OF BUILDINGS

### I. PHYSICAL DETERIORATION

DEPRECIATION of the value of modern buildings is a subject on which opinions very divergent in character are frequently expressed, and appear to be based upon no definite method or system.

Such uncertainty might be expected, in view of the long-continued existence of certain buildings which are within the knowledge of every one, some of which are even to be found in our own country with a recorded history of over two centuries and which are still able to afford some degree of usefulness to their occupants. Such instances naturally tend to the conclusion that if equally excellent methods and solid materials be employed in modern structures, with an equal degree of care during their existence and occupation, at least an equal term of physical existence might be expected, and that therefore the anticipation of any depreciation may be dismissed as being too remote a prospect for necessary consideration or for any financial provision.

The opposite point of view is that of those who are influenced by the short term of existence of many modern buildings under metropolitan conditions, resulting from rapid changes of circumstances and surroundings, and in certain cases from poor character of design or construction, all of which are undoubtedly contributory causes to the shortened existence of many buildings.

"The investor in buildings cannot afford entirely to ignore the fact that the isolation of Manhattan is rapidly disappearing"

This diversity of outlook naturally results in the wide divergence of opinion on the general subject to which reference has been made, but on a closer investigation of the matter it would seem that the main considerations of both points of view may be brought into agreement.

Depreciation is a result of one or two causes: either a falling-off in the effectiveness of the structure in fulfilling the purpose of its existence, or a decay in its physical constitution. Strictly speaking, the result of the former cause is more properly to be described as depreciation, and that of the latter would be better regarded as deterioration; but as common practice has applied the same term to the result of financial as well as material decay, they may be defined respectively as economic and physical depreciation.

The two elements are admittedly interrelated, yet may better be understood if considered separately.

Economic depreciation is shown very definitely in commercial buildings by reduction in earnings, by inadequacy for designed duty, or by inadaptability to the progress of requirements.

The prospect of economic decline may lack sufficient definiteness to impel the owner of a building to make provision in anticipation of such a result, but the effects of physical decay are defined causes for the eventual disappearance of value.

Physical decay may always be expected to combine with exterior circumstances to aid in the process of financial decay, since age is in itself a bar to complete desirability and full effectiveness, and a building though in excellent condition, if it be out of fashion, out of date, antiquated, or insignificant, is just as liable to fall behind in the race, or to be neglected in favor of younger rivals, as the still vigorous man or woman similarly circumstanced.

Age is inevitable, and its effects are progressive in all materials, especially in combinations of materials or of appliances.

The effects of age are always in the direction of depreciation, and are only stayed or discounted by more or less radical reconstruction or remodeling.

The current attentions included under the often misplaced and much misunderstood terms of *maintenance, upkeep, and repair* are necessary accompaniments of the course of existence of all building materials and mechanical appliances, without which the advance of depreciation would be hastened and decrepitude would be precipitated.

*Maintenance* is a process of continuous attention to, and supply of, operating necessaries, including solicitous observation of the condition of the object cared for, and corresponding to the protection, shelter, clothing, and food supplied to living beings in order to maintain their functions in operating condition.

*Upkeep* is a course of partial re-creation involving expenditure of time and money in anticipating causes of decay, of failure, or of possible injury to the object under care, corresponding to the hygienic and recreative methods, often involving considerable expenditures without apparent direct results, which are or should be followed in safeguarding the general health and strength of living beings.

*Repair* is the course of partial reconstruction, replacement, or renewal of worn or injured portions after the necessity therefor becomes apparent, and, unless brought about by accident, the need for the process is due to the failure or inability of maintenance and of upkeep wholly to arrest the progress of decay.

*Deterioration* is the physical result of the natural insufficiency of the foregoing processes of maintenance, upkeep, and repair, all of which are dependent on human agencies, wholly to forestall the effects of wear and tear, of age, decay, or accident.

*Depreciation* is the financial result of the combined effects in a monetary sense of all the foregoing, although it may be, as hereinbefore explained, brought about by exterior causes, just as the health, the vigor, and the energy of a man may be discounted or rendered inoperative by circumstances.

However carefully conducted, the processes of maintenance, upkeep, and repair do not do more than assist the object along toward the eventual period of obsolescence, by avoiding breakdown on the way, or evading premature failure of any part.

But the arrival of that condition is inevitable when the object or combination of objects, its various parts from time to time repaired, replaced, rebuilt, or remodeled, becomes more or less a combination of new and original materials, containing a number of minor elements of weakness, as a garment ever so efficiently yet frequently darned, mended, or patched finally becomes useless, though much of its original material may remain in excellent usable condition.

In such condition the constitution of the building cannot be expected to withstand, any more than can that of a man or a garment, the stress of existence in the same manner as when it commenced its career.

Therefore we may frequently find, in the arrival of a certain extent of physical deterioration, the direct cause of financial depreciation, and by analyzing the former may be able to define or confirm a proper period of provision for both.

The determination of a rate of physical depreciation has occupied the attention of many owners of property, and is commonly dealt with by some empirical allowance, such as is represented by a flat annual allowance of a certain percentage of, or deduction from, the original value. Such a percentage may or may not be correct. The physical aging of a building depends upon the excellence of its original construction, just as much as the substantial health, or, as we call it, the "constitution," of a

This subject has taken on a new and insistent character since the establishment of the income tax. Depreciation and obsolescence are officially recognized and are allowed to be considered in the computation of income tax. Additional observations on the subject of obsolescence are to be found in "Power for Profit," pages 142-5.

man may enable him to postpone to a certain extent the effects of the progress of age.

A building is, however, a composite structure, all the elements in which are not of the same character and do not possess the same age-resisting quality. Inert materials, such as brick, terra-cotta, and concrete, are of a longer-lived character than those with which they are combined in structures, such as worked stones, wood, and metals.

Much confidence has been from time to time expressed in the durability of steel buried in brick or cement; but its real life, even if the most optimistic view be adopted, is modified by that of other elements combined with it, or entering into the structure which it supports. The frame of a steel cage or of a reinforced concrete structure may exceed in durability the exterior shell of the building, and certainly exceeds the life of the interior trim or the roof, and of many other less durable parts; but its eventual fate is parallel to that of a man whose skeleton is in excellent shape, when his demise is brought about by some cause affecting other and less stable elements in his composition.

Thus, some of the diverse views expressed on this general subject may be due to the consideration of a single feature to the exclusion of others, or to consideration only of one or more elements in a combined or compound structure.

Some attempts have been made to assign a life-period to structures proportioned upon the character of their usage, but such classifications, as a rule, have really been based upon considerations affecting the economic depreciation of the structure, and this method may fail if it does not take into account also the character of the construction of the building; in other words, the mere fact that a building is occupied for one form of tenancy or another does not in itself decide the length of its existence, but the period of its effective life may be very largely dependent upon its ability to withstand the stress of usage, and

"Buildings only temporarily enjoy benefits of light and air derived from their location among smaller neighbors"

if suitably sound in material and construction for the purpose of its occupation, then it may be reasonably assumed that its physical life will extend its efficient condition.

A step further in this direction is the view advanced by the author of "Principles of City Land Values," Mr. Richard M. Hurd, who assigns a duration of life to buildings of certain characters in proportion to the cheapness or to the excellence of their general construction, with modifying reference to their general usage. This apportionment is shown in the following table, to which has been added the column of the rate of annual sinking-fund recommended by that authority, with the term of years within which that sinking-fund will mature at 3% compound interest, which brings the real limitation of all buildings in this classification within a period of fifty years.

CLASSIFICATION OF DEPRECIATION

Deduced from R. M. Hurd's assignments of life

| Construction | Occupancy | Term of life in years | Rate of fund proposed in % | Term of sinking fund @ 3%, in years |
|---|---|---|---|---|
| Cheap frame | Tenements | 10–15 | 10–5 | 9–16 |
| Cheap frame | Residences | 25–30 | 3–2 | 23–31 |
| Better-class frame | Residences | 50–75 | 2–1 | 31–47 |
| Cheap brick | Tenements | 25–30 | 3–2 | 23–31 |
| Cheap brick | Residences | 35–50 | 2–1 | 31–47 |
| Cheap brick | Office buildings | 25–30 | 3–2 | 23–31 |
| Better-class brick | Residences | 50–75 | 1½–1 | 37–47 |
| Good brick or stone | Office buildings | 75–100 | 1 | 47 |

NOTE: Sinking-funds bring all the above within 47 years.

This apportionment is based on a shrewd analysis of, and a practical acquaintance with, the relative effects of good and poor materials and workmanship in prolonging or shortening the physical life of a building. Such a method is, however, not quite determinate, because the percentages of original values suggested to be annually laid aside for the amortization of the cost of the property do not agree with the spaces of time allotted, though they do agree in a conservative limitation of the economic existence of each class of structure; and the classification of buildings by their character of construction is reasonable, in view of the general practice of building to a certain standard for certain characters of tenancy and accompanying rates of rental.

Such a classification, however, accepts the building as a whole, or unit of equal character of permanency throughout, or at best limits the life by an assumption that the life of all parts is alike and of the length assigned.

The essential feature in defining a method for arriving at the period of physical existence appears to be the segregation of the elements which compose the building, the assignment to each of a reasonably effective existence, and the ascertainment, by a comparison of either the extent or the value of each element, of an average life of the whole combination.

Such a comparison will define very clearly the endurance of the parts which go to make the structure a whole, and will make clear the extent or number of occurrences of repair or renewal which can be expected to be required within the period which may be found to be that due to the most durable and least frequently repaired portion.

Thus if we may assume a building to be composed only of stone and lumber, it would be natural to expect that the former element would exceed the other in durability and also in ability to withstand the effects of repair. Wood is less durable, and, besides, would in all probability be subjected to strains, shocks, and variations of temperatures, and, moreover, the effect of any changes or repairs would be to weaken its general character in a manner which masonry would not feel; and as it is used for a variety of purposes, some of which involve more exposure to wear than others, such as flooring, it would be safe to say if a life were allotted to the lumber it would not exceed 50% of the more durable element in the structure.

Therefore the necessity for reconstitution of the woodwork of the structure would occur at one half the time of life of the more durable element, and during the second period the material would not possess the same durability as before, nor would the combined structure, as a patched or partly remade construction. The mean duration of the two, if equal in extent or value, would therefore be 75% of that of the longer-lived element.

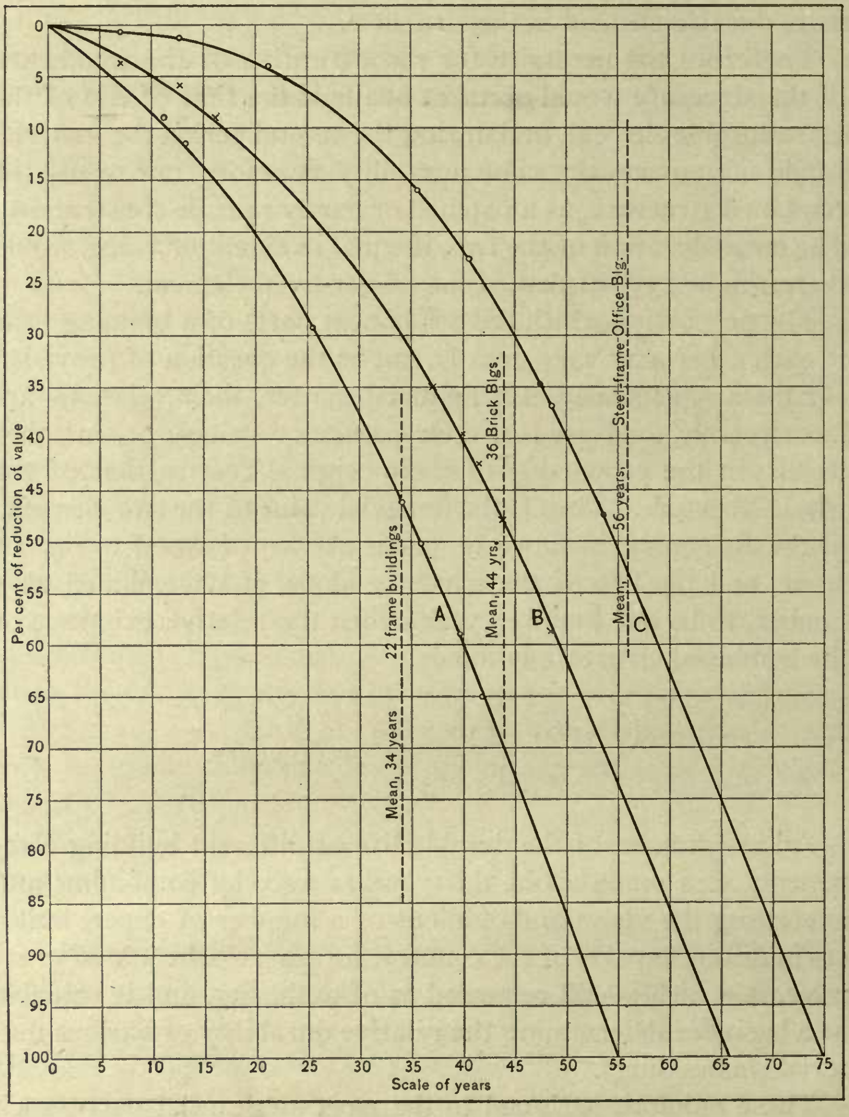
The proportion which the component parts of a building bear to each other may vary greatly, but as the question of provision for their replacement is a financial matter, their relations are most readily expressed in their monetary values, or, in other words, in the proportion of their original cost to that of the whole structure. Thus if the financial value of the two elements in the foregoing instance be taken as two of wood to one of stone, and the life of the masonry alone, if uncombined with lumber, to be one hundred years, then the relative existence of the combined structure becomes:

$$\frac{(2 \times 50) + (1 \times 100)}{3} = 66 \text{ years.}$$

An assignment of the durable life of different building components was made about thirty years ago, by combining and averaging the views and opinions of a number of expert builders in different parts of the country, forming a schedule of great interest, which is still regarded as of authority, and is valuable as a basis for determining the relative durability of various materials in buildings.

These opinions assigned to the most substantial parts, such as brickwork, stonework, and fireproof floors, a life of 66 years

Fig. 10


Per cent of reduction of value
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Scale of years
Mean, 34 years
22 frame buildings
Mean, 44 yrs.
36 Brick Blgs.
Mean, 56 years
Steel-frame-Office-Blg.
A
B
C

when erected in combinations of ordinary brick and frame constructions, and of 75 years when forming part of substantial brick and metal buildings, and also laid down the life to be accorded to each of a number of other elements entering into such combinations.

By applying these terms of durable existence to the values of parts of a series of buildings, and plotting these values in diagrammatic form, it is found that they fall within the line of a regular curve, indicating the correctness of the assumptions.

In Fig. 10 the two curves *A* and *B* are respectively those of the average values of twenty-two frame buildings and of thirty-six brick-and-stone buildings. These values are set off on the vertical scale of depreciation, and their respective anticipated life is set off on the horizontal scale of years. In curve *A,* the most durable elements were assumed to have a life of 55 years, in *B* of 65 years, and in *C* of 75 years.

The curve *A* of frame buildings, as it is reasonable to expect, indicates earlier and more rapid effects of declining life, and results in a mean life of 34 years. Curve *B* of the more substantial buildings, by reason of the greater extent and value of the more durable elements in its composition, declines less rapidly at first, though it eventually takes the same characteristic form, and results in a mean life of 44 years.

To these is added curve *C,* based on the values of the parts of a steel-framed fireproof office building, the mean life of which becomes 56 years. The solidity of general construction is well indicated by the shape of the curve, showing, as it does, a slow rate of early depreciation.

The evident harmony of this system is apparent, and results in the method herein advanced for the determination of average life, viz., to relate the cost values to the existence of each individual material or component of a structure, and therefrom to deduce the financial mean term of the whole, which is the period of physical deterioration to be covered by financial provision or sinking-fund for its amortization.

The method involves the assignment of maximum longevity to the most durable elements of the combination, to which the less durable may be related. By unduly increasing this period, it would appear that the average life could be extended indefinitely, but such a method carries with it its own contradiction, because the physical life cannot be greatly extended beyond the economic or useful period of existence, and the economic usefulness of all types of buildings is clearly bounded by some reasonable lapse of time, and especially so in the case of buildings operated for commercial profit, to which this subject is particularly pertinent. This is shown in the plotting of three periods in Fig. 11, where an office building is plotted on the basis of the life of its most durable parts, of 66, 75, and 100 years. While the two former show harmonious characteristics, the latter is distorted.

Not only the opinions expressed by authorities such as those already quoted, but consideration of the conditions of modern building construction, lead to the conclusion that, even with most careful usage and the best of modern construction, the physical existence of buildings is limited to a period within that usually regarded as two generations.

In response to such an assertion, instances may be afforded, no doubt, of the long existence of ancient materials; of old buildings still affording serviceable shelter; of exposed metal which with care and liberal paint has outlasted a half-century.

Such instances will prove of little value, because modern building methods lack not only the general massiveness of the ancient but their simplicity of composition, and massiveness of construction or mere solidity of one part is not in itself a source of longevity to other more perishable material. Modern construction is composite and employs complex materials, and those materials are generally reduced in proportions and subjected to greater strains than in older structures. The wear and tear of parts is vastly increased, and new forms of strains and vibrations due to modern machinery and appliances, to traffic, to local blasting work, and to the introduction of heating and steam-raising apparatus, all enter into the racking or straining of the elements of the structure, and even extend into the disintegration of inert materials, such as concrete.

In ancient construction, beams and rafters were exposed, so that dry-rot was avoidable, and when houses were unheated, warping of lumber and cracking of trim were rare. The humidity as well as the temperature in old buildings followed natural combinations, while lumber was cheap and plentiful and was used with prodigality and corresponding solidity.

The complexity of materials now employed in construction, the durability of many of which is unknown, is another reason for conservative limitations. Much discussion has been devoted to the subject of the permanency of reinforced concrete constructions, which only time will fully decide; but even if the strength and inert character of reinforced concrete be conceded, it is still found to be subject to deterioration by temperature changes, and even in such enormous masses as are used in dam construction this vast and silent force has rent the mass and opened the channel for deterioration.

The exterior face of a steel-frame and brick building may be in part granite, ashlar, marble, limestone, pressed brick, or terra-cotta. All are not equally durable; some are, in modern construction, extremely slender in dimensions; all are exposed to the action and reaction due to extremes of frost and heat, as well as to the interior expansion and contraction of the frame that supports them.

Materials combined in modern constructions are tabulated on the following page, with assignments of probable life.

Table B

# RELATIVE LIFE OF THE COMPONENT PARTS OF BUILDINGS

## I. GOOD FRAME CONSTRUCTION

Life of most durable part=45–55 years or 100%

| Years | Materials | Relative to 45 ys. Percent. | Relative to 55 ys. Percent. | Years | Materials | Relative to 45 ys. Percent. | Relative to 55 ys. Percent. |
|---|---|---|---|---|---|---|---|
| 45–55 | Masonry | 100 | 100 | 25 | Floors and stairs | 55 | 45 |
| 45 | Exterior brickwork | 100 | 82 | 30 | Hard-wood trim | 66 | 54 |
| 44 | Brick flues | 99 | 80 | 33 | Plastering | 73 | 60 |
| 41 | Lumber framing | 90 | 75 | 20 | Hardware | 44 | 36 |
| 39 | Studding | 86 | 70 | 30 | Tinwork | 66 | 54 |
| 33 | Mill-work | 73 | 60 | 20 | Exterior ironwork | 44 | 36 |
| 33 | Sheathing | 73 | 60 | 6 | Exterior paint | 13 | 11 |
| 27 | Exterior woodwork | 60 | 49 | 9 | Decorat'n and varnish | 20 | 17 |
| 13 | Shingles | 30 | 24 | 18 | Fixtures | 40 | 34 |

## II. BRICK AND STONE CONSTRUCTION

Life of most durable part=55–66 years or 100%

| Years. | Materials | Relative to 55 ys Percent. | Relative to 66 ys. Percent. | Years | Materials | Relative to 55 ys. Percent. | Relative to 66 ys. Percent. |
|---|---|---|---|---|---|---|---|
| 55–66 | Most durable part | 100 | 100 | 27 | Flooring and stairs | 49 | 41 |
| 53 | Exterior brick | 96 | 80 | 35 | Trim | 63 | 53 |
| 53 | Brick flues | 96 | 80 | 33 | Plastering | 60 | 50 |
| 50 | Lumber | 90 | 76 | 20 | Hardware | 36 | 30 |
| 40 | Studding | 72 | 61 | 30 | Ornamental ironwork | 54 | 45 |
| 33 | Mill-work | 60 | 50 | 20 | Exterior ironwork | 36 | 30 |
| 27 | Exterior woodwork | 49 | 41 | 6 | Exterior paint | 11 | 9 |
| 27 | Roofing-slag | 49 | 41 | 10 | Decorat'n and varnish | 18 | 15 |
| 33 | Roofing-tile | 60 | 50 | 20 | Fixtures | 36 | 30 |

## III. MODERN FIREPROOF CONSTRUCTION

Life of most durable part=66–75 years or 100%

| Years | Materials | Relative to 66 ys. Percent. | Relative to 75 ys. Percent. | Years | Materials | Relative to 66 ys Percent. | Relative to 75 ys. Percent. |
|---|---|---|---|---|---|---|---|
| 66–75 | Most durable part | 100 | 100 | 50 | Interior ironwork | 76 | 66 |
| 45 | Exterior cut stone | 68 | 60 | 22 | Exterior ironwork | 33 | 29 |
| 60 | Exterior brick | 91 | 80 | 45 | Window mill-work | 68 | 60 |
| 60 | Exterior terra-cotta | 91 | 80 | 40 | Hard-wood trim | 61 | 53 |
| 66 | Interior masonry | 100 | 88 | 9 | Glass | 14 | 12 |
| 40 | Interior cut stones | 61 | 53 | 9 | Interior decoration | 14 | 12 |
| 36 | Interior marbles | 54 | 48 | 20 | Exterior woodwork | 30 | 26 |
| 36 | Plastering, plain | 54 | 48 | 25 | Hardware | 37 | 33 |
| 30 | Plastering, decorative | 45 | 40 | 20 | Sidewalks | 30 | 26 |
| 27 | Stone flooring | 41 | 36 | 24 | Roof-houses | 36 | 32 |
| 24 | Wood flooring | 36 | 32 | 27 | Tanks | 41 | 36 |
| 30 | Stairs and steps | 45 | 40 | 20 | Plumbing fixtures | 30 | 26 |
| 27 | Roofing-slag | 41 | 36 | 20 | Lighting fixtures | 30 | 26 |
| 40 | Roofing-tile | 61 | 53 | 33 | Piping | 50 | 44 |
| 46 | Partition | 70 | 61 | 20 | Elevator | 30 | 26 |
| 46 | Joinery | 70 | 61 | 7 | Paint | 10 | 9 |

The life of the combination is, therefore, relative to that of the most durable part, in proportion to the share of the total borne by each portion, or, from the monetary point of view, to their share in the cost.

LIFE OF THE MOST DURABLE PART

| | |
|---|---|
| In the cheapest frame construction . . . . | 40 to 50 years |
| In good frame construction . . . . . . . . | 45 to 55 " |
| In brick-stone-wood construction . . . . . | 55 to 66 " |
| In steel-brick-terra-cotta or stone compound constructions . . . . . . . . . . . . | 66 to 75 " |
| In reinforced concrete . . . . . . . . . . | 75 to 90 " |
| In most massive forms of a single material . . | 90 to 100 " |

The life of the less durable materials which are to be combined with the foregoing becomes related thereto, and may be assigned proportionate terms of existence, such as those which appear in Table B.

The foregoing limitations, varying with complexity or simplicity of the construction, may be modified to meet individual experiences or special or local conditions, but the shifting of one or other element higher or lower in the scale will not affect the principle of application, so long as too lengthy periods are not adopted for the most durable parts.

By applying to the cost or quantity of each element in the building its relative life, and taking the average or mean of the whole, a period is found upon which to base the expectancy of loss of entire value. The ratio which each element bears to the whole is most readily expressed in its monetary value, as the quantities do not relate to one another in any common terms except that of money. The method followed is illustrated by the following tabulation of the component parts and respective values of a steel-frame office building.

Fig. 11

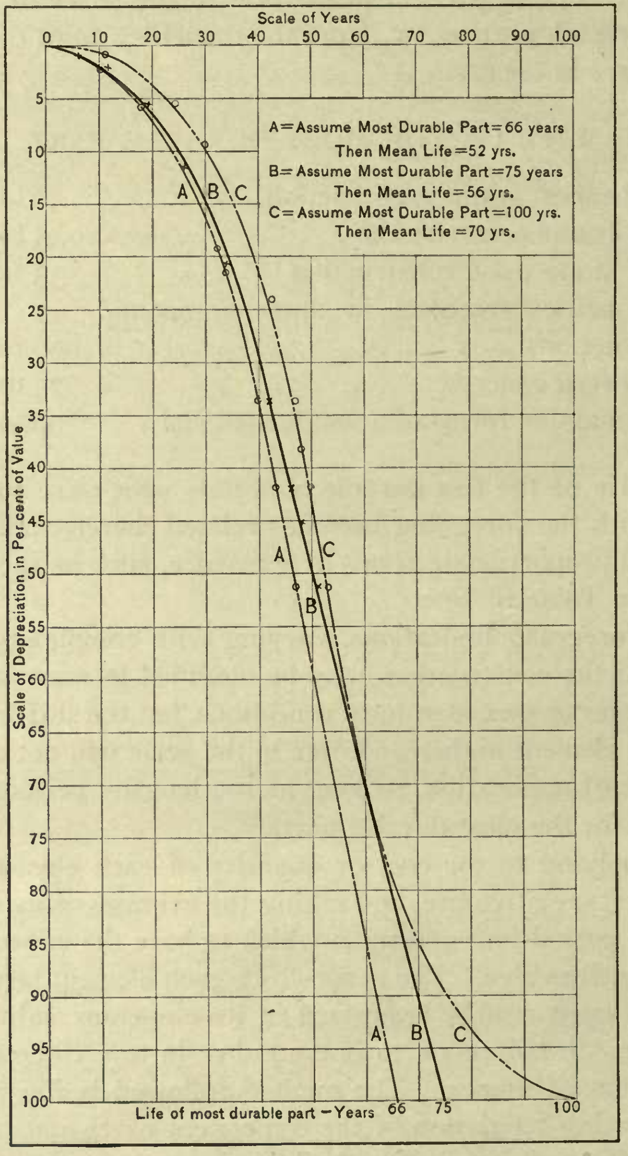

Scale of Years
0 10 20 30 40 50 60 70 80 90 100
A=Assume Most Durable Part=66 years
Then Mean Life=52 yrs.
B=Assume Most Durable Part=75 years
Then Mean Life=56 yrs.
C=Assume Most Durable Part=100 yrs.
Then Mean Life=70 yrs.
Scale of Depreciation in Per cent of Value
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
A B C
Life of most durable part—Years 66 75 100

TABLE C

METHOD OF ASCERTAINING MEAN LIFE OF A BUILDING

Example of a steel-frame fireproof office building

| Material | $l$ Life rel. to 66 yrs. | $c$ Cost rel. to total cost of bldg. | $l \times c$ |
|---|---|---|---|
| Foundations | 100% | 5.3% | 530.0 |
| Steel framing | 100 | 7.6 | 760.0 |
| Masonry | 100 | 33.7 | 3370.0 |
| Fireproof floors | 100 | 2.0 | 200.0 |
| Ornamental iron | 73 | 6.3 | 459.9 |
| Heating | 50 | 3.3 | 165.0 |
| Plumbing | 50 | 1.5 | 75.0 |
| Electric wiring | 50 | 2.0 | 100.0 |
| Partitions | 70 | 1.2 | 84.0 |
| Joinery | 70 | 3.4 | 238.0 |
| Fixtures (plumbing) | 29 | 12.6 | 365.4 |
| Roofing (tile) | 59 | 2.0 | 118.0 |
| Plastering | 54 | 3.8 | 205.2 |
| Marble | 54 | 9.6 | 518.4 |
| Elevator | 30 | 3.1 | 93.0 |
| Hardware | 37 | 0.5 | 18.5 |
| Glass | 14 | 1.3 | 18.2 |
| Paint | 10 | 0.8 | 8.0 |
| Totals | ... | 100 | 7327.6 |

Mean, $\frac{7327.6}{100} = 73.276\%$ of 66 years, or a mean life of 48.36 yrs.

It may be observed that such items as supervision, plans, fees, and carrying charges during construction should be spread over the other items, as each derives a proportionate benefit therefrom.

Relative costs are not difficult to procure from those experienced in constructive work, and it would be well if in every building operation such a record was made.

In Fig. 12 the curve *A* is a brick railroad roundhouse and *C* a modern brick and metal factory, with which is repeated the curve *B* of the average of 36 brick buildings from Fig. 10, plotted, for comparison. Relating all to a life of 66 years of the most durable parts, they give respectively: *A* 48 years, *B* 44 years, and *C* 53 years mean life.

The foregoing instances afford a view of the application of the method of apportionment to quite a variety of structures, and cover relative construction costs under very differing local conditions. In all, the process of depreciation is relatively slow during the first part of the existence of the building, but is greatly accelerated during the latter part, indicating its progressive character. Table E gives the rate of annual sinking-funds for any term of years from 10 to 60, at rates of compound interest from 2½ to 6%.

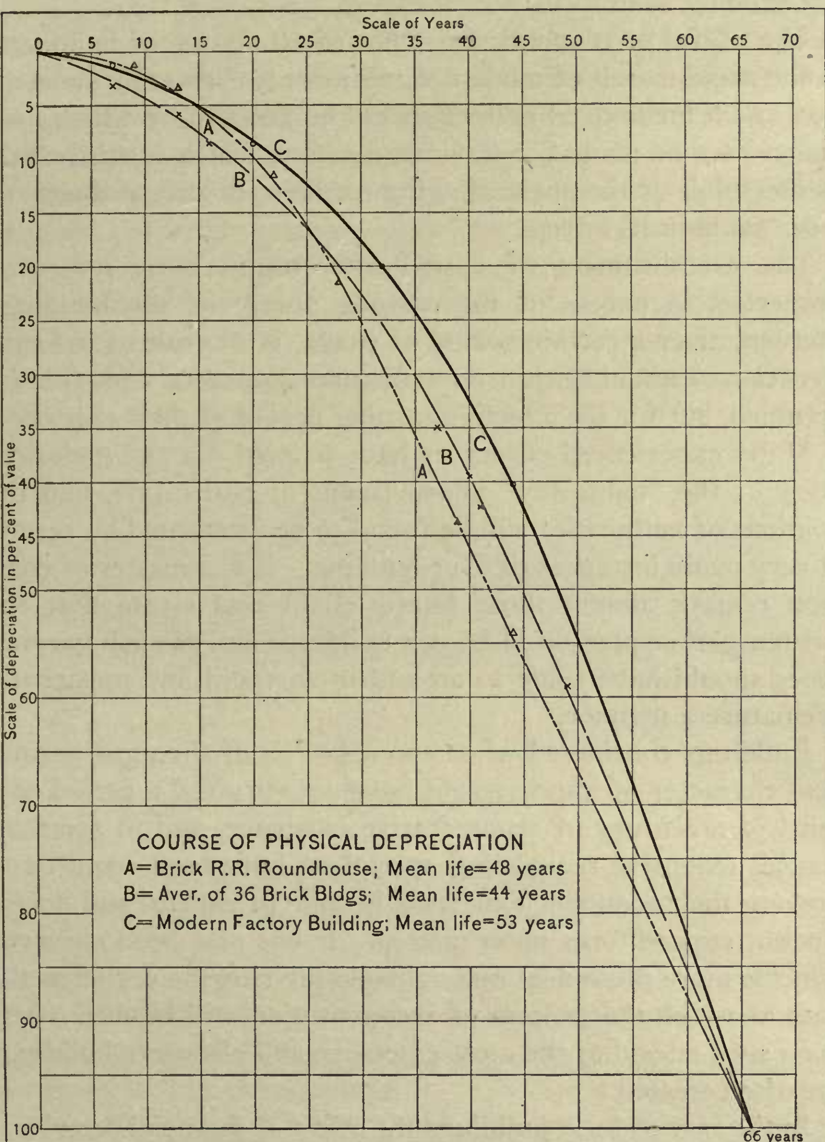
## II. THE ECONOMIC LIFE OF BUILDINGS

We now proceed to examine the second part of this subject, financial or economic depreciation, the term of which must naturally fall within that of physical deterioration.

Some uncertainty due to this cause attends the permanency of the investment of money in real estate, notwithstanding the vast appreciation in value of land in certain cities, especially in New York, which is a natural inducement for the purchase of real property. The prospective investor is frequently led to think that the future appreciation of the land will recompense him for any over-valuation of improved property at the time of the purchase, or for depreciation of the building thereafter.

This is not always the case as has been shown, and therefore consideration should be given to underlying causes which tend to reduce the earning capacity of the buildings which form the improvement, rather than to depend upon an indeterminate

FIG. 12


Scale of Years
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
Scale of depreciation in per cent of value
5 10 15 20 25 30 35 40 45 50 60 70 80 90 100
A
B
C
66 years
COURSE OF PHYSICAL DEPRECIATION
A= Brick R.R. Roundhouse; Mean life=48 years
B= Aver. of 36 Brick Bldgs; Mean life=44 years
C= Modern Factory Building; Mean life=53 years

appreciation of the land value to cover any loss in the value of the building or in its earnings.

The useful or economic existence of all classes of buildings, in the rapid march of modern conditions, is constantly shortening, and a methodical system should be adopted by which provision may be made for this contingency, which is apparently as inevitable as the physical aging of the structure, and may be more rapid in its effects.

The establishment of vested interests in some improved properties in excess of the earning ability of the buildings thereon, after a certain period of usage, is a result of the construction of unduly expensive structures, not merely for the site occupied, but for the effective earning period of their existence.

Many experienced observers have pointed out the undesirability of the "top-heavy" improvement of real estate, and the opinions of authorities will be found to be warranted by results in very many instances of over-building. It is a matter of common remark among those interested in real estate that the existence of so many well-known buildings and of such varying types should have come to an end in so rapid and apparently premature a manner.

Buildings considered when erected to be of the most permanent character of improvement have not survived a period of a third of a century of remunerative existence, and in some instances extensive remodeling operations have been required to prolong their economic existence, in spite of careful and liberal current expenditures upon upkeep. It has also been observed that the more prominent and valuable the site, the earlier is the date at which the process of reconstitution will be due. It is upon such sites that the most extensive and elaborate buildings are often erected.

In the case of hotel buildings the effect of financial deterioration is most quickly apparent, and it is the expressed opinion of one of the most able and successful of metropolitan hotel proprietors that the efficient profit-earning period of a hotel dependent upon fashion for its support does not greatly exceed fifteen years. Some hotel buildings have, it is true, existed for about a third of a century, but their earning capacity has been gradually declining, and more than one instance of a one-time "fashionable hotel" could be cited which after little more than a decade and a half has been productive only of increasing expenses in face of reducing returns.

A rather definite illustration of this subject is afforded in the recent sale of a 12-story hotel of about twelve years of age on a West Side street near a fashionable avenue in Manhattan.

| | |
|---|---|
| This building, on a plot 60 feet × 99 feet, is of about 700,000 cubic feet contents and originally cost about 36 cents a cubic foot, or . . . . . | $250,000 |
| The building and land were mortgaged at 5% for | $360,000 |
| and a recently appraised value of both was . . | $540,000 |
| The sale, however, brought only . . . . . . | $440,000 |
| The site has an assessed value for taxation of about 60%, or . . . . . . . . . . . . . | $188,000 |
| So that its market value if it were unencumbered by a building might be . . . . . . . . . . | $313,000 |
| The value brought by the building was therefore only . . . . . . . . . . . . . . . | $127,000 |

which is about 18.2 cents per cubic foot, or 50% less than the original outlay in the short period of its existence.

If this loss on the building be assumed to have been made up by the increment of land value, then the latter must have risen in twelve years from $190,000 to $313,000, or about 65%, but even if so, there has been no profit in the whole transaction.

The process of deterioration existing in business buildings is somewhat less rapid, but equally inevitable. It is varied only by certain instances where peculiar location and surroundings outweigh the attractions of newer buildings and localities and serve to maintain or even to increase the rentals. But the insistence of modern business life demands, sooner or later, extensive and expensive remodeling or partial reconstruction, for which in most instances no preparation or provision has been made, and which is therefore frequently postponed to the growing disadvantage of the investment. Mere huge proportions or expensive construction cannot be relied upon to bar the need for remodeling in the future, any more than similar conditions have done in the past, as in the instance of the first steel-frame building, which has barely lasted long enough to become interesting ere it is likely to be condemned; while radical changes have been made recently in some comparatively modern steel-frame structures.

The Gillender Building, fourteen years in existence, furnished evidence of the indestructibility of the steel skeleton when its members are protected in a sufficient manner. But in these days the durability of building materials has mostly been dropped from the list of controversial questions in metropolitan work. For in practice it is found that the physical is almost certain to exceed the economic durability of a building as a whole.

Over-expense in original construction, ill proportion for the value of the site, unsuitability for situation, and maldesign are fundamental causes which hasten the progress of financial decay.

But other causes for which the designers of the building are not directly responsible, but by which the property is nevertheless a sufferer, may equally inevitably bring about a period to the useful existence of a building. A change of fashion, shift of business, movement of population, alteration in line of traffic, or even some untoward local occurrence or change in nature of ownership, which injures the character of its neighborhood, may leave the building a financial log upon its site, an economic failure, and an obstruction on the real estate, proportionate to its size and original expense.

Even its construction as one of a large number of similar buildings may contribute to bring about such a result, since sections of cities built up with great uniformity usually drift into a lower class of occupancy and reduced rentals.

Or, inversely, if built too elaborately for its associations, it will gradually settle to their level, as an expensive residence does when placed among cheaper neighboring buildings. A fine old mansion will generally bring less rental than a cheaper but more modern cottage as soon as its appropriate surroundings are changed.

The march of alteration, often miscalled "improvement," is inexorable in modern cities, and their past history shows a process of reconstruction occurring about three times in a century, a natural result of progressive growth of population and relative increase in demand for accommodation in restricted and central locations, bringing about a limitation of the useful or economic existence of buildings of various classes; a condition only to be partially remedied by the expenditure of new capital in reconstruction or remodeling whereby the efficiency of the building may be somewhat renewed and its effective existence extended.

If such contingencies were taken into account at the time of the construction of buildings, it is probable that many extravagant unnecessary expenditures would be avoided, and only such expense incurred as would be justified by estimates conservatively based upon gradually decreasing returns derived from such expense. The risks involved and the burden undertaken in the enormously expensive exterior and interior decorations, the equipments and the conveniences of certain buildings, may perhaps appear justifiable in view of the present attractiveness of such details, but they should properly show a commensurate return in the rentals, not only at first, but after years of existence and competition, and, more conservatively, they should be covered by an annual investment, laid aside from their earnings, proportioned to their limited life of usefulness.

It is true that some buildings have lingered long, so long, in fact, that in some cases the tide of land values has passed over them and they have become stagnated. Instances will be recalled of antiquated or inadequate buildings which have waited long for the turn of the tide, and in the meantime have not earned a justifiable interest upon any increase in the value of their sites. These are instances of failure to effect reasonable improvements in due time and in manner adequate to existing conditions.

Alterations and disuse of residential buildings are often rapid, and are due chiefly to their changed local surroundings. In many cases the expenditures upon such structures were moderate, and the increase of the value of the site has outbalanced the loss on the building.

But in the case of the tenement, flat, and apartment-houses, the interests of a very wide-spread class of small investors are affected by a decrease in earning capacity and in capital value which may be brought about by competition, by change, and by age.

It is too early as yet to observe these effects upon the higher class of apartment-house, apartment-hotel, or residential hotel, but in the case of an enormous number of 5-story tenements or flats which preceded the advent of the elevator apartment building, some such results may be readily observed.

Large sections of the borough of Manhattan, for instance, are covered with such properties, and these are affected in capi-


"Over-expense in original construction, ill proportioned for the value of the site, is a fundamental cause of financial decay"

tal values not only by periodic variations in rentals, due to the fluctuations of supply and demand, reducing their average returns, but by permanent reductions due to the competition of more alluring conveniences in other buildings and localities.

Such buildings cannot be regarded as instances of over-building in the sense of disproportion, but are instances of over-building of a single type and perhaps still more of the practice of building without regard to possible future developments. In very few cases was provision made for the contingency of future additions. In many a 5-story tenement the addition of an extra four inches on the second-story walls would have enabled the later owner to add another story to the building, thereby substantially increasing its earnings, but as this provision was not made, a falling off in value cannot be arrested.

The planning of a building is not really complete unless it takes into account some such possible future contingency. There are many tenements which could have been readily improved by their alteration into stores or lofts, but their flimsy original construction will not permit of this course without practical destruction of the original structure. Recent instances of such changes indicate that the fate of much of the older tenement or apartment-house property may be an entire alteration of character, such as the following out of many recently recorded:

(1) $30,000 worth of alterations, changing an apartment-house at Broadway and 54th Street for loft purposes.

(2) Four 4-story flats on lots 20 feet × 102.2 feet each. They will at once be changed into modern English-basement residences.

(3) 5-story tenement reduced to 2 stories, the entire front removed and rebuilt as a store and offices above.

All properties are usually appraised with some recognition of the probability of fluctuating rental returns, and, as these bring about a probable limit to their earning life, some portion of the gross rentals should be set aside at compound interest to provide for the gradual reduction of the value of the building and the eventual necessity for its remodeling or reconstruction.

If this practice be followed, as is no doubt done by conservative investors, the scale of estimated capital values of improved property would be related to the returns reduced by the depreciation fund, and perhaps the fund would form part of the negotiable property. Where it is not done, there is liable to be an eventual disappointment in the results of the investment. There would seem to be immense opportunities for insuring corporations in the establishment of such funds or their equivalent.

As buildings are not only a part of real estate investment which is subject to elements of financial deterioration, but are liable to not wholly predictable changes of circumstances, such anticipations should not be ignored in their planning, and provision for both forms of contingency would be to the general advantage of real estate from the investor's point of view. And since this is the case, it is of vital importance that no undue extent of capital should be embarked in the construction.

Some difficulty has been expressed by investors with whom the foregoing matter has been discussed, in deciding upon the period which should be allotted to the existence of their buildings, due to the causes herein discussed, apart from the question of physical decay or deterioration.

Such a period may naturally be the subject of very close investigation and of expert opinion in any given instance, yet as such study and views must depend largely on personal observations of results in other structures, some general consideration such as herein given may be of value.

Taking observed effects of the past third of a century in Manhattan as a guide—and it may be noted that we have only such past experiences to aid us in our estimation of future probabilities—it seems that the progressive deterioration of the earning capacity of buildings is the result of the influence of fashion, change of habit, competition, development of new territory and shifting of the centers of population and business, altering of lines of transit, and other causes, all of which act in the same direction of deterioration. but in different degrees in the various classes of buildings.

Any interested observer can place alongside a scale of years the instances which have come under personal observation, by which Table D may be confirmed or modified.

It may be reasonably assumed that any graduated arrangement ranging from the ephemeral "taxpayer" to the "monumental" institution will not extend beyond approximately half a century of effective earning life.

It must be remembered that Table D is not a tabulation of mere existence, which might be as prolonged as that of the pyramids, but which would have little effect upon prolonging effective income-producing existence, which can only be increased by changes, remodeling, or reconstruction.

A comparison of the periods thus allotted to the effective existence of various classes of buildings, with those derived from the study of their physical life, brings out the feature that the effective or economic life thus suggested, even when extended or renewed by the remodeling as indicated, falls within the period of and is substantially shorter than the limit of physical existence, which indicates that the assumptions regarding the former are based on reasonable conclusions.

The economic value of many buildings is dependent to a considerable extent upon the maintenance of its character or purpose, by effective service, and by careful maintenance and repair. Good results in these directions to a certain extent offset the competition of modern improvements, or postpone the necessity for remodeling or reconstruction.

TABLE D

ECONOMIC EXISTENCE OF BUILDINGS

| Type of building | Life in years |
|---|---|
| "Taxpayer" . . . . . . . . . . . . . . . . . | 12–15 |
| Hotels . . . . . . . . . . . . . . . . . . . | 15–18 |
| Apartment-houses . . . . . . . . . . . . . . | 18–21 |
| Store buildings . . . . . . . . . . . . . . . | 21–25 |
| Tenements and flats . . . . . . . . . . . . . | 25–27 |
| Office and business buildings . . . . . . . . . . | 27–33 |
| Lofts and factories . . . . . . . . . . . . . | 33–37 |
| Residences . . . . . . . . . . . . . . . . . | 37–44 |
| Banks and institutions . . . . . . . . . . . . | 44–50 |

From this observation it may be gathered that the conservative course is to adopt the shorter period on which to base the fund for the amortization of the original cost of the building.

The whole matter may be summarized by stating that the course of physical depreciation or deterioration of buildings follows character of construction, and is the average of the relative life of the various component parts of a building. This life presupposes reasonable care and repair and partial replacement in detail during the period of existence, or what is known as "upkeep." Economic depreciation or deterioration may bring about, and generally does so under city conditions, a shorter period to the existence of the building, even with a substantial reconstruction during that economic existence.

The result of remodeling or partial reconstruction is to renew to a certain extent, at the time of its undertaking, the effective earning capacity of a building; but inasmuch as the practical effect is seldom more than a compromise, the result cannot be considered wholly effective or equally as permanent as the original outlay. The previous process of economic deteriora-

| Rate of Interest | YEARS OF EXISTENCE | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 6 | 7.58 | 6.68 | 5.9 | 5.29 | 4.75 | 4.29 | 3.89 | 3.54 | 3.23 | 2.96 | 2.71 | 2.5 | 2.3 | 2.12 | 1.96 | 1.82 | 1.69 | 1.57 | 1.45 | 1.35 | 1.26 |
| 5 | 7.95 | 7.0 | 6.28 | 5.64 | 5.1 | 4.63 | 4.22 | 3.86 | 3.55 | 3.27 | 3.02 | 2.8 | 2.6 | 2.41 | 2.24 | 2.09 | 1.95 | 1.82 | 1.71 | 1.6 | 1.5 |
| 4½ | 8.1 | 7.2 | 6.4 | 5.8 | 5.28 | 4.8 | 4.4 | 4.0 | 3.7 | 3.44 | 3.18 | 2.96 | 2.75 | 2.56 | 2.39 | 2.24 | 2.1 | 1.97 | 1.85 | 1.74 | 1.64 |
| 4 | 8.33 | 7.41 | 6.65 | 6.0 | 5.46 | 4.99 | 4.58 | 4.22 | 3.9 | 3.61 | 3.35 | 3.12 | 2.92 | 2.73 | 2.55 | 2.4 | 2.25 | 2.12 | 2.0 | 1.88 | 1.78 |
| 3 | 8.7 | 7.8 | 7.0 | 6.4 | 5.85 | 5.37 | 4.96 | 4.59 | 4.27 | 3.98 | 3.72 | 3.48 | 3.27 | 3.08 | 2.9 | 2.74 | 2.59 | 2.45 | 2.32 | 2.21 | 2.1 |
| 2½ | 8.9 | 8.0 | 7.24 | 6.6 | 6.05 | 5.57 | 5.16 | 4.79 | 4.46 | 4.17 | 3.91 | 3.67 | 3.46 | 3.27 | 3.09 | 2.92 | 2.77 | 2.63 | 2.5 | 2.39 | 2.27 |

| Rate of Interest | YEARS OF EXISTENCE | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 60 |
| 6 | 1.18 | 1.1 | 1.0 | 0.95 | 0.89 | 0.84 | 0.78 | 0.73 | 0.69 | 0.64 | 0.6 | 0.56 | 0.53 | 0.5 | 0.47 | 0.44 | 0.41 | 0.39 | 0.36 | 0.34 | 0.18 |
| 5 | 1.41 | 1.32 | 1.25 | 1.17 | 1.1 | 1.04 | 0.98 | 0.92 | 0.87 | 0.82 | 0.78 | 0.74 | 0.7 | 0.66 | 0.62 | 0.59 | 0.56 | 0.53 | 0.5 | 0.47 | 0.28 |
| 4½ | 1.54 | 1.45 | 1.37 | 1.29 | 1.22 | 1.16 | 1.09 | 1.04 | 0.98 | 0.93 | 0.88 | 0.84 | 0.79 | 0.75 | 0.72 | 0.68 | 0.65 | 0.61 | 0.58 | 0.56 | 0.34 |
| 4 | 1.68 | 1.59 | 1.51 | 1.43 | 1.35 | 1.28 | 1.22 | 1.16 | 1.1 | 1.05 | 1.0 | 0.95 | 0.9 | 0.86 | 0.82 | 0.78 | 0.75 | 0.71 | 0.68 | 0.65 | 0.42 |
| 3 | 1.99 | 1.9 | 1.81 | 1.73 | 1.65 | 1.58 | 1.51 | 1.44 | 1.38 | 1.32 | 1.27 | 1.22 | 1.17 | 1.12 | 1.07 | 1.03 | 0.99 | 0.95 | 0.92 | 0.88 | 0.61 |
| 2½ | 2.17 | 2.07 | 1.98 | 1.9 | 1.82 | 1.74 | 1.67 | 1.6 | 1.54 | 1.48 | 1.42 | 1.37 | 1.32 | 1.27 | 1.22 | 1.18 | 1.14 | 1.1 | 1.06 | 1.02 | 0.73 |

TABLE E

PERCENTAGE OF ORIGINAL VALUE TO BE INVESTED ANNUALLY

to bring back total at end of various terms tion sets in at a new rate, and the net result is a prolongation for a period less than the original term.

The rates for amortization which should apply to provision of depreciation funds either for economic or physical deterioration are tabulated in Table E, in the form of a percentage on original value to be annually set aside, at various rates of compound interest.

Since the rates at which the process of compounding can be followed with the least amount of care are those obtainable in savings-banks, the scale has been carried as low as 2½%, but there will be cases where the sum annually set aside for depreciation may be reinvested in the business of the investor, and may therefore be capable of bringing in a higher annual return.

The conservative course to be pursued is naturally the actual physical setting aside of money for a depreciation fund in some definite investment, and the effects of neglect of this practice may be seen in buildings in which remodeling is overdue or reconstruction is unduly postponed for lack of funds, and in others where the increase in value of the land has failed to offset the loss in the building.

"An almost confusing variety of structures"

# V

## DEPRECIATION OF MECHANICAL EQUIPMENTS AND POWER PLANTS

### I. PHYSICAL DETERIORATION

THE depreciation of engineering equipment and appliances appears to follow equally well the same general principles as apply to other elements in building construction, but in a markedly increased ratio.

Where its costs bear any large relation to the total cost of a building, the inclusion of an elaborate system of piping, and especially of machinery, adversely affects and reduces the *total life* of the combined structure, a fact to which very little observation has heretofore been directed. The effects of the interrelation of metallic apparatus with other parts of the structure are generally similar to those already discussed, but are increased by the more perishable class of the materials employed, by their more active character, and by the mechanical movements, and the thermal, electrical, and chemical effects, which they introduce into the structure.

It therefore follows that their character not only affects the general average of their own existence, but detracts appreciably from that of the building.

Throughout modern structures, miles of buried piping lie beneath other materials, which would have to be destroyed if it should at some period be necessary to renew or replace the piping, and thus these materials are affected and their life limited by the piping they conceal.

Decorative features, including trim of all kinds, are affected by what supports them, and thereby affect the permanency of the support. Tile, terrazza, and cement floor surfaces, which have little or no expansive capacity, are laid on steel-framed supports, which are capable of expansion. One portion of a modern building may be overheated by flues, by pipes or radiators, while another part is cold.

After a building is completed, the framing is heated to 70°, while the exterior may be zero. The interior, therefore, may rise, and expand sidewise, while the exterior is contracting in both directions, by which process the building face is minutely cracked, either in the joints or in the material.

In mechanical appliances a new feature has been imported into buildings which, bearing no inconsiderable relation to the total cost, is of fragile, impermanent character. We do not know the length of life of some of the parts of the equipment of buildings, but we are aware of the fact that much of it is subject to conditions tending toward a perishable character, due to the very services it performs. Sanitary equipment has immensely increased in extent and expense, yet less than a quarter of a century has brought about radical changes in methods, and has demonstrated the perishability of some materials, which were at one time thought to be of the very highest type of permanency.

Mechanical equipments may be considered in two parts—fixed and motive. Fixed equipments are largely in the form of piping, for a variety of services of more or less importance, affording the means of usage of electrical, steam, sanitary, water, gas, air, and vacuum appliances. Most such systems are liable to become superannuated at an early period, being subject to the course of progressive invention and improvement, requiring their modification or alteration in order to secure efficient results. Such changes are, however, very difficult of attainment, involving serious expenditures and disturbance of the structure, not only on account of the amount. but of the general inaccessibility of piping.

The ramifications of such systems may be illustrated by those installed by the writer in a large apartment-hotel, the extent of which is, in miles, as follows:—

| | | | |
|---|---|---|---|
| Sanitary | 15.81 | Refrigeration | 3.35 |
| Water | 44.01 | Pneumatic | 1.07 |
| Fire | 2.11 | Electric | 39.28 |
| Gas | 37.30 | Bells | 5.43 |
| Elevators | 1.99 | Flues and ducts | 4.61 |
| Steam | 18.56 | Total miles | 173.57 |

Even one of the minor elements, if disturbed, would affect a considerable portion of the building materials.

Motive appliances are also quite extensively installed in modern buildings, and comprise elevators and engines, ventilating-fans and motors, refrigerating, pumping, and electrical generating machinery. The life of such apparatus is affected largely by the rapidity of its operation, the shocks or variable loads to which it is applied, and also to some extent by the suitability of its proportions to the work to be performed by it.

The greater the effort which is made to secure economy in operation, the greater will be the complexity of appliances; and the trend has been toward a multiplication of engineering apparatus in buildings. These introduce into the structure new features tending toward physical deterioration, by vibration, strain, and temperature. In electrical apparatus, not only have materials, frail in themselves, been introduced, but a new element aiding the processes of decay has been developed in electrolysis. Apparatus such as the elevator, imposes new and irregular strains on the structure, and power machinery intro-

Table F

# PHYSICAL EXISTENCE OF MECHANICAL APPARATUS

Life of most durable part, 40 years

| I. FIXED EQUIPMENT | Years | Per cent. |
|---|---|---|
| Most durable elements—steel construction, foundations, elevator guides, and overhead framing | 40 | 100.0 |
| Exterior framing, copper-cased housings, etc., heating pipe systems used part of the year, gas piping | 33 | 82.5 |
| Buried vents and ducts when painted | 32 | 80.0 |
| Steel-plate stacks and smoke-ducts, cold-water piping, electric conduits | 30 | 75.0 |
| Heating-boilers used part of year | 28 | 70.0 |
| Roof-tanks, sanitary piping systems | 27 | 67.5 |
| Pressure steam piping and appliances | 26 | 65.0 |
| Interior drums and tanks, hot-water and pneumatic piping | 25 | 62.5 |
| Exposed and unpainted vents and ducts | 24 | 60.0 |
| Highest-class pressure steam-boilers | 22 | 55.0 |
| Sanitary fixtures, refrigerating piping, kitchen fixtures, and valves | 20 | 50.0 |
| Drip and drain piping, cheaper class of pressure steam-boilers | 18 | 45.0 |
| Electric switches, wiring, and connections | 15 | 37.5 |
| Exhaust heads, exposed galvanized ironwork, hot-water drums | 12 | 30.0 |

| II. MOTIVE APPLIANCES | Years | Per cent. |
|---|---|---|
| Slowest-speed apparatus, apparatus intermittently used | 24 | 60.0 |
| Dumb-waiters, switchboards, elevator gates, slow-speed elevator engines, shafting and bearings, slow-geared apparatus, elevators intermittently used | 22 | 55.0 |
| Motor-driven pumps, compressors, and moderate-speed fans | 20 | 50.0 |
| Slow-speed reciprocating apparatus, such as pumps, elevator reversing gear, platform lifts | 17 | 42.5 |
| Elevators in regular use, laundry, kitchen, refrigerating, electric devices, and other apparatus frequently reversed | 16 | 40.0 |
| Moderate-speed reciprocating engines, medium-speed rotary apparatus, dynamos and motors | 15 | 37.5 |
| Fan engines, high-speed rotary apparatus on large variations of loads, dynamos, motors, high-pressure engines, condensers | 12 | 30.0 |
| High-speed, high-pressure, reciprocating engines and machines on extreme variable loads | 10 | 25.0 |

duces vibrations, while boiler plants and flues increase the effects of expansion and contraction.

These and many other considerations all point to the necessity for equal conservatism in assuming a life for those less durable features which affect the life of the more durable elements.

Proceeding along such lines, we may reasonably conclude that the life to be assigned to the mechanical appliances in buildings may be classified as shown in Table F.

The mechanical elements in a building may be related to the life of the building materials, and their depreciation combined therewith; but as the life of mechanical apparatus is relatively shorter, it would appear to be the best course to work out its rate of depreciation independently, and assign a special fund to cover it.

The fixed and motive equipments of a large apartment building bear relations which are plotted on Fig. 13, and very interestingly indicate the same general form in the resulting curve as in the case of building materials.

Of the total cost, the fixed equipment was 60% and the motive apparatus was 40% of the cost of the whole equipment.

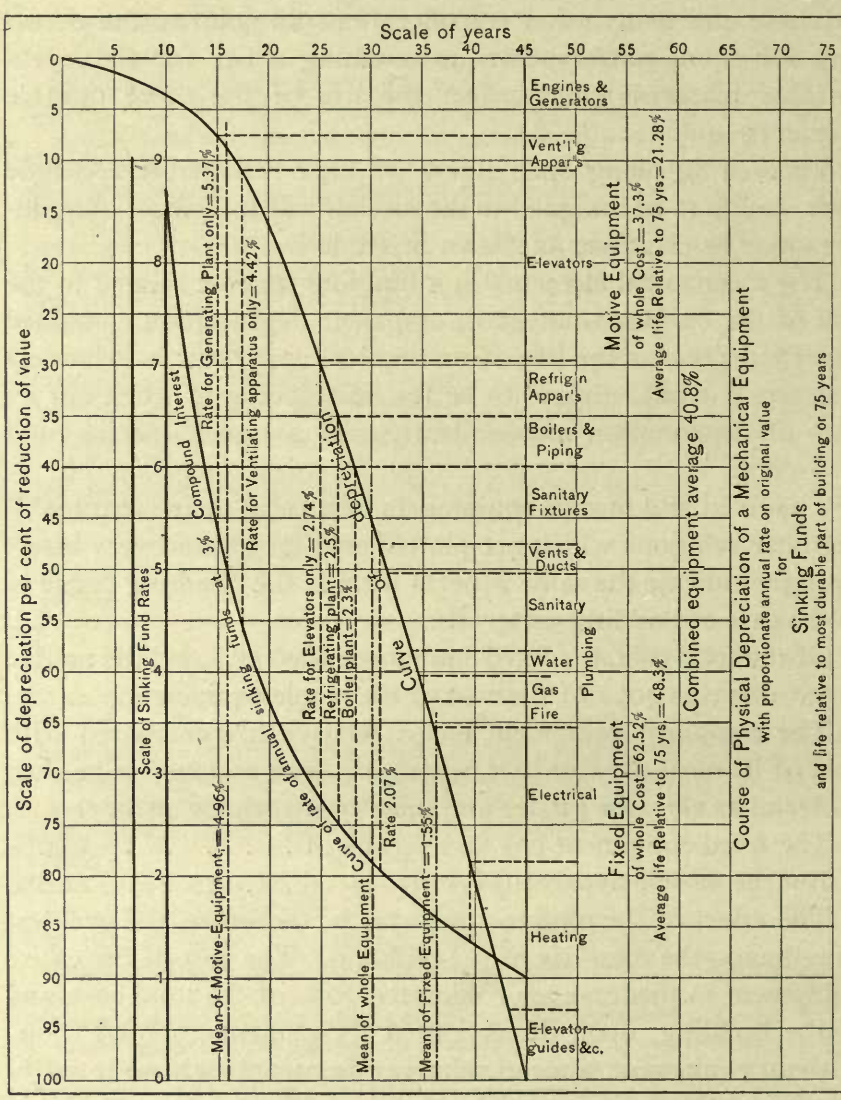
The combined equipment has a relative life compared with that of its most durable part, which has been assumed to be such material as elevator guides and fixed ironwork, of 40%.

The fixed equipment has an average of . . . . . 52.0%

But the motive apparatus is only . . . . . . . . 21.8%

The effect of the motive apparatus is, therefore, the greatest in reducing the total life of the building. The cost of the entire equipment in this case approximated 20% of the total cost, and if the building, upon dissection of its elements, should show, without equipment, a mean relative life of 77%, then the introduction of the equipment reduces the combination to 70%, or, in other words, the building alone would have a mean life of 57¾

FIG. 13


Scale of years
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
Scale of depreciation per cent of reduction of value
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Scale of Sinking Fund Rates
9 8 7 6 5 4 3 2 1 0
Curve of annual sinking funds at 3% Compound Interest
Curve of depreciation
Rate for Generating Plant only=5.37%
Rate for Ventilating apparatus only=4.42%
Rate for Elevators only=2.74%
Refrigerating plant=2.5%
Boiler plant=2.3%
Rate 2.07%
Mean of Motive Equipment=4.96%
Mean of whole Equipment
Mean of Fixed Equipment=1.55%
Engines & Generators
Vent'l'g Appar's
Elevators
Refrig'n Appar's
Boilers & Piping
Sanitary Fixtures
Vents & Ducts
Sanitary
Water
Gas
Fire
Plumbing
Electrical
Heating
Elevator guides &c.
Motive Equipment
of whole Cost=37.3%
Average life Relative to 75 yrs=21.28%
Fixed Equipment
of whole Cost=62.52%
Average life Relative to 75 yrs=48.3%
Combined equipment average 40.8%
Course of Physical Depreciation of a Mechanical Equipment
with proportionate annual rate on original value
for
Sinking Funds
and life relative to most durable part of building or 75 years

years; but this would be reduced by the effect of the equipment to 52½ years, involving on each one million dollars of total invested value an annual addition to the necessary sinking-fund for depreciation of about $7500 a year.

In an office building where no power plant is installed, but elevators and heating-boilers are included, we find that the relative life of this equipment is . . . . . . . . . . 45.7%
The building without the equipment is . . . . . . . 77.0%
and the effect of the equipment is to reduce this to . . 74.7%

In a dry-goods building the investment in the equipment and in a power plant was:

For the fixed equipment, elevators, sprinklers, and boilers for heating . . . . 20% of the cost of the building
For the motive apparatus, or generating plant . . . . . . . 6% of the cost of the building
The relative life of building alone being . . . . . 77.00%
The relative life of fixed equipment is . . . . . . 52.00%
Thus the building and fixed equipment average . . 73.00%
The relative life of the motive plant is, however, only 18.00%
Reducing the average relative life of all to . . . . 70.25%
and reducing the mean life of the whole by about . 9.00%
and increasing the proportionate sinking-fund by about . . . . . . . . . . . . . . . . 20.00%

The introduction of delicate and short-lived machinery into buildings, therefore, affects not only the proportion of funds for its own replacement, but that covering the duration of life of the entire structure.

## II. ECONOMIC DETERIORATION OF EQUIPMENT IN BUILDINGS

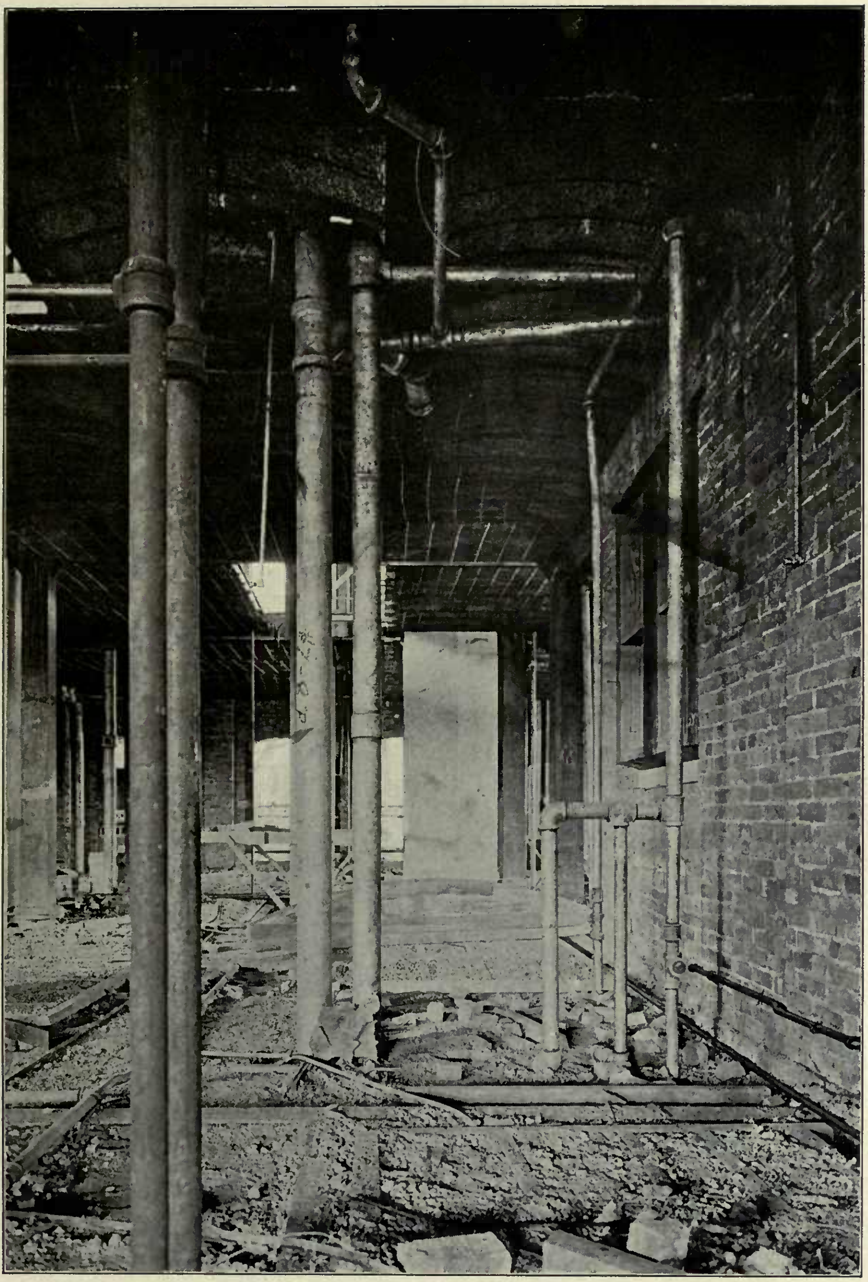
The economic as well as the physical depreciation of buildings involves the deterioration of their equipments or mechanical appliances, which to-day form no small part of their first cost, and constitute some of the largest items of expenditure in their operation.

The effect is felt in fixed apparatus and in motive appliances, but the latter are subject to more rapid effects. With regard to this part of modern buildings, a personal occupation during a third of a century has afforded the means of observation of the progress of economic deterioration in both classes of apparatus. While physical deterioration of equipments has usually received consideration, the subject of depreciation in economic value has received less attention, with unsatisfactory results which have adversely affected some building investments. If no fund is regularly apportioned or laid aside for the purpose of replacement of apparatus on reaching the inefficient or uneconomic condition, the day of reconstitution or replacement is unduly delayed, and costs of operation become excessive.

Many instances of this nature could be cited and may to-day be observed; one or two must here suffice.

A large office building constructed twelve years ago was equipped with elevators of a type which at that time was advocated as of the highest known efficiency. A considerable amount over and above the cost of other then applicable forms was paid for these appliances. From the first they proved expensive in physical upkeep, and this cost has advanced with age at an increasing ratio, which is provided for by the usual methods. But the property has suffered also by their ineffective service, and is to-day operated at an increasing cost by reason of growing inefficiency of the machines. The result is that the building's renting credit has suffered, and rentals are not what its position and importance would appear to-day to justify. Had a sinking-fund been established at the time of installation, money would have been in hand toward the replacement of the apparatus with up-to-date appliances.

Since the foregoing was written electric elevators of effective and economic type were installed, affording a more efficient service. A direct increase resulted in the rentals of the building which covered the entire cost of elevator reconstruction in less than two years. The subject of adequate elevator service and the economic proportioning of elevator installations is laid down in detail in "Elevator Service."



"The vast ramification of piping buried within the construction of modern buildings"

The deterioration, both physical and economic, of fixed equipment in buildings, which largely consists of piping systems, is an element which has not come into much notice, as the multiplication of services provided by their means is of comparatively recent introduction. But it is a fact that the growth of the uses and demands for pipe systems has been accompanied by a radical reduction in their permanency, for the material of which much of the vast ramification of piping is composed, and which has been buried within the construction of modern buildings, is not of the substantial character which was at one time obtainable. As an instance may be cited the experience of one large modern hotel, in which a considerable proportion of the sanitary piping has been recently replaced under difficult and expensive conditions.

Remodeling operations in a number of buildings have afforded opportunities of similar observations.

The proportion of cost which the modern equipment bears to the total cost of a building varies with the elaborateness of each, but may be expected to involve not less than from 9 to 15% of the whole cost of the structure when unaccompanied by power machinery, and when the latter is included, to involve from 16 to 26% of the total. The economic deterioration of these appliances and apparatus is more rapid than in the case of the building they occupy, and may be greatly accelerated by maldesign or poor construction.

In allotting the periods of effective or economic existence to such equipments, the results of actual experience and observation again must be the guide, reinforced by knowledge of the extent of usage and the character of their operation.

The results of such observations are embodied in Table G, in which the arrangement of motive apparatus is in the order of rapidity of operation, a feature which has a greater effect on physical and economic deterioration than mere continuity of operation. It is needless to add to the table the effect of cheapness or poverty of construction in every class included in the list.

From the table the conclusion may be reached that the average economic life of fixed equipment is about one half the average effective life of the buildings it occupies, which agrees with many observable conditions. In other words, the fixed equipment requires reconstitution to an efficient point at least once during the effective life of a building, unless the rate of general deterioration of the whole is to be accelerated, or, otherwise stated, if the equipment be not brought "up to date" at least once during the effective life of the building, the general life of the investment is reduced.

Here again the reader must be reminded that the mere length of existence of such appliances is not the question. There are to-day in existence mechanisms which have been in operation of a certain sort for a century, a life which may by some surrounding circumstances be even further prolonged. But the *effective earning existence* of all apparatus is a different matter, and in the case of appliances installed in buildings operated for profit, the results of ineffective service may be and are much greater than mere mechanical inefficiency would represent under other conditions.

For the successful operation of high buildings the elevator forms an integral part of the building. The physical deterioration of this part of the equipment is compound, consisting of that due to the fixed portion of the construction, the hoistway—guides and beams—and that of the motive portion or engine with accompanying apparatus, such as valves, gears, wheels, bearings, drums, shafts, ropes, and motors.

An adequate number of such appliances, providing not only an ample but an easily operated service, will have a longer physical life than one in which, by a shortage of machines, the service becomes severe, involving heavy loads, frequent reversals,

TABLE G

## ECONOMIC EXISTENCE OF MECHANICAL APPARATUS

| I. FIXED EQUIPMENT | Life in years |
|---|---|
| Steel construction, foundations, elevator guides, and overhead framing | 30 |
| Exterior framing, copper-cased housings, heating pipe systems used part of the year, gas piping | 27 |
| Buried vents and ducts when painted | 26 |
| Steel-plate stacks and smoke-ducts, cold-water piping, electric conduits | 24 |
| Heating-boilers used part of year | 22 |
| Roof-tanks, sanitary piping systems | 21 |
| Pressure steam piping and appliances, interior drums and tanks, hot-water and pneumatic piping | 20 |
| Exposed and unpainted vents and ducts | 19 |
| Highest-class pressure steam-boilers | 17 |
| Sanitary fixtures, refrigerating piping, kitchen fixtures, and valves | 16 |
| Drip and drain piping, cheaper class of pressure steam-boilers | 14 |
| Electric switches, wiring, and connections | 11 |
| Exhaust heads, exposed galvanized ironwork, hot-water drums | 9 |

| II. MOTIVE APPLIANCES | |
|---|---|
| Slowest-speed apparatus, apparatus intermittently used | 20 |
| Dumb-waiters, switchboards, elevator gates, slow-speed elevator engines, shafting and bearings, slow-geared apparatus, elevators intermittently used | 18 |
| Motor-driven pumps, compressors, and moderate-speed fans | 17 |
| Slow-speed reciprocating apparatus, such as pumps, elevator reversing gear, platform lifts | 15 |
| Elevators in regular use, laundry, kitchen, refrigerating, electric devices, and other apparatus frequently reversed | 14 |
| Moderate-speed reciprocating engines, medium-speed rotary apparatus, dynamos and motors | 12 |
| Fan engines, high-speed rotary apparatus on large variations of loads, dynamos, motors, high-pressure engines, condensers | 9 |
| High-speed, high-pressure, reciprocating engines and machines on extreme variable loads | 7 |

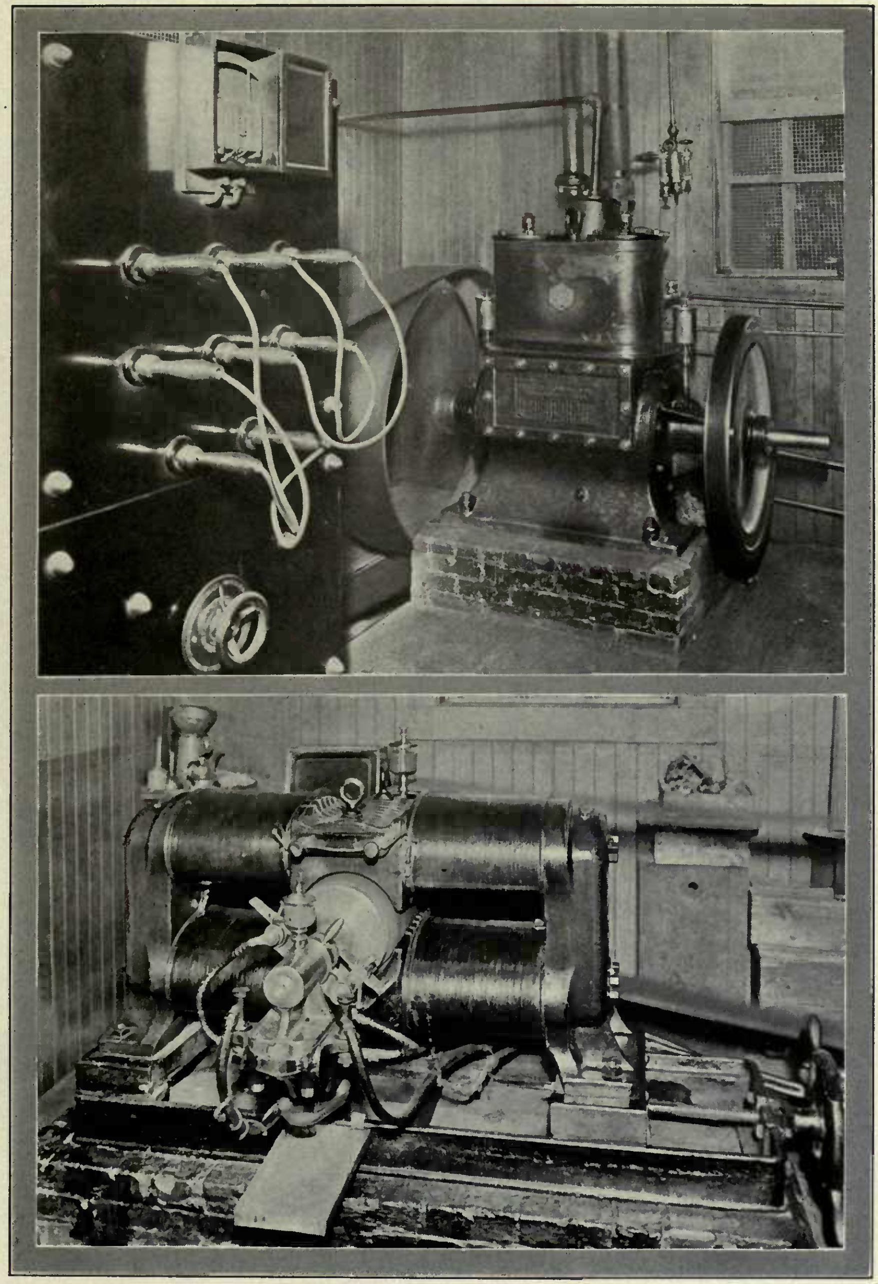
and general wear and tear. The elevator, like any other moving apparatus, requires constant care and minute supervision to maintain it in thorough serviceable order. If all the elevators in a building are in constant urgent use, there is not available time for this work of upkeep to be properly effected.

The effective life of much of the appliances is thus reduced, and its upkeep is at the same time rendered burdensome as well as a source of much anxiety to those charged with its maintenance. But apart from the foregoing, the economic side of the matter requires an ample provision of elevators in a building, inasmuch as inadequate or irregular service directly affects the rentable value of the upper floors, which are totally dependent for access, in lofty structures, upon the elevators.

The economic life of the apparatus is, moreover, affected by the march of mechanical improvement, and an elevator installation maintained in excellent condition may be properly abandoned in favor of another affording greater efficiency in service and perhaps in cost of operation. It cannot be assumed that the effective life of an elevator installation is equal to that of the building it serves, and, in fact, the evidence of past experience in this line is to the effect that this part of the motive appliances must be reconstituted at least once and perhaps twice during the period of effective life of the building.

This has been the case in a number of instances. In the building in which one of the earliest forms of hydraulic elevator was installed, the apparatus was replaced, after about seventeen years of service, by others of more modern hydraulic pattern. But it is reasonable to suppose that in another equal period, should the building's existence be so prolonged, another replacement by still better appliances will take place.

The steam-driven machines in several office buildings saw service of approximately a similar length of time, so that a period of about twenty years certainly has covered the life of



"Extending this existence by reconstruction may be of so expensive a nature and of so limited an effect, that replacement may be preferable"

such apparatus in the past, and there is no reason to anticipate a greater length of economic life in the future. On the contrary, in elevator engines, as in other lines of development, modern devices nearly always take the direction of high speed, which in itself contributes to physical deterioration. An ample number of elevators, of moderate speed and moderate size of cars, is the best form of economic investment in this important part of building equipment.

A noticeable feature in connection with equipment is the increase in the demand which arises as time proceeds, and which directly affects the economic side of the investment.

The apparatus, which is originally designed or purchased for a given service or combination of services, is not, by the process of use and age, improved in its capacity to respond to this increased demand, and it therefore often happens that efficiency decreases at a ratio accelerated by these two causes.

This is an effect specially noticeable in boilers, the working value of which is decreased directly by age and accompanying reduction of allowable pressure, and indirectly by irregular usage and wear and tear, so that an increased demand for output comes upon a weakened and aged appliance incapable of efficient response. Further, when the power thus generated has been planned to operate machinery with a given economic pressure, the lowering of that pressure adversely affects the economy of the machinery.

A boiler when installed may have an allowable working pressure of 100 pounds per square inch, and the engines it supplies do their work best and most economically with that pressure. As time proceeds, the boiler itself becomes less efficient by leaky setting, by fouled and choked smoke-passages, and by scaled interior, and, to cap these deficiencies, the local inspector reduces the allowable working pressure. The engines are therefore supplied at less pressure, reducing further as time proceeds, and their product is affected in both quantity and economy, until some point is reached in the scale where the owner is compelled to undertake rebuilding or replacement.

The operation of extending this existence by remodeling, by reconstruction, or by additional apparatus may be of so expensive a nature, and of so limited an effect, that their entire reconstruction or replacement may be economically preferable.

Radical remodeling, involving more or less reconstruction, may bring the appliance up to reasonable mechanical efficiency, yet may not bring it to the point of full effectiveness to meet the growth of demands for its work. Therefore the conservative practice will be to set aside an annual percentage of value which will cover complete replacement within the period of effective earning existence, so that provision may be made in advance for such contingencies as have been referred to, which percentage can be readily ascertained by reference of any item to the corresponding rate of compound interest in Table E.

As regards the life of usefulness of power-generating machinery, the further consideration must be applied that the commercial value of such apparatus ends as soon as the cost of its operation reaches the price at which its output could be purchased from another source of supply or supplied by some other substitute.

Lenders of money upon security of improved real estate sometimes demand the installation of machinery therein, regarding it as a part of their security; but the value of motive machinery in such a connection is discounted by its relatively short period of useful existence and by the probability of necessary replacement more than once during the life of the structure. Moreover, the mortgageable value of such apparatus, even if regarded as part of the building, is but second-hand value as soon as it is put in operation.

If a mortgage or bond is secured in part upon motive appliances, that part of the security declines at a much more rapid rate than the building, and would seem to require the establishment of a special and regularly invested sinking-fund in order to maintain its stability, since the relative life of motive appliances as compared with that of the building is only from 20 to 27%.

## VI

## COST OF OPERATING BUILDINGS

THE details entering into the operation of a building and composing its cost are not always accessible, on account of the natural hesitancy of owners to afford information as to their expenditures.

It would seem, however, that the publication of statistics, comparing costs of operation in percentages of the rentals, such as those recently compiled by C. T. Coley, M.E., would be of general advantage, creating, as they would, a greater interest in the subject, and directing attention to certain elements upon which relief or improvement might be especially desirable.

If, for instance, it should develop that in certain classes of buildings some practice was common which was productive of undue expense, or some burden was unfairly or unevenly laid upon them, the comparison of details would doubtless tend to bring about an economic modification to the advantage of owners of such properties.

The best method of comparison seems to be that of the relation of each item to the gross rental, which brings out very clearly the burden laid upon the ownership for each element of outlay and gives its direct bearing upon the returns, and through the returns, upon the capitalized value of the investment. A comparison and study of a number of actual instances affords the following approximate averages as classified in Table H.

In examining the outgoing expenses upon any class of improved property, the largest item, and that which, therefore, naturally first attracts attention, is taxation.

Any system by which taxes are raised in this country must, to

"In certain cases the relation of the building to the land, as regards height and expense of construction, has not been happily proportioned"

meet popular views, be such as will conceal the contributions of the general public, among whom there appears to exist a general and deep-seated objection to a direct form of taxation. Consequently, the main burden of city taxation is laid upon real property, and becomes a first charge thereon, taking a prior position to any lien or mortgage, either of land or building thereon.

Table H

AVERAGED OPERATING EXPENDITURES

Classified in percentages of rentals

| Item | Business or office | Lofts and warehouses | Elevator apartments | Flats |
|---|---|---|---|---|
| **FIXED CHARGES** | | | | |
| Taxation . . . . | 15.5 | 17 | 12.2 | 13 |
| Insurances . . . . | 0.7 | 1.6 | 1.6 | 1.7 |
| Water tax . . . . | 0.6 | 0.75 | 1.5 | 2.0 |
| Total . . . . . | 16.8 | 19.35 | 15.3 | 16.7 |
| **MAINTENANCE** | | | | |
| Management . . . | 5.3 | 4 | 3 | 2.75 |
| Upkeep and decoration . . . . . | 2.4 | 3.5 | 11 | 12 |
| Cleaning and janitor | 7.3 | 0.25 | 4.7 | 4.25 |
| Total . . . . . | 15.0 | 7.75 | 18.7 | 19 |
| **CONVENIENCES** | | | | |
| Elevator . . . . | 9 | 8.5 | 6.5 | . . . . |
| Heat and hot water. | 2.8 | 3.3 | 8.5 | 10 |
| Public lights . . . | 2.2 | 1.1 | 2.8 | 1.6 |
| Total . . . . . | 14 | 12.9 | 17.8 | 11.6 |
| **EXTRAS** | | | | |
| Light . . . . . | 4.2 | 3.5 | 4.8 | . . . . |
| Refrigeration or iced water . . . . . | 0.6 | . . . . | 7.0 | . . . . |
| Vacuum cleaning . | 0.9 | . . . . | 1.8 | . . . . |
| Total . . . . . | 5.7 | 3.5 | 13.6 | . . . |
| Gross totals . . . | 51.5 | 43.5 | 65.4 | 47.3 |

All the items included in operating expenditures have increased, so that the proportion which the present expenditures bear to the present increased rentals has not substantially changed from those previously existing, as shown above.

Unequal results of present taxation seem to be due largely to the old practice of assessing values inclusive of the improvement, but in New York City the commendable work of the assessing authorities is now in the direction of establishing a separate value for the land and a separate value for the building. It will perhaps be thought that such valuation would settle the question, but it will not do so fully unless it takes into account the depreciation of the structure, which is continuously reducing in permanency if not in earning capacity.

If the assessments, so far as the building is concerned, should be based on valuation at its full earning capacities, they would have to follow the course of the earnings of the building, which would present a shifting and deteriorating basis, so that a very moderate assessable value on the building would naturally be established, which would provide in advance for its deterioration, while the land might safely be taxed nearer to its full value.

It may be observed that at present no other class of investment makes contributions to municipal purposes similar to those of real estate. The budget of 1910 for the city of New York amounted to $163,130,270. Of this amount, $131,099,280 is raised by taxation, of which real estate contributes $124,540,-732, or 95%, while personal property furnishes only $6,558,548, or 5%.

The increase of the tax rate is ten points, added to the increase of assessed valuation, which is five points, so that the taxpayers' bills have increased since last year at the rate of fifteen points. While taxes are thus increasing, the income produced by real estate does not grow, at least not at the same rate. Within a year or two the entire revenue of the city will depend on real estate, as the tendency of the present administration to abolish taxes on personalty will probably be successful. The irresistible tendency to increase public expenses, at the same time disregarding the revenue of the municipality, places a growing burden on property-owners.

Unfortunately it must be added that no other contribution is at present exacted with like degree of uncertainty and inequality.

That this is the case is generally understood, but the extent of the variation may be worth illustrating, as is done in the accompanying tabulations of taxation in typical buildings in Manhattan.

RELATION OF TAXATION TO RENTALS AND VALUES

NEW YORK CITY

| Building | Case | Per cent. of book value | Per cent. of gross rental | Per cent. of net income |
|---|---|---|---|---|
| Offices . . . . . . . | 1 | 1.88 | 17.20 | 39.6 |
| Offices . . . . . . . | 2 | 1.58 | 15.02 | 31.0 |
| Offices . . . . . . . | 3 | 1.23 | 18.10 | 35.2 |
| Offices . . . . . . . | 4 | 1.07 | 11.80 | 23.8 |
| Mean . . . . . | .. | .... | 15.50 | .... |
| Lofts . . . . . . . | 1 | 1.43 | 20.15 | 39.3 |
| Lofts . . . . . . . | 2 | 1.40 | 14.10 | 31.3 |
| Lofts . . . . . . . | 3 | 1.33 | 19.00 | 38.0 |
| Lofts . . . . . . . | 4 | 1.30 | 15.10 | 24.7 |
| Mean . . . . . | .. | .... | 17.00 | .... |
| Apartments . . . . | 1 | 2.10 | 16.70 | 18.7 |
| Apartments . . . . | 2 | 1.95 | 13.00 | 16.8 |
| Apartments . . . . | 3 | 1.26 | 9.70 | 14.7 |
| Apartments . . . . | 4 | 0.73 | 9.48 | 20.5 |
| Mean . . . . . | .. | .... | 12.22 | .... |
| General average . . | .. | 1.43 | 15.00 | 27.8 |

Much of the irregularity in taxation is due to the failure of both owners and assessors to take into account variations in earning capacity and consequent effect on economic value. If assessed values be utilized as a basis for computing fair rentals, it would become the interest of the owner as well as of the assessing authorities to determine and uphold a fair value of land and building. Or inversely, if assessments took into consideration the earning capacity upon which value really depends, the assessment might fluctuate but would be nearer actual market value. Under such circumstances, owners, assessors, tenants, and investors would be unitedly interested in the subject.

This comparison of contributions by improved real estate to public expenditures shows how much the maintenance or increase of taxation upon the gradually reducing value of buildings may affect their capital value or even accelerate their demise.

It will be seen from an examination of these statistics that the owners of these Manhattan properties are in partnership with the community to a very substantial extent, for upon the net returns the average owner is called upon to share nearly one third of his entire income with the city in the form of taxes, and such are the inequalities that while a more fortunate neighbor may be paying no more than 15% of his income, another may be parting with no less than an amount equal to 40% of the net returns from his property.

A system of public taxation which involves a tenth of the entire earning capacity of a property may or may not be regarded as burdensome, but when it is so unequal as to involve in a similar property double that proportion, it cannot be considered to be based on an entirely satisfactory system of allotment. Nor does its present adjustment appear to much better advantage when regarded from the point of view of comparison with the total invested value, for we find that where one property gets off with a rate of less than ¾ of 1% per annum, another of the same class is loaded with three times that rate.

If these buildings may be considered representative of present average conditions in respect of taxation—and there seems no reason to doubt that other instances would confirm them—we find that the annual contribution made by the ownership of such improved properties to the support of the city expenditures varies from ¾ of 1% up to 2% of the total value, from 10 to 20% of the entire incomes, and from 15 to 40%, or an average of 27%, of the net returns from the investment.

Any system, therefore, which takes no account of the economic deterioration or decreasing earning capacity of any building, but, in spite of these elements, fixes or raises their contribution by empirical assessed valuation, must tend to render some improved real estate unproductive, and therefore unattractive to capital.

It is of course to be conceded that the burden of this taxation is ultimately borne by the lessee, tenant, or rent-payer, who is the real taxpayer. But while that is the case, it also follows that when a point is reached at which the contribution of the property is on an undue scale or is raised beyond that which can be levied upon the occupants, not only the burden of reduced income, but a loss of capitalized value, falls directly upon the property-owner, so that undue increase of assessed value, in the face of the deterioration of a building or depreciation of its rentals, effects a direct reduction of the commercial value of the property, and by such action the State or city indirectly reduces its own credit.

Tenants of buildings, particularly the large part of our population who live in apartments and community business buildings, have a common interest in this subject. Their usual happy-go-lucky view of the matter is to ignore it altogether, or blindly to assert that they are not taxpayers.

As a matter of fact, the majority of rent-paying citizens pay taxes twice over. Of the rentals paid in their homes, from 10 to 17% applies to this purpose, and of the rentals paid for their places of business, from 12 to 20%. This comes more directly to view when the proportion is related to the rental paid, and is also apportioned to the room occupied, as in the accompanying instances from actual circumstances in Manhattan.

If the proportion of the tax to the rent could be uniform, then a tenant would know just what his or her contribution to the city amounted to; but concealed in the rent is an unequal and often disproportionate share of the general burden.

TAXATION PER OCCUPIED ROOM PER ANNUM

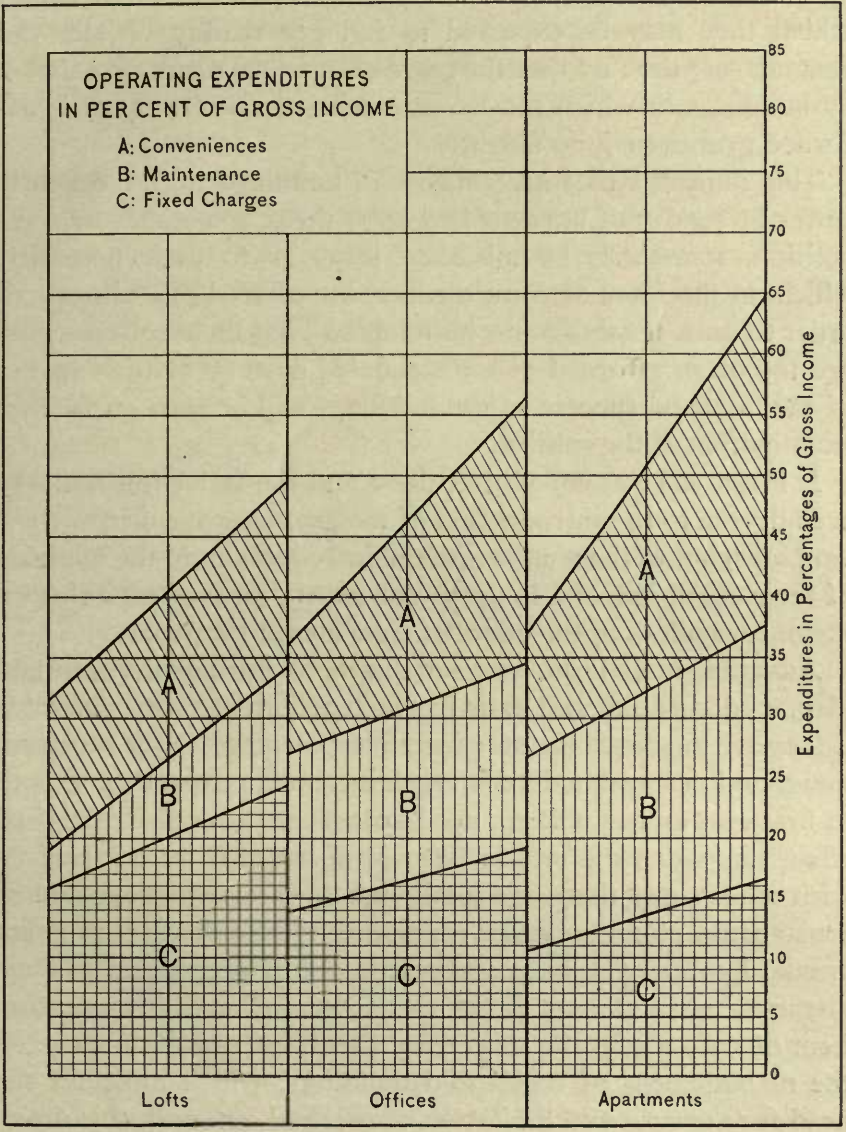
| Character | Per cent. of rent | Per room per annum |
|---|---|---|
| 7-story high-class apartment . . . . . . . . | 9.48 | $18.00 |
| 7-story high-class apartment . . . . . . . . | 16.70 | 30.00 |
| 8-story modern apartment . . . . . . . . . | 13.00 | 18.50 |
| 8-story modern apartment . . . . . . . . . | 9.70 | 13.70 |
| 5-story new-law flats . . . . . . . . . . . | 13.00 | 8.55 |
| 5-story cold-water tenement . . . . . . . . | 13.50 | 8.50 |
| 5-story cold-water tenement . . . . . . . . | 15.00 | 9.58 |
| Average . . . . . . . . . . . . . . | 12.90 | .... |

Being somewhat more than one and one half months' rent, sometimes two months' rent.

If this feature were more fully understood, it is probable that a very lively interest would be evinced by tenants in the question whether their share of taxation was on an equality with that of their neighbors, and a more general interest in the matter of taxation charges would be awakened, which might be expected to lead to an understanding of the principle that the building exists for the purpose of establishing the value of the site, and that the earning capacity of buildings is the measure of the commercial value of the land on which they stand, and that, while it may be fulfilling this purpose, the building itself may be and generally is a fluctuating and decreasing quantity, the value of which is not determinable for taxation purposes with positive definiteness.

The relation which expenditures upon fixed charges and those which may be classified as *Maintenance* and *Conveniences* bear to the total income obtainable from the building is illustrated by Fig. 14, which in diagrammatic form represents both

Fig. 14


OPERATING EXPENDITURES
IN PER CENT OF GROSS INCOME
A: Conveniences
B: Maintenance
C: Fixed Charges
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Expenditures in Percentages of Gross Income
A
B
C
Lofts
Offices
Apartments

the highest and lowest observed expenditures for each item of operation as detailed in Table H, from which the limits within which they may be expected to fall are readily visible, and demonstrate the fact that the more economical results are shown by buildings in which the lesser extent of *Conveniences* is afforded gratuitously to tenants.

This indicates that investments in buildings may frequently suffer by reason of burdens laid upon them, sometimes by competition, sometimes by mistaken ideas as to their necessity, which, in the form of conveniences, are offered gratuitously in order to draw tenants to the buildings. That these conveniences are too often afforded at unreasonable cost, or at the expense of the financial success of the building, will be seen on further examination of the subject.

It is not to be assumed that these and the following remarks are adverse to the introduction of modern improvements or advantages, but to their unconsidered introduction, to the methods of their operation, and to the undue expenditure of capital upon them, regardless of the effect of time upon their value.

Advantages of light, air, and space, of interior division and plan, of decoration and artistic construction, are very desirable if they are the direct means of securing earnings. But constructional and decorative details involving undue expenditure, both in first cost and in upkeep, are burdensome after their original effect has worn off or has become discounted by comparison with others, and there are many details of architecture and of constructive planning which carry with them a direct permanent annual burden of upkeep and repair out of proportion to their attractiveness to tenants. Interior redecoration is an increasing item of cost which the migratory habits of tenants impose on the management of residential buildings, which indicates the need for very careful limitation of original outlay in this direction.

Considerable interest has been of recent years shown by managers of buildings in the subject of economies in the items entering into operating costs. Those coming under the head of maintenance include exterior and interior building repairs and redecoration, house-cleaning and window-cleaning, house labor of all kinds, disposal of rubbish, and many other minor items, and are fortunately receiving a commendable detailed attention largely due to the interchange of information thereon.

These items must, however, be in the main regarded as necessaries, where the owner of property undertakes to maintain the building for the occupancy of a number of tenants.

The remaining element, or conveniences, consists of the operation of mechanical or engineering equipment provided at the owner's expense for the tenants' use, convenience, or even luxury, all of which require more or less mechanical apparatus of a fixed or of a motive character.

The growth of mechanical conveniences has been very widespread during recent years, and the general effect of their adoption in buildings has been to promote irregularity and unsettlement in tenancies.

These conveniences include such service as heating, refrigeration, hot, cold, iced, and sterilized water, artificial ventilation, elevator operation, and gas and electric lighting, with the accompaniments of apparatus for the necessary production of heat, and in many cases the further accompaniment of appliances for the manufacture of power.

Some of these conveniences must, of course, by custom and usage, be regarded in these days as having become almost necessaries. In all buildings, for instance, a certain amount of sanitary convenience is required by law. But the extent and character and even the location of such apparatus is very varied, and is, in some cases, extravagant as regards space, and there appears to be little agreement upon the subject of its desirable position. The result is that many buildings are burdened by this service with unnecessary cost in labor, upkeep, water, and even in elevator service. And in connection with the usage of sanitary equipment, the wastage of water alone is enormous in volume and not an inconsiderable amount in cost.

The heating of buildings in this climate must be regarded as essential, but the frequent misuse made of the convenient form in which heat is provided is noticeable, and is a result of the practice of providing this convenience without direct charge being made for it.

The provision of elevator service is a necessary common convenience in buildings of numerous floors, and its adequacy directly affects the rate of income of the property, affording, as it does, the only practicable means of access to the superimposed floors required to provide a return on large investments in land value.

If the foregoing were the only services of a mechanical nature imposed upon the owner, the burden of the operation of buildings would not be so severe as it is. But the obligation to render a building accessible and habitable does not appear to be necessarily extensible into obligations to afford other conveniences which are of such a character that their misuse may involve the property not only in loss of income, but through that in depreciation of capital value; nor does it follow, if tenants are to be attracted to a building only by such means, that the policy may be as advisable or prudent or justifiable as would be that of avoiding the responsibilities and uncertainties attaching to such features, and accepting a less rate of rental without them.

Of such character are some of the more recent inducements which have been introduced in certain properties, and they are:

Refrigerated boxes in apartments.
Free ice to tenants.

Clothes-brushing by vacuum apparatus.
Cold storage for clothing.
Compressed air for barbers' use.
Omnibuses to carry children to and from school.
Children's playrooms with uniformed attendants.
Heated conservatories for flowers.
Free telephone service.
Sterilized drinking-water.

Recent Conventions of Building Managers have been occasions of great interest to all those concerned in the numerous features which enter into the operation of improved real estate, and have afforded unique opportunities for the comparison of experience, and of the results of the work of those who are charged with the responsibility of operating, for their owners, buildings of every description in all parts of the country.

Much interesting information has been afforded by such experts upon the details of costs and expenditures, and a number of references have been made by them to the numerous burdens now laid upon the owners of property, in the various conveniences which competition has introduced into buildings.

Upon one part of this subject so general an agreement was expressed that it may be regarded as a definite and wide-spread result of experience, namely, that electricity given to tenants without charge is mercilessly wasted, and its value is not appreciated. Frequent instances have been quoted of the reckless usage of electric force by tenants, in any of the now numerous conveniences in which electricity is the method of operation, and of the burden thus laid upon property-owners, where the practice has been established of including in the rent an assumably reasonable supply of electrical current for such purposes.

The owner of a large office building, where the service is supplied free from his own generating plant, voiced the general

Since the above suggestion was presented the practice has become general of metering to tenants their supply of electric energy, with advantage to owner and occupant.

sentiment on the subject at the convention at Detroit in 1909, by describing the practice as "giving something for nothing which is regarded as of no value."

The natural question has been asked whether the exclusion of free electrical service would not be necessarily followed by a corresponding or assumably corresponding reduction in rentals; but instances were cited in which the free supply of current had been discontinued, and no loss of rental had resulted.

It may be observed that it is not merely desirable that an owner should be relieved of the expense of the manufacture or purchase of this source of supply for light and minor conveniences or for power in loft buildings, but that he should also be relieved of the responsibility and anxieties attending its supply, as well as the liability toward his tenants in case of failure on his part to maintain such services, if contracted for directly or indirectly in his leases.

In the case of the use of electricity for power and lighting purposes in loft, warehouse, and manufacturing buildings, it is stated by several prominent owners in Manhattan that the elimination of the free service has not only removed a cause of frequent complaint and dispute between landlord and tenant, but has resulted in actual economy to the tenant by inducing greater care in the use of power, and the recent developments of such buildings in this city have established the practice of placing upon the tenant the obligation of securing his own supply of power from a public source.

Opinions thus expressed by men of wide experience and knowledge of conditions in all parts of the country are impressive and conclusive. If owners of other classes of buildings which are similarly burdened, and are found to be unproductive or undesirably lean in their return upon the investment they have involved, should unite in divesting their properties of such uncertain elements of outlay, they would render improved real estate a more attractive because a more definite investment. At present, to a considerable extent, the operation of improved real estate involves the simultaneous conduct of two or more businesses, and a very ancient and trite saying long ago foreshadowed the fate of those who undertake such hazards.

The abandonment of power-generating machinery and high pressure steam with accompanying outlay in fuel, repairs and labor, and many subsidiary expenses, has substantially lowered the operating expense of many buildings.

Steam-heating systems have been reduced to simplest form, with much advantage. The use of gas for heating in buildings of moderate proportions is found to afford superior convenience, and its adaptability to automatic control eliminates the expense of labor and provides a more regular and controllable supply of heat.

The establishment of metered electric service to tenants has enabled the owners of numerous business and apartment buildings to derive a reasonable profit from the purchase at wholesale rates of the total amount of electric energy used in the building and its sale to the tenants at the prevailing public rates. For this purpose the owner usually leases electrical meters and contracts for their maintenance in accurate recording condition. These economic processes, by improving the net income, have not only benefited the owners, but by their effect in stabilizing rentals have thereby benefited the tenant as well.

## VII

## MANUFACTURING OR POWER MACHINERY

THE urgency of competition with other buildings, which has led many owners to enter into those obligations to their tenants which have been previously referred to, has further involved certain of them in very extensive expenditures of capital and much unknown future expense by entering upon the manufacture of power or heat for these conveniences, by means of the installation and operation of high-pressure steam- and power-generating machinery of complex and expensive character and of limited useful existence.

The cost of installation and operation of these domestic factories, which are often quite complicated combinations of mechanisms, is greatly enhanced by the provision of necessary space, which is usually obtainable only by the most expensive part of a building's construction, namely, the excavation of cellars or sub-basements, which may be otherwise unnecessary.

The services covered or provided by such power or motive equipments may not be and are not generally the largest element in the operating expenditures of a building, but they are thus made to involve a relatively large share of capital outlay and a disproportionate share of the depreciation of the total investment. In effect, they are a growth upon building operation in which real estate investors have really no interest, which renders the investment less definite.

The actual proportion of the gross income involved, inclusive of depreciation, in the manufacture and supply of power, heat, etc., for these modern conveniences is

"Sections of cities built up with great uniformity usually drift into a lower class of occupancy and lower rentals"

In loft buildings, about . . . . 13 to 14%
In business buildings, about . . . 15 to 17%
In elevator apartment-houses, about 23 to 25%

The practice of establishing interior heat- or power-generating plants seems to have grown out of past deficiencies in public supplies of some particular form of service installed in the building, as, for instance, in the use of elevators operated by hydraulic force, for which the public water service is unsuited, and of which there is no available commercial supply such as is established in some European cities of magnitude.

The provision of necessary power for this particular purpose led in many buildings to the addition of other engineering appliances affording other services, which, as above remarked, are not similarly obligatory upon the ownership. These have become largely gratuitous, being included in the established rate of rental, and have thereby become the subject of much extravagance, waste, and misuse on the part of tenants.

As rentals decline, the relation which such services bear to the gross rentals increases and often becomes burdensome, and the relative cost of the production of power also increases by reason of the age and corresponding inefficiency of the domestic factory, while the tendency of usage is all in the direction of increase and brings greater demands upon the apparatus.

The financial bearing, upon the investment, of the provision of machinery or power-manufacturing appliances in a building is not often fully appreciated, it being assumed that such apparatus justifies its existence by some economy in cost of its output as compared with some other presumed condition.

The location of such apparatus has already been referred to. It necessarily involves the use of some portion of the building below the ground level, and sometimes of an extension of the building below ordinary basement levels, specifically constructed for this purpose.

This naturally becomes the most expensive portion of the construction of the building, by reason of the excavation of solid materials which is involved, of the construction of retaining-walls, and, in the case of any depth exceeding that of the sewer or drainage system in the vicinity, of the provision of water-proofing, not infrequently accompanied by the operation of pumps to drain away seepage, or to lift sanitary discharge-water from this low level.

The logical purpose of engineering appliances thus placed is to operate the required services and conveniences of the building in the absence of means for this purpose provided by a municipal system or by a public service.

But where such apparatus is installed in face of the accessibility of such public supplies, the purpose of the installation becomes merely competitive, and is no longer to be regarded as necessary. The commercial value of such apparatus is then limited to its ability to compete with the exterior service, and its life of effective usefulness ends when the cost of its output equals the cost of a similar output purchasable from any other source.

Such supplies may be obtainable from neighboring installations, but then require consideration from the viewpoint of their stability and reserve capacity.

There are, however, generally available in most cities municipal or public supplies of various characters. Thus, electrical service is practically universally available, and this alone covers the operation of a large proportion of the conveniences and necessaries in modern buildings.

Usual public supplies also include water, gas, and in some sections steam for heating purposes, and in other cases refrigeration. The cost of such supplies may be regarded as generally liable to future reductions in rates, and conservative practice would therefore seem to dictate provisions for their future use, even if their present use be not adopted.

The economic value of power-generating apparatus is commonly established, or assumed to be established, by the difference between the cost of a public or neighboring supply and the cost of the same service provided by the installed apparatus; but this limited comparison does not take into account some essential elements which, if properly considered, are found to place very decided limitations upon the justifiable expenditure of capital in this direction.

In the case of mechanical services, the economic effect of power manufactured for their operation is confined to that portion of the operating expenses which is concerned with the conveniences of the building. As has already been shown, these form, of the aggregate income, a proportion of about 13 to 25% according to the character of the building, and out of this expenditure only some portion is of such nature as to be affected one way or another by the alternative of the employment of a manufacturing apparatus or of public services.

The establishment of machinery in a basement, which has necessarily formed a part of the construction of most modern buildings, and is usually included in the general cost of the building, must not therefrom be assumed to be unaccompanied by expense for the space thus occupied. Basements, by reason of the demand for storage space, below ground-floor stores, offices, banks, and particularly in apartment buildings, are adjuncts to the general rentable space of the building, and in computing its average renting value the rentals of the basement space must be included, as has been done herein, as a part of the average rent. If, therefore, any portion of a basement be diverted from utilizable purposes to that of housing apparatus which does not pay rent, then the building suffers some loss of renting capacity, which is chargeable against any apparent economy effected by the operation of the appliances.

Where the installation of machinery in a basement is found from these causes to bring about an interference with the rentable value of the building, the expedient is frequently adopted of constructing a sub-basement or sub-cellar at a still deeper level for the special purpose of providing space for the manufacturing apparatus. This process is accompanied by the progressive expenses of construction already referred to, including, in the case of steel-cage construction, an extension of the steel columns, which is necessitated at their heaviest part.

Details of the cost of such sub-basement construction are not here necessary, and indeed the expenditures upon such construction are so varied and sometimes so disproportionate that it would be difficult to lay down any definite method for their computation. Building contractors can, from their experience, afford facts as to expenditures in past construction of this nature, but it may be moderately estimated that sub-basement construction of the least difficult character involves not less than double the cost per cubic foot of building construction above ground.

The proportions and cost of engineering machinery thus located are very varied, but the natural desire of those interested in its design and in its operation to secure very ample proportions and reserve capacities tends to proportions considerably in excess of actual requirements, so that the cost of such power plants may vary, according to the degree of precautionary liberality exhibited, from 3% to 7% of the cost of the entire building. In an apartment hotel of large proportions the cost of power-generating apparatus was 3.6% of the cost of the building, and the cost of the space occupied was approximately 2.6% of the building.

To the total capital outlay upon the improvement of a property, on which a certain rate of interest is to be secured by the average rental, the cost of any construction, appliance, or apparatus which is not directly rent-earning is added, and the interest thereon must be derived from rent of some portion of the rentable space. Therefore, for any expenditure of capital in such directions, either an enlargement of the rentable area or an increase in rentals would be necessitated, in order to provide interest upon the outlay in plant and upon the space occupied by it. The effect upon rental rate may be found by the computation:

$$s = \frac{100 \times (x + y) \times \frac{i}{r}}{f \times n}$$

in which

$x$ = cost of construction per cubic foot × height in feet of the space occupied.

$y$ = cost of the apparatus contained in the manufacturing plant, divided by the square feet occupied.

$i$ = rate of interest on investment.

$r$ = ratio of net income to total rentals, *including therein any economy effected by the use of the plant.*

$f$ = number of stories in the building.

$n$ = percentage of the net rented area to the gross rentable area of the building.

$s$ = increase in rentals per square foot necessitated by a manufacturing plant and the space it occupies.

The point may be illustrated by referring to one of the examples previously figured, in which, on a land value of \$100 per square foot, it was found that a 15-story business building, at the prevailing average rental of \$1.80 per square foot per annum, would return 4% interest upon the land and upon the cost of the building.

Now if there be added to the cost of the building and the land that of a sub-basement and of a manufacturing plant, or, say, $18.57 per square foot, the interest on this capital is found to require an increase of the rate of average rental from $1.80 per square foot to $1.95.

It will be evident, however, that such an addition to rentals of a building would not in most cases be practicable, because the rates of rentals are fixed by surrounding circumstances, and cannot be arbitrarily raised or predetermined. It therefore follows that additional renting space must be added to the building in order to provide for the addition to the interest account. Moreover, the cost of the construction of such additional renting space, added solely for the purpose of earning interest upon the capital expended on the plant, becomes another addition to capital investment, and interest must also be earned thereon.

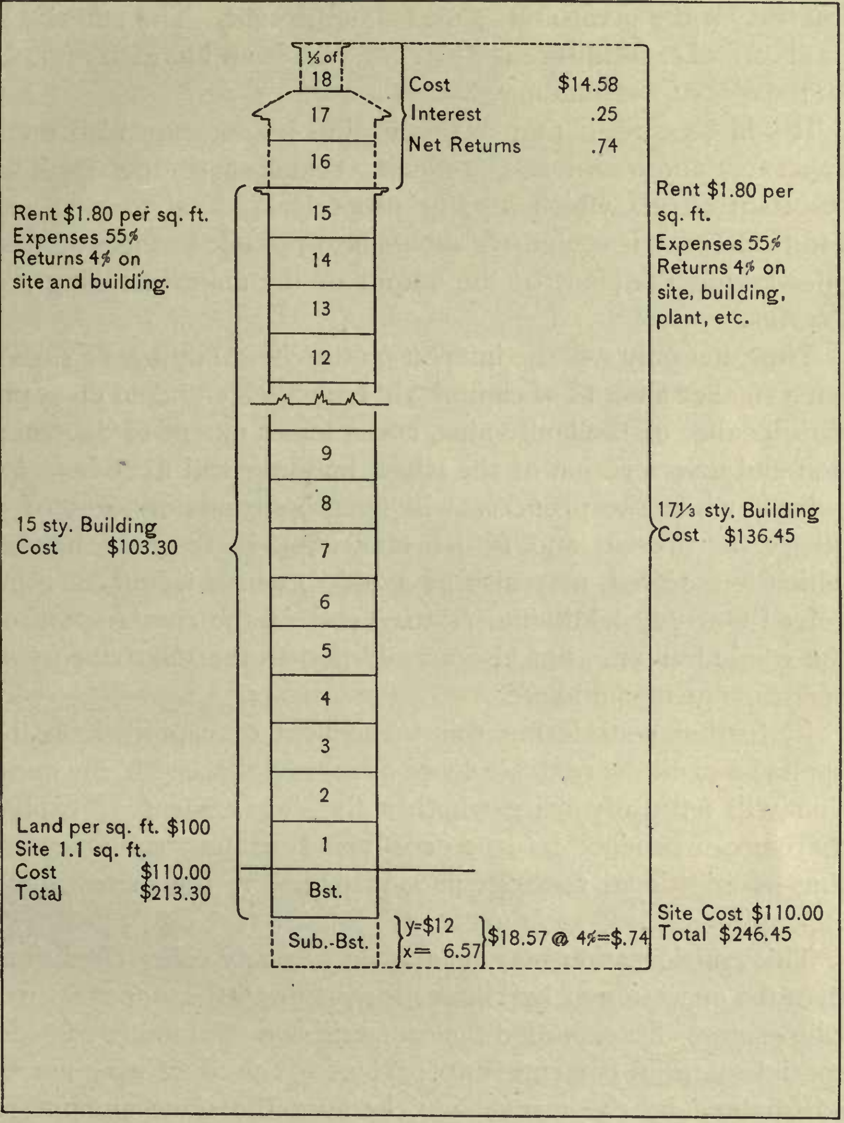
It therefore becomes clear that for every unit of capital involved in mechanical conveniences, appliances, or apparatus for the generation of supplies of force, and in space for the same, additional building construction has been added or is to be added above ground, the renting of which shall suffice to pay interest upon its own construction and interest upon the appliances and upon the space occupied by them.

The effect is shown in the accompanying diagram, Fig. 15, illustrating the same building of fifteen floors, at the prevailing rental of $1.80 per square foot.

In this building the addition of a manufacturing plant and space therefor has involved an additional capital expenditure of $18.57 for the square foot of building area, requiring interest amounting to 74 cents to be paid, at the rate of 4% per annum.

The interest thus required is found to involve the addition to the building of two and one-third floors, the cost of which adds another $14.58 of capital expenditure. The additional renting space thus provided brings in a net return of 56.7 cents per floor, from which has to be deducted 25 cents for interest upon the

FIG. 15


⅓ of 18
17
16
15
14
13
12
9
8
7
6
5
4
3
2
1
Bst.
Sub.-Bst.
Cost $14.58
Interest .25
Net Returns .74
Rent $1.80 per sq. ft.
Expenses 55%
Returns 4% on site and building.
15 sty. Building
Cost $103.30
Land per sq. ft. $100
Site 1.1 sq. ft.
Cost $110.00
Total $213.30
Rent $1.80 per sq. ft.
Expenses 55%
Returns 4% on site, building, plant, etc.
17⅓ sty. Building
Cost $136.45
Site Cost $110.00
Total $246.45
y=$12
x= 6.57
$18.57 @ 4%=$.74

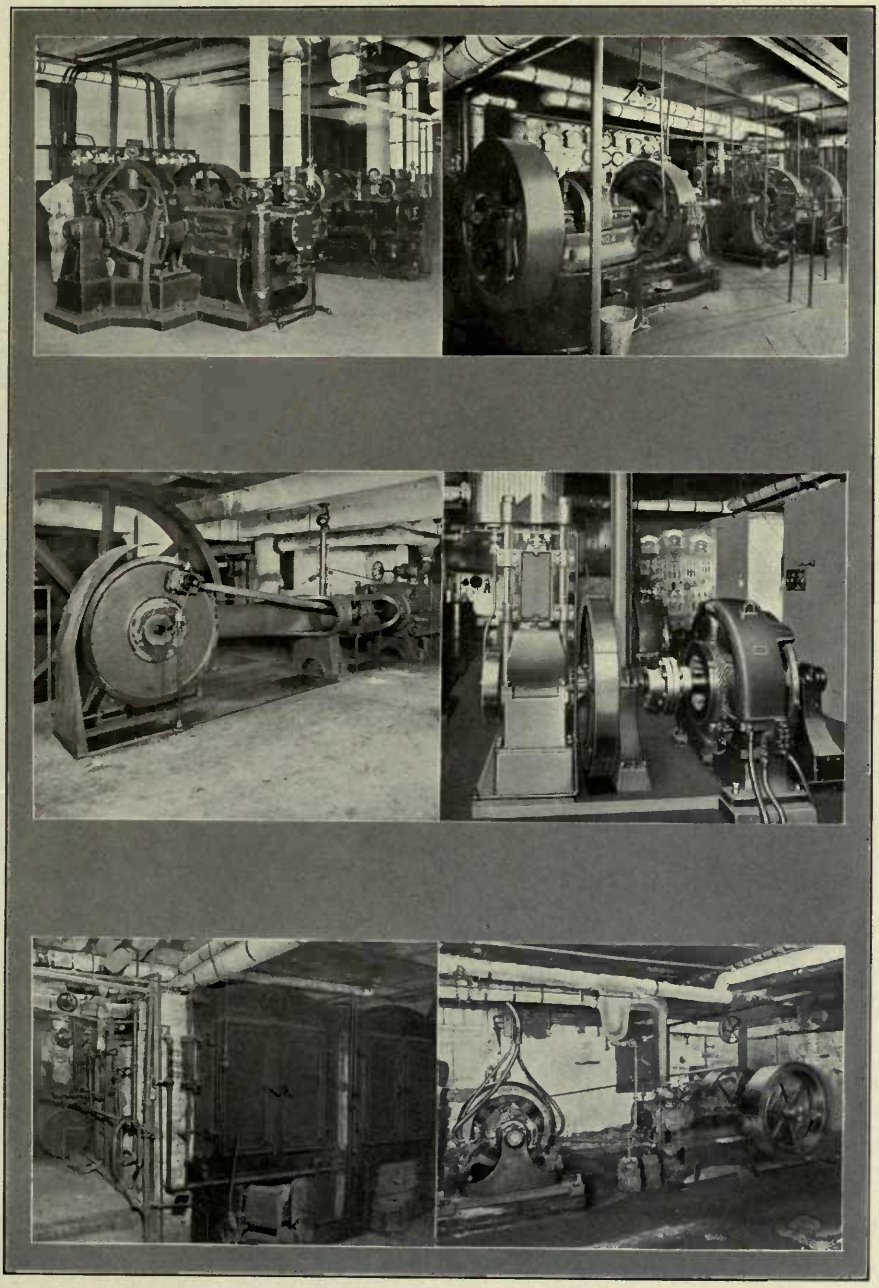
cost of these floors, leaving available 31.7 cents per floor, or from the two and one-third floors the 74 cents required for interest on the plant and space below ground. The additional total capital expenditure is $33.15, which is an increase of 32% on the cost of the building.

It will be evident that if this capital be not expended upon apparatus and its interest-producing rental space, there will be resultant effects which may be properly credited toward any additional cost, if such there should be, of public services or supplies taking the place of the output of the manufacturing apparatus.

Thus, not only will the interest on the capital outlay be saved, but a smaller amount of capital will have been engaged upon the maintenance of the land value, and a lesser extent of depreciation and deterioration of the whole building will have been involved, while the property will be proportionately less of a target for present and future taxation. Increase of height, which is required, may also be avoided, which would have involved not only additional relative cost of the construction of the whole building, but also an addition to the relative cost of operation of the building.

In further considering this investment of capital upon the appliances and the rentable space connected therewith, the question will naturally arise whether the engagement of capital therein can produce returns or offer advantages equivalent to that of additional renting space provided by the same capital expenditure.

This consideration may be applied to many other conditions than the operation of buildings; for instance, the manufacturer who engages his capital in the competitive manufacture of some special material entering into part of his product may not be advantaged by the transaction, because the same amount of funds expended in means or apparatus for extending the sale or



Abandoned Machinery

"The commercial value of such apparatus is limited to its ability to compete with an exterior service"

enhancing the value of the complete product might bring in a greater net profit by increasing the gross output.

The same principle appears in the application of manufacturing machinery in buildings. If it be found, for instance, that a supply of gas be desirable or necessary in a building, it does not follow that a gas-manufacturing plant competing with the present price of a public supply of gas will produce enough return by any difference between price of that supply and cost of its own output to justify the expenditure accompanying its installation, when compared with the results derivable from an expenditure of the same capital in enlarging the area or improving the rentable character of the tenantable part of the building.

Thus, to refer to the previous illustration of a 15-story building, if we assume that the expenditure of $18.57 involved in a plant should be expended instead in constructing additional renting space, it would add (at the same rate of cost of construction) three stories to the assumed square foot of vertical section of the building. The rentable space thus provided would bring in a gross addition to rents of $3.78 per annum. If we should assume that the purchase of supplies of a mechanical nature from public services instead of their manufacture on the premises would involve an addition of as much as 25% to the cost of the entire mechanical services, this would be but one quarter of one fifth of the gross income, and in this instance would amount to 95 cents.

Deducting this entire amount from the gross return of the three added floors, still leaves a net addition to the rentals of $2.83.

Reducing this amount to the net of 45%, leaves $1.27, which, upon the expenditure of $18.57, brings back interest at nearly 7% per annum, a return which is much higher than that obtainable by the investment in the plant and cellar.

Finally, the security afforded by a building to a mortgagee is not proportionately increased by the capital expended upon machinery, because the life of the latter is shorter than that of the building, and involves future expenditures which might fall upon the mortgagee. Such apparatus does not form a security for bonded or mortgage funds of the same stability and life as a building or land.

## VIII

### APARTMENT-HOUSES, FAIR VALUES, AND FAIR RENTS

IN residential apartment and tenement buildings the shortage of housing—which is not, of course, a permanent condition—enabled many owners of such properties to fill all vacancies and thus increase their gross income. In spite of large accompanying advances in the cost of fuel and labor, by close economy in upkeep and services they have been able to maintain that income with moderate increase in rents. But in other instances less considerate owners advanced the rent to extremely high rates. Upon a new level of value, thus created, speculative purchasers or lessees endeavored still further to add to the rate of return by additional increases in rental. The process became so ill regulated and oppressive that a large number of tenants combined to demand restrictive legislation, which has been enacted in several States, whereby the courts are now empowered to decide upon the rate of rental in residential buildings, and the owner is also made personally responsible to the law for the adequate maintenance of such services as heat and elevator operation, for the proper upkeep of the structure, and can be fined or even imprisoned if in default.

The speculative process of successive sales and the substitution of the irresponsible lessee for the owner were thus incontinently checked, and the sale of such properties at enhanced speculative values became restricted. New buildings now coming into existence with unexampled rapidity will eventually meet the demand for housing accommodation, and excessive rates of rental must decline, bringing down with them any unsubstantial assumed values of the properties.

Residential property was and is entitled to substantial increase of income required to cover the advanced prices of fuel, labor, and repairs, and sufficient also to earn a net return upon a properly established invested value at a rate not less than that obtainable in the investment market for securities of equal standing. Such an increase is necessary merely to maintain the investment. But any additional income is dependent upon the permanency of high rentals, and the conservative investor will do well to consider the question whether rent raised to a high level during a period of emergency can be regarded as permanent.

Nor can it be assumed, merely because the cost of new building construction has advanced to high levels, that an existing building has thereby advanced in value to a similar extent. Such comparative worth could only come into practical consideration in case of the destruction of an existing building, and meantime it constitutes only a very good reason for increasing the extent of fire insurance to cover the enhanced cost of reproduction in case of disaster. In point of fact these advanced costs of construction rendered new buildings so unattractive to the builder, operator, mortgagee, and investor that the process of new construction was completely halted, and was only recommenced when a reduction in taxation was brought about roughly commensurate with the added cost of construction.

It has always been the case that the tenement class of residential property is required to produce a high rate of return in order to render it attractive and marketable, while the more elaborate class of apartments in which leases are obtainable, and which have heretofore been managed with little risk and personal liability, find a market at a lower rate of interest on their investment.

This scale of rates of return presents the same complexion under conditions of high rents and higher prices of money. But the one-time, well established return providing 5 to 6½% on investment in residential property has now advanced to rates of 7 to 10%. It is probable that this higher level will be permanently required to attract investors to properties to which legal complexities and personal liabilities are now attached. Thus as an illustration the first of the tenement buildings in the table on page 41 would require, in order to cover enhanced expenses and return 10% upon its established book value, a rental of 86 cents per square foot, or an increase of nearly 60%. If 10% should have been added to book value, either by assumption or by a sale, then to maintain that value the rent would have to be raised to 90 cents, or 68%. A second sale or addition to book value of another 10% would require another increase in rentals to $1.00, or 83% increase.

The proportion of the book value of the property represented by the annual gross rent has changed by the general advances in rents and rates, so that in the cold-water class of tenement, at a return of 10%, the gross rent becomes about 15 4/10% of the book value, and the ratio of the rents to the book value is as 1 to 6 4/10.

Where the operating expense is greater, as in the steam-heated class of apartments, a return of 10% involves rentals aggregating 17 2/10% of book value, or a ratio of rents to value of 1 to 5 8/10.

Rentals have also greatly increased during the housing shortage in the more expensive class of apartment buildings. The occupancy of such apartment buildings has been the subject of much acrimonious discussion and a vast extent of litigation in regard to what constitutes a proper rental. The ascertainment of a fair rental presents much difficulty because it necessarily introduces the question of what is the real value of the property, and also what constitutes a reasonable rate of return upon that value.

The assessed valuation has been suggested as a basis for fixing fair value. The proposal is made that 15% be added thereto, constituting a "minimum" value which, being thus determinable by established official figures, could be utilized by the courts as a general basis, leaving it to the owner to prove any higher value. By this plan the assumed basis of assessment would be 85% of market value. This plan offers a workable basis, and if adopted it would become the means of adjusting assessments to some fairly uniform relation to true values, because it would then be to the interest of all parties to see that the assessment accurately indicated that value.

The rate of interest on the value thus ascertained should be commensurate with prevailing circumstances in the money market, and the net return should be graduated according to the character of the building and its location.

The following tabulation shows the rentals necessary to maintain upon any book value and for various classes of buildings the graduated rate of return suggested, and also gives the relation which such rentals bear to the book value of the property.

| Class of Building | Book Value of Rents | Ratio of Rent to Book Value | Operating Expense and Taxes of Gross Rents | Net Income of Gross Rents | Rate of Interest on Book Value |
|---|---|---|---|---|---|
| | % | | % | % | % |
| Cold-water tenements . . | 15.87 | 1 to 6.3 | 37 | 63 | 10 |
| Hot-water tenements . . | 16.66 | 1 to 6 | 46 | 54 | 9 |
| Flats, heat and hot water . | 18.18 | 1 to 5.5 | 53.8 | 46.2 | 8.5 |
| New law "walk-up" . . | 19 | 1 to 5.25 | 57.9 | 42.1 | 8 |
| Elevator apartments . . | 19.73 | 1 to 5.06 | 62 | 38 | 7.5 |

Many buildings pass through periods of depression and excessive competition during which their net earnings are less than a prevailing rate of interest, and even in some cases result in actual loss.

This situation has been used by some owners to justify, during the period of acute shortage, an increase of rents to a level sufficient to recoup them for these prior losses.

The policy may appear justifiable, but its application is unfair. To the extent that a new basis of rentals will reestablish the current market value of the property, the present tenant can have no complaint, but to require tenants to make good deficiencies created by past conditions over which they had no control, and the benefit of which passed to other tenants, is evidently unfair. The owner of improved real estate must expect variations in certain conditions affecting the income which, if understood and anticipated, may be largely discounted or negatived. Misfortune of course may attend the best efforts, but on the whole real estate has afforded relatively less disturbance and loss than other lines of investment.

In a rather despairing effort on the part of the public authorities to induce the construction of new housing, resort was had in the State of New York to a system of temporary reduction of municipal taxation. New buildings for residential purposes are at present exempted from taxes up to certain values, the taxes on the land, however, continuing. The concession proved sufficiently attractive to recommence the construction of a large number of new dwellings and tenement buildings. Though constructed at a high cost of materials and labor, buildings erected under these circumstances find tenants at the same prices as existing buildings of equal character. Evidently, therefore, the ten-year reduction in taxation may be regarded as practically offsetting the increased cost of production.

In that case, the owner cannot afford to ignore the fact that the annual relief is but temporary, and that the extra cost of construction of his building—over and above that incurred by earlier buildings with which he is competing—must be disposed of within the period of exemption.

After the building reverts to full taxation, unless by then the excess costs shall have been written off, it will stand at a disadvantage in regard to its competitors of less invested value, and may be worth in the market no more than they are.

The owner, therefore, is justified in regarding the reduction in taxes as a concession intended to meet his temporary excessive overexpenditure and as being designed to provide relief in the present necessity for housing. The amount which is thus saved in taxation cannot be applied in reducing the rents of tenants.

This matter has taken a very definite form in some cases in which mortgagees have required that the excess cost of building shall be paid off by annual instalments upon the mortgage. It is evident that the funds for such instalments can be derived only from rentals.

Objection has been made by tenants—who are now beginning to show a very desirable concern in such subjects which have long affected their own interests—to the inclusion of depreciation in the computation of an official rate of rental, on the ground that the tenant is thereby purchasing the fee of the property for the landlord. But this view is unsound. The tenant is interested in providing for depreciation as a means of continuing the existence of the building or its successor. If the sum set aside for depreciation were invested its gradual accumulation would replace the capital expended upon the building, and rentals should be reduced when the fund has entirely accumulated. But the reduction could be carried on only as far as the end of the economic life of the structure, for by that time the capital invested in it has disappeared and its renewal or replacement requires the use of the accumulated depreciation fund.

It cannot be assumed that investors will be willing to lay out a sum of money in the construction of a building which at the end of a term of years is entirely to disappear. By neglect of provision for depreciation in only too many cases this has actually occurred, and often as much to the inconvenience of tenants as to the detriment of landlords.

Depreciation is therefore properly included in rentals, though it should be compounded by crediting interest so as to accumulate at the most rapid rate possible.

The present complexities of ownership and the existing discordance between the interests of owners and tenants will be desirably modified by a more general understanding of those underlying principles controlling the improvement of habitable real estate, which have been set forth in these pages.

And we may look forward to a time when, by a better comprehension of their mutual interest in the development of the homes and business buildings of our country, a new spirit of cooperation will arise between those who use and those who own improved real estate.

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