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130 WEST 42nd STREET, NEW YORK

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MAJOR J. W. SWAREN,
Cleveland, Ohio

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PUBLICATION DEPARTMENT NOTE

Events haven't happened in the life of the subject of this sketch. That is why after investigating the joys of working for many and varied concerns, he began consulting work in San Francisco, California in 1909. His hobby was investigation for investors. He never achieved popularity with promoters. Perhaps this was occasioned by reason of the fact that no company, the purchase of whose stock he recommended has ever succumbed, or defaulted on its obligations.

In 1917 he joined up with the "big show" and after leaving the hospital in 1919 was Sales Manager for the Division company of Dayton, Ohio, and New York Manager for the Merril Company of San Francisco.

But early in 1922, the Government couldn't collect enough income taxes so he was called into the Income Tax Unit as an engineer. Late in 1923, one of the Directors of this Association enticed him into private practice once more. And that is how it came about the Cleveland Chapter was told that the Engineer isn't such a bad chap after all.

## CO-OPERATION BETWEEN THE COMPTROLLER AND THE ENGINEER

For the fullest measure of coöperation between the comptroller and the engineer knowledge of the point of view of each on the part of the other is necessary. Let us consider somewhat the respective points of view of the comptroller and the engineer.

Accounts, obviously, are the bases of the work of the comptroller. And accounting is primarily historical. An event occurs, and it is recorded in the books of account by figures representing dollars and cents. From the records of what has happened, the comptroller endeavors to direct the financial relations of the company, and to forecast its financial future. This is the historical method.

But I am speaking to comptrollers and all of you are more familiar with this point of view than I.

It is my desire then to present to you the point of view of the engineer.

Engineering is based primarily on visualization. The training of the engineer is intended to acquaint him with the fundamental laws of nature and to enable him to reduce these to mathematical formulae, and by combinations, to visualize the project in hand. The engineer uses experience and records as a check against his visualization. And if his visualization stands the test of mathematical logic, he discards experience and proceeds on the bases of his computations. Here is encountered one point of contact between the comptroller and the engineer that requires a delicate touch to avoid friction. Suppose an appropriation is included in the budget for a construction job embodying advances into new or semi-explored territory of engineering and that it has been subjected to every theoretical and mathematical test. It may have been checked by the judgment of experience. But suppose the costs overrun. As to the reason it may be stated first that there are limits to the skill of artisans in interpreting the visualization of the engineer. Then there are limits to the stresses that may be withstood when materials are subjected to new and unusual conditions. The engineer finds excuses for his creation. The comptroller sees the overrun appropriation. Neither quite grasps the other's point of view as to the reasons for the overrun appropriation.

That one may gain an insight into the engineer's point of view, let us examine the method by which he approaches his task. Incidentally, it will disclose an important point of contact for coöperation—a coöperation that will save your company, and in fact, any company, money today, and more money in the future; and probably labor for both the comptroller's force and the engineering department.

## Phases of Engineering Jobs

All engineering jobs, whether they be the conception and completion of a major project, such as a railway terminal, or a power plant, or merely a slight change in some operating method, comprise three distinct phases.

The first, and most important, is the assembling of all data pertinent to the task in contemplation. Please note the expression used—all data pertinent. This requires a rare perception of the essentials. It requires a sound knowledge of fundamental science, and a consumate skill in coördination. And if the economics of the situation are to be clearly conserved, it requires access to accurate, distinct, and "engineeringly" intelligent cost records. With these factors in coördination, the decision, which is the termination of the first phase—is almost automatic. This phase is time consuming, and often gives rise to the thought that nothing is being accomplished.

The second phase, likewise second in importance, is the design of the project. This is a visualization almost in its entirety. From the decisions based on data accumulated is developed a visualization of the completed structure. This is reduced to concrete form by computation, and the results are drawings and specifications sufficient for the direction of the man who is actually to build the project. And far from the least of the tools used by the designer, are "engineeringly" intelligent cost records.

The third phase is the actual construction of the project. Here is required again a power of visualization so as to carry into materials of three dimensions and mass, the lines of the plans and the words of the specifications. And to the man in responsible charge, tools of the utmost importance are accurate, and engineeringly intelligent cost records, both contemporaneous, of his daily progress, and retrospective, of other jobs, inclusive of similar operations.

Perhaps, some curiosity has been aroused about the phrase "engineeringly intelligent cost records." By this is meant cost records identifying the major units in which the engineer thinks. Let me illustrate by an example, one intended to be purely illustrative, and not literal.

In the normal course of events at a certain factory it is necessary to build a fence. Its prime cost consists of labor and materials. These may be carried into the proper betterment account. The appropriate secondary costs are added and then a single journal entry carries the whole cost into plant account. A request from any department for the cost of that fence produces one item, the total cost. Some time afterward, it becomes necessary to run an overhead steam line into the factory yard. An estimate is being prepared. You are asked for the "costs" of the fence. And probably you see no connection between fences and steam lines as the total cost is sent down. Or if in one of those rare phases, with a little spare time, you segregate the total costs into secondary costs, labor and material. And the engineer makes a few remarks when he gets it, but vows that on the next job he'll have one of the draftsmen keep some costs that mean something. For he is thinking in operations. That fence required post holes. Digging these post holes is an operation. Each bent that is to carry the pipe line will require two holes of the same size as those post holes, and if the costs are available on the previous similar job, that is digging post holes for the fence, the estimate of the new job, building the steam line, can be made more accurately.

It is difficult to foresee just where certain items may be useful in determination of future work. Fortunately, most engineering work falls into a comparatively few basic functional operations. And the *engineeringly intelligent cost accounting* system provides that functional segregation. And it provides it today.

At the risk of repeating something all of you know, a cost accounting system on a construction job that doesn't give today's costs tonight isn't worth the paper consumed in its keeping as a tool for the engineer in charge. And it is mighty poor ammunition for the comptroller in a fight in the director's room.

Please do not think that I am advocating that cost forms should be prepared by the engineer. Quite the reverse. There is no need in my reminding you of the necessity for any form having to do with dollars and cents, tying into the balance sheet. I have seen a lot of costs forms prepared by engineers. I am not an accountant, but my guess is most of them couldn't have been tied into a balance sheet.

But, when you start to build a cost sheet, go to the engineer, and ask him what he wants on it. Your accounting skill should be able to give it to him.

It has been my experience that in very few concerns is it possible to go into the plant, lay one's hand on a piece of equipment and ask where it is in the balance sheet. It's in the plant account. But how did it get there? And is all of it there, or is too much of it there? I shall not stop to discuss this phase further, but shall summarize:

It is the duty of the comptroller to tie costs into the balance sheet through cost sheets. But it is the duty of the engineer to tie correct costs into the physical properties. And the two must coördinate to accomplish these objectives.

## PROPERTY RECORDS

Having examined at some length, the relative points of view of both the comptroller and the engineer and one specific point of contact, let us inquire what are other points of contact between the engineer and the comptroller. These are so many that only a few can be examined. My own experience has been largely with capital costs and only these will be discussed. Contacts in operating costs are just as plentiful and occur far more frequently as operation is continuous, while capital expenditure is intermittent.

Most capital contacts can be grouped under one general heading, namely, Property Records.

How many companies can tell the history and present location of every capital asset, from its acquisition to date, and its true balance sheet relation at all times? First of all let us see where accurate property records are of value.

Primarily, they are valuable, nay, indispensable, for the purpose of *operating costs.* Depreciation, obsolescence, and interest or investment are essential factors in any correct costing system.

What is *depreciation?* One definition is "An allowance for wear and tear, sufficient to return the cost of the asset during its normal life." And the setting up of a depreciation reserve results in a return of capital investment. But is that sufficient? To my mind, the nature of the industry is an important factor in the determination of depreciation reserve rates of accrual. Let me ilustrate: One company buys a coal mine. It knows beyond any reasonable doubt that it has 1,000,000 tons of coal in the property It is a developed property; i. e., there are working places and entries, but no equipment. It proceeds to build a hoist and tipple having an annual capacity of 100,000 tons. In ten years' time this equipment will remove the entire coal body. Now after ten years' use, this machinery will still have several years' life, but would it be salable? Would the company be justified in moving it to another property? Probably not. Therefore, for the sake of simplicity, neglecting salvage value, for each year's operation, this company must include in its costs one-tenth of the cost of equipment, if the stockholders are to have returned their original investment. This can be done by charging one one-millionth of the cost to each ton of coal, or by charging off one-tenth of cost each year; or it may be done by sinking fund methods. The procedure is largely an accounting feature. But as an engineer interested in the protection of my clients, the stockholders, I want you, Mr Comptroller, to return in some manner, the cost of that equipment.

Now let us turn to the manufacturer of mining machinery. Suppose he installs a new bay of machine tools and that it costs him $100,000. Determined by means to be discussed later, the life of this machinery likewise is ascertained to be 10 years. Do I want 10% returned each year? No. My clients at the end of 10 years are still making machinery. They expect to continue making machinery. What they want at that time is not $100,000.00 but a sum of money that will enable them to install another bay of machine tools capable of performing a like work as the tools just worn out. They want each year, 10% of the reproductive cost of their equipment. Will this be greater? Or will it be less? Will it be composed of the same items? Or will changes in the art require marked departures in the design? No one can foretell. But the engineer can tell you at the end of each fiscal period what the reproductive cost is. And for the following period, there should be included in the costs, one-tenth of this reproduction cost, plus or minus a balancing factor, so that with the amounts returned in previous years, the proper reproductive fund is available at the end of the ten-year period. And this balancing factor cannot be determined by the engineer, or the comptroller, alone. Only by the closest coöperation between them can it be determined.

The amount of depreciation is fixed primarily by the life. Please note that life is the term used, and not *estimated* life. Your records tell you that the average life of a certain equipment has been so long. Now that is a definite fact—that has been. But is it safe to infer that the same type of equipment, or the same equipment if moved to other conditions, will deteriorate at the same rate?

When electrical energy was first offered for sale, it was sold by flat rates, because there were no practical meters for measuring it. But here was a point of contact between two conflicting interests. And accurate meters were soon available. But depreciation is an invisible reduction of value. No one thought seriously about it until recent years. But now there are available scientific instruments that will measure depreciation as accurately, and more quickly, than any electrical meter. I suppose all of you are more or less familiar with the Grand Trunk case, in Canada. Probably all of you feel that there are ample data on the wear of rails to render the computation of proper depreciation a mere matter of figures based on the date of installation and cost. Yet measurements of deterioration were taken on every mile of rail, and the deviation between the actual depreciation as measured, and as calculated, was very great.

The same condition exists in all industries. The engineer has available deterioration meters, if the accountant desires accurate measure to determine his costs. And the consulting engineer demands accurate costs, including reproductive return, in the interests of his clients, the security holders.

What I have just stated regarding depreciation is equally true of obsolescence. Its determination is more intricate, and much space in this article could be devoted to it. I shall content myself with stating that obsolescence must provide reproductive return to compensate for advancement of the industrial art.

The treatment of interest on investment is an accounting feature and any one of you is no doubt better able to discuss it than I. Many a concern would be in better health if its engineers had coöperated with the comptroller in regard to interest.

### Other Uses of Property Records

It is difficult to determine the next most important use of accurate property records. It may be in connection with either taxation or insurance purposes. Whether taxes be a matter of Federal Income, State and Municipal or Estate taxes, accurate, provable, and intelligible property records are essential. The points of contact between engineer and comptroller in the matter of taxation, are so many, and so important, that even those mostly concerned have scarce scratched the surface of usefulness. Just to recount a few: We have prime valuation, invested capital, depreciation, depletion, capital losses, obsolescence, corroborative costs and investment, prime operating costs—in short, any schedule for any class of tax, having to do with investment or operation, can be strengthened by coöperation between comptroller and engineer.

It may for insurance purposes. Here, the clear-cut differentiation between insurable and non-insurable values, saves many thousands of dollars in premiums. And accurate data as to depreciated value, reproductive value, and unexpired life, hasten the settlement of claims, and assure correct recovery.

To the public service comptroller accurate data for use before regulatory bodies is of course, a prime essential. I shall not discuss this phase at all, but for the non-public utility shall group regulatory body affairs under *legal uses.*

This is the most spectacular, and far from least important of the value of accurate property records, and coöperation between engineer and comptroller. It is spectacular because it is usually unexpected, and being unexpected, requires prompt attention, which it generally gets until something else diverts the thought and time of the management, leaving the comptroller, engineer and counsel to work out the solution.

No company can foretell when it will be called before some regulatory or quasi-regulatory body. It may be only because of a refusal on the part of some taxing authority to accept schedules submitted after careful preparation on the part of the accounting forces. It may be a call to appear before the Federal Trade Commission for some real or imagined fracture of the omnipotent act which gives it power. It may be a call to appear before the Interstate Commerce Commission, or state public Utility Commission because of some phase of rate regulation, in short it may be a call to appear before any one of the more than 500 State and Federal agencies which seek to control the course of business. But in any case, where the question of physical, and on occasion, incorporeal property, is involved, both engineer and comptroller can coöperate with profit to all concerned.

None of these have to do with court proceedings which formerly were considered the chief province of the legal profession. But this is still another point of contact. Differences of opinion may easily arise between buyer and seller, between neighbors, and between parties of whom one side had no knowledge of the existence of the other until the issue is joined. No doubt each one of you has in mind some equally important point of contact not mentioned.

All of the above has had so much to do with records, that possibly you are beginning to think the engineer should usurp the function of the accounting forces and keep property records. That is far from the case. The point that I want to make is this: the engineer is an important factor in the design and construction of satisfactory records.

Let us examine for a moment the features which a satisfactory property record should reflect.

First, it must show accurately the complete history of the facilities. Since a facility has its inception in the design of the engineer and is constructed under his direction, he has a need for an accurate record of its physical life. And not the least important of historical data is the historical cost. In order that the engineer's future designs may be tempered by experience, it is imperative for the engineer that the historical cost be accurate, and "engineeringly" interpretable. Likewise, the comptroller demands accurate historical data in order that present investment value may be measured, and future expenditures be tempered by a knowledge of results as revealed by return on investment.

Property Records should reflect past and present status from a value point of view for many and divergent purposes. This involves questions of deterioration, obsolescence, and reproductive costs. The determination of these factors is essentially an engineering function; the calculation, and recording as essentially, an accounting function. And it is highly desirable, almost imperative, that all the above enumerated uses be served by one and the same record. From an investment, from a legal, from an insurance point of view, both the engineer and the comptroller are essential to the design, construction and maintenance of a satisfactory record.

The question that automatically comes to mind at this time is—What assests should be treated in a property record? As a comptroller, you have funded debt and floating debt. An analogy could almost express the formula of property record content. The terms "fixed assets" and "floating assets" are frequently used. I like the term "floating asset" properly applied. But the term "fixed asset" is too limiting. It very properly is usually restricted to assets affixed directly or indirectly, to the real estate.

The most satisfactory method is to let the life of an asset, modified by its importance, determine its placement. Certain taxing and regulatory bodies have held that any asset which has a life of more than one year is a capital asset. To me this has always seemed more theoretical than practical. Many small hand tools have a life much longer than one year. Yet to call these capital assets individually is a costly expedient. These are being constantly replenished Some last a few days, others as many years. Unquestionably then, a group inventory system is far more convenient, and for all practical purposes, a sufficiently accurate method of capitalization. In certain branches of the chemical industry, on the other hand, expensive pieces of apparatus have lives materially less than one year. It would be equally absurd not to include such items in the property record.

So in each industry, the close coöperation of engineer and comptroller are essential to correct capital accounting and property records.

## PHASES OF PROPERTY RECORDS

It has been said that an engineering project passed through three phases, each successively of less importance. Let us examine the creation of a property record in the same light.

From a legal point of view, the work must be done by independent parties. Most regulatory bodies, including all Federal taxing and most State rate regulating bodies adhere rigidly to this rule.

The courts have emphasized this feature repeatedly.

Fortunately the leading cases are sufficiently long established to constitute satisfactory and easily accessible precedent. And Whitten in his "Valuation of Public Utilities" has made the legal phases readily accessible to the lay reader.

First, there is the assembling of data, and winnowing of the mass, to determine the pertinent facts. This means the correlation between what is customarily contained, and what is essential for a particular industry—and a particular concern which is paying the bill for such work. Such a study involves a knowledge of the industry, a perception of the legal restraints, and careful analyses of the particular case in hand. For some, the quantity production of Ford meets all requirements. For others, the stability and life and prestige of Packard is essential.

The second phase of property records is a proper design. In this connection a close coöperation between the engineer and the comptroller is required in order that the record may serve the fullest measure of purpose, and tie into the books. And it must be efficient. Any job that doesn't pay dividends isn't good engineering. No, I'll go one step farther and say it isn't engineering at all.

Needless to say, this problem of design may range all the way from quantity production to an accurate fitting of special conditions. No fixed rule can be promulgated.

And this leads to the third phase. How is a property record built? Two ways are available, and most records are a combination of the two. These are: (1) by reconstruction, and (2) by contemporaneous record.

Let us discuss the second method first. For sake of clearness, managerial and directorial responsibility have been and will be omitted throughout this entire discussion. The inception of a capital asset is in the province of the engineer. He prepares his estimates and sends these to a higher authority for approval. The comptroller is called upon for information as to funds and finance. If he is to have satisfactory accounts, he wants controlling records of these expenditures. And in controlled expenditures is the foundation of contemporaneous property records. Whatever you may call it, appropriation, authority for expenditure, or authorization, it should be the "original source" for the property record.

Taking up the first method, the establishing of a property record by reconstruction, presents an entirely different problem. There may have been no records of controlled expenditures. Records of all expenditures may be missing or unavoidable. Even the property the history of which is so essential for any one of a dozen reasons may be missing. But in any event, the foundation of a reconstructed property record is an appraisal.

## Appraisals

Three words are virtually synonymous, namely: appraisal, appraisement, and valuation. The legal profession seems to favor the term "appraisement." But among engineers, the terms "Appraisal" and "Valuation" are usually employed. And a distinction is beginning to grow between these two. "Valuation" is more usually employed in connection with the determination of the value of some natural resource, but in any event, it is the placing of a value on an asset by personal opinion. Rarely is any scientific precaution taken to eliminate the personal equation. The professional reputation of the engineer is the prime basis of the valuation. "Appraisal" on the other hand denotes the scientific application to the assets, of prices and proven values as of specific dates, and then by use of determinative factors, reduction of this valuation to the required date. Every step of the process is traceable, and checkable, and the personal equation is eliminated as far as the cost of so doing is justified.

Both valuation and appraisal are based on accurate inventory. And an accurate inventory means the personal inspection of a competent lister. It may mean the measurement of deterioration as well. But under any condition it means a painstaking determination, item by item, of quantity, and frequently the quality, of every asset the presence of which is justified in the property record.

Appraisals are of two broad groupings: contemporaneous and retrospective.

Contemporaneous appraisals, as the name indicates, apply present day prices to the inventory items. These may, or may not, as occasion determines, be adjusted for deterioration.

Retrospective appraisals apply costs as of some specific date, other than the present, to the inventory items. Likewise, these may, or may not, as the occasion demands, be adjusted for deterioration.

Appraisals are of many classes, to fit the purpose in hand, or the limits of allowable time and cost. I will not endeavor to even mention the various types. But to give an idea of the scope, two will be described. The simplest is a mere pricing of the inventory. This is called a rate appraisal, as the most elementary form of inventory includes certain items of freight, cartage, and erection.

One of the more extensive is a reconstructed, compensated and adjusted retrospective appraisal. By "reconstructed" is meant the re-determination of costs based on the changes in the art. Thus a few years ago most building excavation was done by wagons and pick and shovel. Today it is done by tractors and trailers, or motor trucks, and steam shovels. The engineer who makes such an appraisal must study carefully the plans and specifications, reconstructing these, if necessary, and lay out his construction plant just as it would have been done on the date selected as the focal date.

By "compensated" is meant the adjustment necessary to provide for changes in value due to use. Thus the embankments of a canal settle, and to a certain extent improve with age. And while this improvement occurs, there is a paralleling deterioration, which must be considered. These two factors must be compensated.

By "adjusted" is meant the adjustment for change in value due to deterioration. Thus a structure may have been erected in 1910. In 1918 it is purchased by a certain group of interests. In 1924 these interests have a parting of ways. A value as of the date of purchase is desired. The inventory is priced as of the date of purchase. Then, based on such corroborative data as is obtainable, an adjustment of this value for the five years of life prior to the purchase is made.

The obtaining of corrobrative data is a problem in itself, which I will not attempt to discuss. But it is my hope that these citations of points of contact have shown you a few of the many ways in which the comptroller and the engineer can join forces to the lessening of the labors of each, and the saving of many dollars to their employers—the investing public.

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