did have "A", and afterwards will have the equivalent of "D". The real injury wrought to the property owner is the difference between the values of his original lot "A" and the lot he has later, "D". Then

A — D = DAMAGES.

This theory is expressed by the phrase "Taking damages off the rear". This theory saves our cities vast sums in street widenings without taking from any individual anything to which he is honestly entitled.

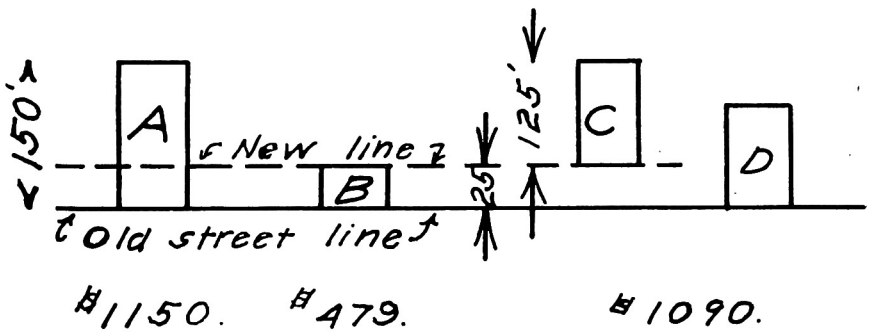

FIG. 4.

On many streets in Hartford there are deep building lines established by the city. No building can be erected between the building line and the street. In street widening awards the city has held that, because part or all of the land taken could not be built upon, that restriction ought to be taken into account in fixing damages. Because of the way in which this restriction was applied to the damage calculations, the city has not had uniform success. The appraisers applied the building line restriction as a sort of adjustment to the damages, after subtracting A — D, with results which were unfortunate. More properly, the building line should be considered in fixing the value of "A" in that formula. Experience is a good teacher and next time things may be done correctly with better results.

The public may take rights over or through property without taking full rights in the land. Thus it may take a right-of-way for a sewer or something which does not prevent the use of the same land for other purposes. Or a city may impose a restriction on the use of some land, as by a building line. In these cases the same general rule for determining damages applies:—

VALUE BEFORE
less VALUE AFTER
DAMAGES.

In this case the value before is the value of the land when not subject to the right-of-way or whatever right is taken. The value after is the value of the same land when subject to those rights.

As a matter of fact, most takings of property under eminent domain are but takings of limited rights to use the property for a specific purpose. Very rarely does such a taking, in theory, amount to the taking of full ownership. Any discussion of this feature would lead the writer into legal fields, outside the scope of this paper. But engineers should know the meaning, the legal significance of the word "take" and others which enter condemnation proceedings. Failure to grasp the force of these terms may lead one into costly difficulties. Knowledge of them may enable the engineer to accomplish projects at a considerable saving.

Hartford has tried to anticipate future street widening needs at a minimum of present expense by applying this theory of taking only limited rights. On certain streets the city has taken nominal rights in the land on the side of the street, back to proposed future lines, without paying at the present time for such trees, fences, and other things as were standing in the widening strip. The city has tried to delay paying for the things standing on the land until some future time when they would be actually removed to make room for physically widening the street. Meanwhile some of the trees etc. would disappear from other causes, some would never have to be paid for. Meanwhile the city would be spared the investment to pay for things which the owners still used and enjoyed. The city's theory has been questioned. The exact form of procedure has been criticised. Appeals involving these are now pending in the Supreme Court.* When those decisions are

* Since this paper was presented at the 49th Annual Meeting of the Society, the Supreme Court of Errors has rendered a decision in the appeals of The Fourth Congregational Church, Louis Schreiber, Inc., and Eidel Sudarsky et al., each vs. City of Hartford. The Supreme Court found that the vote by which these takings were made only nominal or paper takings, for future use, was invalid because the vote was taken by only the Board of Street Commissioners, without report to or action by the Common Council. That if the city has such power to make paper, or nominal takings, it lies in the Common Council; that the exact rights taken should be carefully described, should be more exactly defined than was the case in the vote on this particular project; that further, the owners should be assured of a future award of damages and assessment of benefits in the regular form to cover the further rights taken when the physical widening actually occurs. Thus these appeals are decided by a technical flaw in the form of vote, without passing on the general broad principle described in the text. But, if one may read between the lines of the Supreme Court decision, one may imagine that the fundamental principle of such provision for future needs might have been allowed, had the details of its execution been different.

handed down more will be known as to this way of making awards. If some procedure along this line can be made possible, our cities will then be able to do some long distance planning and to provide for future needs at a minimum of present expense.

The engineer working on damages and benefits should know somewhat of real estate appraising. In a paper of this length the writer can only touch on a few points. For more complete information one must turn to the many books written on this subject. Probably for the man just entering this field Zangerle's "Principles of Real Estate Appraising" is the best text.

Real estate may have several kinds of value, known variously as "replacement value", "sound value", "market value" etc. depending on how the value is fixed and the purpose for which it is to be used.

In condemnation cases the public is governed by "market value", which is defined in Connecticut as "That value which a willing buyer, willing but not forced to buy, would pay, and which a willing vendor, willing but under no pressure to sell, would accept" The author always likes to qualify this definition with the assumption that both hypothetical buyer and seller are intelligent persons, acquainted with all pertinent facts and able to interpret and apply those facts.

There are other definitions of "market value" which may have as much, or more, merit than this definition used by our Connecticut courts.

This rule of market value leads directly to a discussion of one very common error in appraising the values of buildings and structures. Many people, including many engineers, assume that one may figure the present cost of erecting a given building, discount this by some percentage corresponding to the degree to which it is physically worn out, and call the result the value of the building. What relation does replacement, less physical deterioration, bear to the price which a buyer might pay, which a seller might accept? Often no relation at all. That certainly is not ordinary market value.

There are occasional buildings etc., built and suitable for only some special purpose for which there is no ready market. Sometimes to value such special structures one must resort to cost less deterioration. But that mode of fixing values is to be used only when no better way can be found.

This mention of building values leads directly to another popular fallacy. Many people think that the value of a whole property should be determined thus:—

LAND VALUE (as for vacant land)
(add) + BUILDING VALUE (figured as just described)
WHOLE VALUE

That is wrong, for it puts the cart before the horse. The correct calculation is:—

VALUE OF WHOLE PROPERTY (determined from sales of similar property, income, or some other way)
(less) — VALUE OF LAND (in event land were vacant)
VALUE BUILDING (or more properly the amount which the presence of the building adds to the value of the land.

Calculated in this second way, the figure assigned to the building or structure takes into account whether that improvement suits the spot where it stands. Obviously a building which is ill suited to the place where it stands, or a building of obsolete type of construction, is not worth what it might cost to exactly reproduce it. An Empire State building, standing in the middle of a farm, or a cow stable on lower Broadway, would either of them be practically worthless.

Since land can not be moved, can not be destroyed, while improvements on the land can be altered, one may assume that the value of the land in any particular case is fixed. Any improvements which have been made on the land have merely been added to, or detracted from, that value.

It is impossible to precisely determine the exact value of any particular piece of real estate, for reasons which the writer does not take space here to explain. At best, the value assigned to any piece of real property is only an approximation.

But there are logical ways of comparing the values of lots which are similar in certain respects. If the value of one lot is known, the values of similar lots can be estimated, taking into account one or two features in which the lots may differ. There are ways of recognizing and evaluating many of the factors which effect land value. Engineers engaged in appraisal work should be familiar with the more common of these. Strange as it may seem, the engineer may be able to apply the appraiser's own tools and real estate tables more accurately than most real estate men. Engineers are analytical; they are mathematicians. Most real estate men are salesmen. Applying depth tables, corner influence tables, sinking funds etc. are analytical and mathematical operations.

Most city land, being suitable for business buildings or residences, should be valued by the front foot. The amount of street frontage

determines the amount of use which can be made of it; i. e. the number of buildings, stores, etc. which can be erected on it. The value of such land goes up more slowly than the depth of lots increases. The values of such lots vary about as the square root of the depth, or if we have a constant "c" which represents a factor for location etc., a factor derived for a standard lot, than we may say

$$\text{VALUE} = c \sqrt{\text{depth}}$$

The writer does not take space here to explain why this is so, nor to go over details of depth tables, their history, types and uses. Depth tables are used for comparing lots which are similar in all respects except depth.

Neither will the writer discuss in detail various corner influence tables, etc.

As an example of the way depth tables work out, the writer turns to the street widening illustration in Fig. 4. Suppose that the original lot "A" were 150 ft. deep and worth $1,150. That the street was widened 25 ft. on that side, taking 25 ft. from the front of that lot. Then "B", a lot equal to what is taken would have a value, by the depth table, of about $479. "C" or "D" would be 150 ft. less 25 ft. or 125 ft. deep. By depth table, in comparison to "A", a lot 125 ft. deep should be worth about $1,090. The damages then are A — D or $1150 less $1090 = $60. Not B which was $479. Note the effect on our public treasuries of this theory of damage.

By contrast, when other things are equal, the value of most industrial or farm plots varies directly as the area. The quantity which can be produced on such a lot varies directly as the area, regardless of the ratio of front to depth. Hence land of these kinds would be valued, not by frontage, but by area units.

But there are exceptions to all rules. Some real estate men in Hartford persist in trying to value industrial land by the front foot. And in some places it is customary to express the values of all kinds of land in terms of square feet. Those are poor local customs. The logical way to value most ordinary urban land is by the front foot; most industrial or agricultural land by area.

When only part of a building or plant is taken, the questions of alterations to, and value or utility of the parts remaining may be very complex. Schemes must be devised to adapt what is left to further use, if that is possible. What is to be left, after alterations have been made, must be valued. There may be many schemes of alterations possible. The first scheme worked up may not be the best. Several schemes may

have to be tried out. Right here, let the author warn any engineer working on this sort of problem to test any scheme he devises by the possible criticisms which a man on the other side of the case might make of it. A claimant may insist that the only plans which are feasible are those which are expensive. A municipal engineer may feel that some inexpensive plan is adequate. Both should try to check their schemes from the other man's point of view.

Each feasible plan should be estimated, both as to the cost of executing the plan and as to the value of the property after the alterations were finished. The award of damages should be based on that scheme which indicates the least damage, taking into account both cost of alterations and value afterwards.

But in estimating alterations, one should also consider the possibility of total demolition of the building, total loss of the structure. It may not be worth altering. If this indicates a still lower award of damages, it may be made the basis of the award.

To show what may be involved in problems of this class, the writer mentions a recent Hartford case where three or four general schemes for altering a plant were considered, six actual plans and estimates for executing these were introduced in evidence before the court, all in addition to estimates assuming the total destruction of the buildings. All these were laid before the court in addition to several schemes which were considered outside but never reached that far.

In order to properly estimate the value of the property after alterations are made, in any complex case, floor plans etc. should be sketched out and furnished to the real estate appraisers. But detailed structural plans are seldom needed.

Devising schemes for altering buildings and structures, estimating the costs of alterations etc. are ordinary engineering operations. They need not be elaborated on in this paper. But the writer would urge that all engineers engaged in such problems be honest in their selection of feasible plans, in their estimates of cost, and in their presentation of them. Let us not, as engineers, sell our birthright of a reputation for integrity for a mess of pottage, in order to help someone put across a wild claim for damages.

But whatever scheme of alterations may be made the basis of an award, the owner is in no way bound to ever construct that plan. Once an owner receives his damage money he may do with that money as he pleases. The plan used in estimating damages may never be heard of again.

Estimating damages and benefits, checking the claims and estimates of others, defending awards and assessments is very interesting work. One can use his engineering skill, whatever knowledge he may possess of economics, real estate appraising, salesmanship, psychology and lots else. New ideas come up for study. Old problems take new forms. The writer has seen elaborate claims for damages worked up and presented in what appeared to be convincing form, yet which, when properly analyzed, were no basis for damages at all, in a few cases were actually a possible argument on the other side of the account.

When the author first undertook to prepare this paper he had visions of sketching out various interesting problems, analyzing them and working them out here. But first he had to outline the fundamentals of this subject, and that has taken all the space which should be given to this subject on this occasion.

The writer has tried to briefly show why engineers engaged in the design and layout of public works should know somewhat of appraising damages and benefits. He has sketched a few of the general rules governing such awards and assessments. He has tried to outline what may lie before the engineer who goes into this line of work. To go over this more thoroughly, to cover the whole field would far exceed the length of this paper. In fact, whole books have been written on particular branches of this work. The writer has tried to state a few fundamentals, and that is all the extent of this paper will permit.

How Long is an Inch?

Since the Bureau of Standards assumed responsibility for the maintenance and promulgation of UNITS in 1901, it has been considered best to adhere to the basis which had been established by the Weights and Measures Office of the Coast and Geodetic Survey in 1893.

The Inch as used by the Bureau is therefore not 25.4 millimeters, but 25.40005. In other words, the present United States Inch is larger by two parts in a million than the value which it is proposed to adopt as an American industrial standard.

American Standards Association
New York.