

CONSTRUCTION BY CONTRACT AND BY DAY LABOR

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SYNOPSIS

The relative advantages and disadvantages of public works construction by means of day labor or contract are discussed and data from two surveys are presented

Under the day labor method a public agency performs the work with employees hired for the purpose. There are five forms of the contract method: cost plus percentage, cost plus fixed fee, negotiated lump sum, competitive lump sum and competitive unit price. Most public road and street construction is done by the unit price contract method.

Prequalification of contractors and the facilities of the Bureau of Contract Information are discussed as factors in successful public work contracting.

Under authorization of the Congress and with the cooperation of the Bureau of Public Roads (now Public Roads Administration) 46 States and one Territory built 53 highway projects by day labor after first taking competitive bids in order to get a basis of comparison of the two methods. The total cost of the 53 projects by day labor was 18 per cent in excess of the bid prices. On 40 of the jobs the day labor cost exceeded the bid prices by 31 per cent and on 13 the cost was less than the bid prices by 10 per cent.

In a survey of county practices conducted in 1941 by *Public Works* by questionnaire 62 per cent of 595 counties replying reported in favor of day labor and 38 per cent in favor of the contract method. Generally, contract work was favored for heavy excavation, large bridges and high type paving, which types of work are relatively infrequent in county operations. Advantages of day labor appeared to be most apparent on small operations.

It is concluded that, except under most favorable conditions, contract work is superior in economy and efficiency to day labor.

In the expenditure of funds for the accomplishment of public construction projects two principal methods are recognized. One of these is known as the "day labor method" and the other as "contract construction."

The best information available at this time on the relative merits of day labor and contract construction consists of statements by authorities whose chief occupation has been construction and of the results of comparative research on the two systems.

This report relates principally to highway construction and has for its purpose to define the contract and day labor systems, and to compare the advantages and disadvantages of each.

DAY LABOR METHOD

Day labor construction is a procedure whereby a public agency itself undertakes the work with employees hired for the purpose

In this connection the terms day labor and force account may not be used synonymously although common usage makes no distinction between them. Force account is the term used under a contract to designate extra work done by the contractor for which no price was bid in the contract. Whereas, day labor is the term applied to construction that is accomplished by the owner with his own organization.

FIELD OF USE FOR DAY LABOR

Advocates of day labor procedure claim that it saves the contractor's profit, that it readily permits changes in original design or scope of project without cumbersome negotiation, and that it enables the owner to maintain direct control of every feature of the operation at all times. However, day labor has several proved weaknesses which for the most part have limited its application to exceptional situations. In the first place it is

highly vulnerable to political manipulation. In the second place no certain means are provided whereby ultimate cost of the completed structure can be fixed in advance. In the third place a construction organization recruited for day-labor work usually lacks the background of teamwork, experience and driving accomplishment which speedy and economical construction require.

The day-labor method may be used to advantage on public works where much employment must be given quickly and costs may not be an important factor. The day-labor method may be used on new or unusual types of construction, on projects of unprecedented size, experimental undertakings or projects for which a schedule of work items cannot be set up. A number of major projects have been constructed by day-labor after bids were received and rejected including the Panama Canal, the Miami Conservancy District and certain locks and dams along the Ohio River.

Reasons advanced to justify day labor on highway work are better employment of common labor, proximity of supervisors and equipment operators living in the vicinity of the project, better use of local materials and saving in construction costs. It is believed by some that day labor construction can be carried on at a cost equal to that for contract construction provided projects adaptable to day labor are selected and competent supervision is employed. Types of highway work adapted to day labor methods include clearing of right of way, clearing of ditches and culverts, improving shoulders, removal of obstructions to improve sight distance, widening curves, improvement of slopes, minor drainage construction, and resurfacing secondary roads.

In investigating costs of day labor construction all essential and appropriate items must be included if the true cost is desired. Essential items that sometimes are omitted include charges for overhead, depreciation of equipment, equipment rentals and other items of less importance.

Plans and specifications for new highway construction are well standardized. A large number of contractors are well acquainted with the requirements for highway construction. Consequently probable cost can be estimated in advance of the construction.

Under the day-labor system, plans, specifications and detailed cost estimates usually are not available at the time of starting the project and the final cost may remain unknown until long after the work is completed.

CONTRACT SYSTEM DEFINED

Under the contract system a single construction agency assumes the full responsibility for the completion of the project. The contractor usually agrees to furnish all labor, materials, equipment, required for the construction and to complete the work according to plans and specifications. The contractor also agrees to protect the owner from all losses due to damage suits, liens or other causes. He provides highly specialized skill, assumes the financial responsibility for the completion of the work, and is usually required to complete the work within a specified time. The owner does not assume any financial responsibility for the completion of the work.

There are several forms of contracts which include the following:

- Cost plus percentage contract,
- Cost plus fixed fee contract,
- Negotiated lump sum contract;
- Competitive lump sum contract and
- Unit price contract

COST PLUS PERCENTAGE CONTRACT

Under this form of contract the contractor agrees to complete the project for its actual cost plus a fee for his services. Such fee may be on a direct percentage of the cost, or on a sliding percentage of the cost.

COST PLUS FIXED FEE

The contractor under this form agrees to complete the project for the actual cost plus a stipulated amount.

NEGOTIATED LUMP SUM CONTRACT

Under the provisions of the lump sum form of contract the contractor binds himself to furnish all the materials and labor and to complete the project for a stipulated amount. In this case the owner negotiates with contractors selected by him as competent to handle the work.

COMPETITIVE LUMP SUM CONTRACT

By the lump sum form of contract the contractor agrees to furnish all materials and

labor and to provide a completed project for a stipulated amount determined as a result of competitive bidding.

UNIT PRICE CONTRACT

Under the unit price form of contract a price is bid for each unit of construction as set up in a bid schedule.

After an exhaustive study and discussion of contracts "Cost Plus" and other forms, J. A. L. Waddell, the well-known consultant and engineer recommended in the 1919-1920 Transactions of A S C E an Ideal System of Contract-Letting and Profit Sharing which among other desirable features calls for each bidder to submit unit-cost prices.

Substantially all highway construction done by the State Highway Departments with or without federal aid as well as street work done by the larger municipalities is by the unit price form of contract.

FEDERAL AID

Federal aid highway construction is carried out by contract methods using the unit price type of contract. Under the rules and regulations for such construction it is required that no part of the Federal money set aside on account of any project shall be paid until it has been shown that adequate methods, either advertising or other devices appropriate for the purpose were employed prior to the beginning of construction to insure economy and efficiency in the expenditure of such money. An advertising period of two weeks may be accepted provided a suitable mailing list of contractors is maintained by a State highway department to whom notices of new work are mailed, and adequate public advertisement over a specified period is carried out.

Substantially all contracts for the construction of Federal aid highways require the contractor to furnish all materials entering into the work.

No procedure or requirement will be approved which is designed or may operate to prevent a submission of a bid or the award of a contract to any responsible contractor whether resident or non-resident of the State wherein the work is to be performed. Federal legislation and regulations are specific with regard to highways constructed with Federal

aid and they are recommended for study and use.

PREQUALIFICATION

An important procedure in the administration of public works by contract is the prequalification of contractors. This has been rather widely adopted in one form or another although its greatest peace-time use appears to have been in connection with State highway construction. Nearly all the states, except those in the northeast corner of the country, have laws or regulations dealing with the subject.

During the war emergency, prequalification has been a necessary proceeding in connection with awards of Federal cost-plus-a-fixed-fee and negotiated lump sum contracts and in selection of invitation bidders.

Among the advantages commonly attributed to prequalification are the following.

1. It provides adequate time for determination of the contractor's qualifications before bids are received, thus obviating the necessity for hasty, and frequently incomplete investigation of the low bidder after bids are opened.
2. It eliminates pressure often brought to bear upon the awarding authority to accept the bid of an unsuitable contractor.
3. It prevents the public criticism which sometimes arises when an awarding authority disqualifies the low bidder and makes the award to a higher one.
4. It influences contractors to build up their qualifications to definite standards and thus creates a larger group of qualified competitors.
5. It discourages the activities of shoe-string operators, so called, who do not possess the responsibility or resources necessary to surmount unforeseen construction difficulties.

On the other side of the question the following arguments are sometimes advanced.

1. Prequalification opens the way to restriction of competition for political reasons or to favor local contractors.
2. It offers an opportunity for collusive bidding, especially if the qualified bidders are regularly in competition with each other.

3. It retards participation by new organizations which, through process of small beginnings and sound growth, would eventually qualify and replace organizations retiring from the field.
4. It becomes a factor in the establishment of trade barriers between the states, thus restricting interstate commerce and free competition.

Experience covering the past fifteen years appears to have justified the arguments in favor of prequalification. There seems to be little doubt but that the idea is a practical and helpful one, capable of producing beneficial results. In those occasional situations where the procedure has proved relatively ineffective the reason usually may be traced to defects in the laws or regulations governing its operation. During the war contractors have accustomed themselves to Federal prequalification and there is cause to believe that the subject will obtain wider recognition when peace returns.

Standardization of forms and data requirements would perhaps do more than anything else to promote the use of prequalification.

CONTRACT INFORMATION

Information about prospective contractors is important to successful operation by the contract method. Since the first World War facilities have been provided whereby officials and financial interests can obtain needed information regarding the qualifications of contractors. In 1926 committees representing the principal technical, official and trade organizations interested in construction, recommended establishment of an independent agency which would investigate the business reputation and construction ability of contractors. As a result of this recommendation in 1929 construction and surety interests cooperated in the establishment of the Bureau of Contract Information. It is an independent non-profit institution financed principally through subscriptions from nearly all important bonding companies. Its principal function is that of a clearing house which assembles and verifies data regarding the background and capacity of contractors. This information, in factual, unbiased form, is available without cost to those charged with the responsibility for making contract awards.

Each State highway department usually

maintains a file of information relating to the performance of contractors within the State and this information is available for exchange between the States.

SUMMARY OF THE ADVANTAGES AND DISADVANTAGES OF THE CONTRACT SYSTEM

Contracts wherein the owner assumes the risk and pays the contractor a fee for services have been proved to be uneconomical for ordinary employment in connection with public works; and this type of contract has been limited principally to emergency use and to unusual projects where the estimation of costs within reasonable limits is impossible.

The negotiated lump sum contract usually involves submission of a proposition by a contractor and subsequent negotiation between him and the owner, using his proposition as a basis. Purpose of the negotiation is to arrive at a lump-sum contract price acceptable to both parties. This form places upon the contractor full responsibility for completion of the work in accordance with plans and specifications and in compliance with all terms of the contract. Its principal disadvantages are that it may not develop the lowest obtainable contract price and that it affords an opportunity for favoritism or for collusion between the negotiators.

The most widely used and most firmly established means of carrying on public construction is that of open competition on a lump sum or unit price basis and award made to the lowest responsible bidder.

Experience has shown that successful routine employment of the competitive contract method requires,

1. Full and clear plans and specifications available in advance.
2. Sufficient notice to prospective bidders
3. Opening of sealed bids in public, surrounded by safeguards designed to prevent bid manipulation.
4. Prompt award at prices offered by the lowest qualified bidder.
5. Exaction of a binding third party indemnity against loss.

This last requirement, that of third party suretyship, is one of the most important factors in the success of modern contract construction for it brings in a separate outside

resource, distinct from but bound with, the contractor.

RELATIVE ECONOMY OF HIGHWAY
CONSTRUCTION BY CONTRACTOR
AND BY DAY LABOR

In carrying out the program of Public Works highway construction authorized by the Act of June 16, 1933 it was required that each State undertake to construct one or more sections of highway with forces employed directly by the State. The purpose of the requirement was to determine the relative economy and efficiency of highway construction by contract and by direct employment of labor.

At hearings concerning Emergency Construction of Public Highways, before the Committee on Roads, House of Representatives, January 22 and 23, 1935, the Commissioner of Public Roads, then Chief of Bureau, stated in part regarding the project as follows:

"In order to get a reasonable measure of the relative efficiency of contract and force account work,¹ we required each State to undertake at least one project by the force-account or direct-labor method. These projects were selected after bids had been taken in order to know what the work would cost if let to contract. The States have kept very careful records of the cost of doing the work by force account, and, while we have not the final records, in practically all cases the cost has been higher by force account—some materially higher.

"There is no question about the quality of the work performed, and the increase in cost is not an entirely fair comparison, because the States were not operating this method on a large scale. However, there is no question about the relative economy of contract work versus force-account work under the supervision of the public bodies.

"The principal reason, I think, is that it is very difficult to get the same loyalty and performance from either material suppliers or the employees on the job, to the public, as the contractor can secure."

Forty-six States and one Territory constructed 53 sections of highway that were considered representative of the work generally done. The sections of highway were

selected from advertised work after bids had been received and publicly opened and without advance determination.

Construction was executed under the same requirements as for contract work, adhering closely to the original plans. Labor was obtained through the local reemployment agencies when available. The regulations governing wages, hours of employment, and the use of equipment that were applicable to contract work were observed.

As the work progressed the State highway department kept detailed cost records of expenditures classified according to the items upon which bids were received and of general charges to be prorated among the various items. These data were submitted to the Bureau and are the basis of this portion of the report.

Each highway department was considered as a contractor. With two exceptions compensation and liability insurance premiums that would have been paid had the work been performed by contract, were included as a part of the construction cost and no payments of damages were included. In one State neither premiums or payments of claims are included. In another State actual payments of damages exceeded the estimated premium and the actual payments only were included. The cost of a bond for faithful performance was not included.

The 53 projects selected for the test totaled 244 miles in length and were of various types of construction. Substantially all projects were graded and drained and were surfaced with concrete pavement, a granular type surface such as gravel or stone or with a standard type of bituminous construction.

The total cost of construction by the force account method was \$3,942,879 an increase of \$593,126 or 18 per cent over the total of bid prices of \$3,349,753.

On 40 of the jobs aggregating 176 miles or 75.5 per cent of the total projects the cost exceeded the bid price. The cost of these jobs by the force account method was \$2,944,773 an increase of \$703,384 or 31 per cent over the total of bid prices of \$2,241,389. Comments were received on the efficiency of management of 29 of the jobs in this group. They are summarized as follows:

- (1) Eighteen reported as inefficiently managed.

¹ In this statement "force account" is the same as "day-labor."

- (2) Two reported as inefficiently managed and subjected to outside interference.
- (3) Four reported efficiently managed.
- (4) Five on which the State claimed contractor's bid did not include ownership expense of equipment.

Thirteen jobs, totaling 68 miles in length or 24.5 per cent of the total were completed at a cost less than the bid price. The cost by force account was \$998,107 a decrease of \$110,257 or 10 per cent under the bid price of \$1,108,364. Six of these jobs were reported as efficiently managed, one was reported as inefficiently managed, and no comment was made for six of the jobs.

may have increased the day labor costs on certain projects.

As a result of the cooperative investigations it is believed that one of the principal advantages of the contract system over the day labor method has its inception in the self interest that is characteristic of human nature. Employed supervision, not having a monetary interest, does not have the same incentive as a contractor who enjoys the financial rewards and to whom losses are a personal penalty. He is spurred on by the knowledge that he must maintain efficiency or be forced out of business.

These tests of the day labor method, with

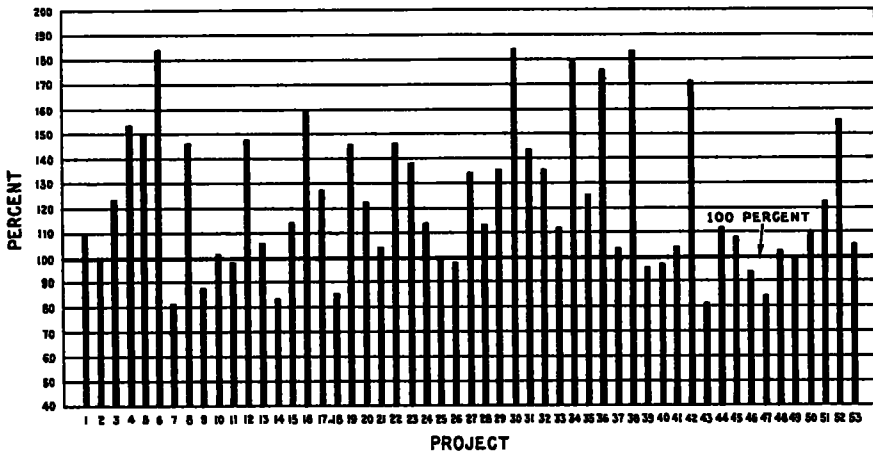


Figure 1. Comparison of Contract and Force Account Costs Based on Contract Cost Being 100 Per cent

Figure 1 shows graphically the comparison of contract with day labor costs, based on contract cost being 100 per cent.

Since the State highway departments had not been constructing highways by day labor on a large scale it was conceded that the day labor costs would have been slightly lower if the States had had more experience and time for preparation.

Some of the States lacked equipment and personnel with which to handle the work.

The regulations required competitive bids for supplying equipment on a rental basis and for supplying materials. A contractor probably would have used his own equipment and could have purchased materials as he chose. It is claimed by some that these requirements

few exceptions and those only where conditions were most favorable, show the advantage in economy and efficiency of construction under the personal supervision of a contractor who has suitable equipment.

DAY LABOR VERSUS CONTRACT IN COUNTY ROAD WORK

In 1941 Public Works Magazine, New York, undertook to determine which was considered more advantageous for county work, construction by contract or by day labor. Of nearly 1,000 counties answering the questionnaire, 595 gave definite replies, 368 or 62 per cent found day labor more advantageous while 227 or 38 per cent reported that contract construction was better.

In some States practically every county followed the same system while in others both methods were used. For instance in Iowa, 41 counties reporting, contract construction was almost universally favored; but in Kansas, the 50 counties replying were in favor of day labor.

With regard to efficiency and quality of work 28 counties out of 47 reporting stated that a better job was done and the work was more efficient by contract while 19 favored day labor for the same reason.

Generally contractor equipment was favored for heavy excavation and for high type paving which, however, were constructed by relatively few counties. Day labor was favored because it employs local men and more money stays in the county and because it made it possible to build up and maintain a force of trained men.

There was general agreement that day labor is more flexible and convenient than contract work and that it permits small jobs to be done without delay.

A majority of those reporting on the subject of control and planning considered the contract method better for estimating costs and for planning in advance as well as for controlling funds.

A relatively small number of engineers favored the contract method because it eliminated "petty graft and politics," while one felt that day labor was preferable for the same reason.

Many of those making a reply felt that there is a place for both the force account and contract methods. In essence these men utilized contract construction for big excavation jobs and large bridges, neither of which most counties were well equipped to do, while day labor was employed on smaller jobs and on the usual work for which the county-owned equipment was adapted.

Necessarily most of the reasons for these beliefs were based on local conditions and local experiences.

SUMMARY AND CONCLUSIONS

The day labor method may be used to advantage on public works where much employment must be given quickly and cost may not be an important factor. Day labor should not be used as an economy measure or

to secure better or quicker construction at low cost.

Types of highway work adapted to day labor methods include clearing and grubbing of right of way, clearing ditches and drainage structures, improving shoulders, removing obstructions to improve sight distance, widening curves, flattening slopes, resurfacing low type roads.

The day labor system of highway improvement is quite universally followed by town officials, officials of small cities, county authorities, and by State bodies when the work involved is classified as maintenance work.

Under the day labor system plans, specifications and detailed cost estimates usually are not available at the time of starting the project and the final cost may remain unknown until long after the work is completed.

The most widely used and most firmly established contract form of carrying on public construction is that of open competition on a lump sum or unit price basis and award made to the lowest responsible bidder.

The principle reason for the success of the contract system is that with other systems it is difficult to obtain the same loyalty and performance from material suppliers and employees that the contractor can secure.

Suitable equipment is essential to the success of either contract or day labor procedure.

Substantially all new Federal aid construction is carried out by the contract method using the unit price type of contract.

Substantially all new highway construction done by the State highway departments with or without Federal aid as well as street work done by the larger municipalities is by the unit price form of contract.

Experience covering the past 15 years appears to have justified the practice of prequalifying bidders. The practice is considered to be practical, helpful and capable of producing beneficial results.

The tests made by the Public Roads Administration to determine the relative economy and efficiency of highway construction by contract and by day labor show that construction by contract is more economical and more efficient than when done by day labor under the supervision of public agencies.

Briefly stated it appears that unless working conditions are favorable, supervision compe-

tent and the undertakings free from political and partisan interference, construction of new projects by day-labor is likely to be high in cost and low in quality.

REFERENCES

Federal Legislation and Rules and Regulations Relating to Highway Construction Administered by the Public Road Administration. Hearings before the Committee on Roads, House of Representatives, Seventy-Fourth Congress, First Session, January 22, 23, 1935
Transactions of the American Society of Civil Engineers, 1919-1920.
Proceedings, Association of Highway Officials of the North Atlantic States—1934.

American Association of State Highway Officials.
Highway Administration and Finance, Agg and Brindley, 1927.
American Road Builders' Association, Proceedings, 1935-1936.
Estimates and Costs of Construction, Frank Whitworth Stubbs, Jr.—1938.
Economics of Construction Management, J. L. Harrison—1932.
Force Account on Unit Price Construction Contract—A Report by the Bureau of Municipal Research of Philadelphia—1928.
The Associated General Contractors of America.
Bureau of Contract Information, Inc.
Public Works Magazine

WAGE EARNER EMPLOYMENT RESULTING FROM HIGHWAY CONSTRUCTION

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*Bureau of Labor Statistics
U. S. Department of Labor*

SYNOPSIS

Employment data are reported from 508 highway projects built under PWA allotments costing a total of \$23,101,018. Most of the work was by contract.

It was found that payrolls of on-site wage earners exclusive of administrative and supervisory employees accounted for 27.85 per cent of the cost on grading and drainage, 19.94 per cent on bituminous paving, 25.09 per cent on concrete paving and 25.78 per cent on bridges. The overall percentage for wages in this class was 24.91. Percentage of the total for materials was 45.1 and for other costs and profits was 29.99.

Additional wage employment was produced away from the site of the work in the production and delivery of materials, and in repairs and replacements of the construction machinery and equipment used. The ratio of off-site to on-site man-hours of work was found to be 1.09 for all types of work. This ratio was 0.91 on grading and drainage, 0.96 on bituminous paving, 1.16 on concrete paving and 1.43 on bridges.

Before considering the relationship between expenditures on highway construction and resulting employment, it is important to note the governing background of our present highway resources and the type of improvement which they need. The highway system, improved progressively from year to year for almost a generation, has reached a high state of development. Simultaneous increase in the traffic burden has been constantly raising the standards which must be met for fully satisfactory

service. The current need therefore is quite different from what it was a few years ago. The basic work of creating a paved highway system, to overcome its imperfections and to keep pace with future developments in our vehicles and their manner of use.

Part of this unfinished business is the improvement of minor roads, to extend year-round highways to those not now reached by them. This is important, and doubtless will receive full attention. While the less expen-