

61

(16)

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Trial Survey
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Manpower Use on Building Construction Sites

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THE COST OF construction includes cost of materials and labour, besides overhead costs. The cost of materials depends upon the market conditions which are beyond the control of an individual or an organisation, and thus, in general, has an equal effect on all constructions. Similarly, the overheads depend upon the organisational structure and the duration of the project. Broadly speaking, therefore, the main cost which can be looked into to achieve economy is that of labour. This paper describes a survey carried out on two construction sites—one comprising about 55 residential quarters, and the other a three-storeyed laboratory building—to determine how the workmen are managed, the planning methods adopted and the amount of working and non-working time of both skilled and unskilled workers.

The work on the two sites had been allotted to two contractors on a rate contract basis. The organisational structure on both the sites was almost similar. The contractors themselves exercised control and supervision, and were generally present on the site for most of the working period. The contractor for the residential quarters had employed a retired overseer to supervise and instruct the workers who were all employed on daily wages. The second contractor himself supervised the work, but had employed a labour contractor for executing the brick work, plastering, and flooring. Both the contractors had given a sub-contract for the bar-bending, and had employed one storekeeper and a watchman. Further, it was noticed that the contractors seldom plan for more than a month in advance, and go on making adjustments as the work proceeded. In fact, they did not seem to be very particular for the completion date. The workers were shifted from one work to the other in between without completing the jobs on hand. The layout for storage of different materials was not well-planned, and this

resulted in double, and sometimes triple, handling of materials and excessive loads.

To observe the working and non-working time of the workers, the technique of activity sampling was adopted, because a large number of workers performing varied tasks and located over scattered areas—conditions which are typical of construction site operations—could be observed by a very few observers within a designed degree of confidence and accuracy. The time for which the workers were engaged on main works, or did other avoidable works, and the time for which they did not work, were classified as working and non-working time. The non-working time was noted under delay, idle and absent personnel.*

Employment Pattern

The weekwise daily average employment of labour force on the residential building site and the laboratory building is shown in Figs. 1(a) and 1(b) respectively which clearly indicate that there is a great fluctuation in the employment of labour force from day to day. This is attributed to lack of planning, unscheduled and uncertain supply of controlled materials, viz., cement and steel, as well as labour shortage due to seasonal harvesting. It was further observed that the contractors did not care to provide continuous employment to the workers, but often employed

*For this study the day was divided into two sessions—morning and afternoon. Four observations on all the skilled workers, and two observations on all the helpers, per session, were taken. The actual time of daily observations was not intimated to the workers and was selected at random so that there could be observations covering all the time. The observations were also started from different points, and different routes were selected for the various readings. As a matter of fact randomness and the elimination of bias were guaranteed by the nature of the building activities which were extensive in size and area. The workers, scattered all over the construction site, were observed by the 'Glance Method'.

new workers. Thus, a part of their time was often wasted in getting familiar with the work, and during this period their efficiency was lower. Although the contractors had a feeling that, by their policy of employing and discharging workers as and when they desired, they were able to get high output because of fear in workers of losing their jobs if they did not put in their best, in actual practice it was not so. The workers never felt that they were a part and parcel of the organisation, and thus never took full interest in completing the work.

Working & Non-working Time

The time spent in working and non-working on the two sites is given in Table I. This indicates that the utilisation of all categories of workers on the construction of residential buildings site has been better than the laboratory building site although the residential buildings were scattered over a larger area. This may be attributed to better control and greater supervision on the residential buildings, as this contractor had employed one supervisor and a head mason in addition to himself for overall supervision work. Also, construction of the laboratory building, where work progressed vertically rather than horizontally, presented more complications in construction, and congestion in the area, thereby impeding free movement of the workers. From the same table it can be seen that in all the categories of workers, the helpers have been working for a lesser percentage of time than the respective skilled workers. This is mainly due to improper and unbalanced strength of gangs which were provided by the contractors based on their opinion rather than on facts.

The percentage of working and non-working time in morning and afternoon sessions is given in Table II. This shows that all the categories of workers, except carpenters, spent comparatively a greater

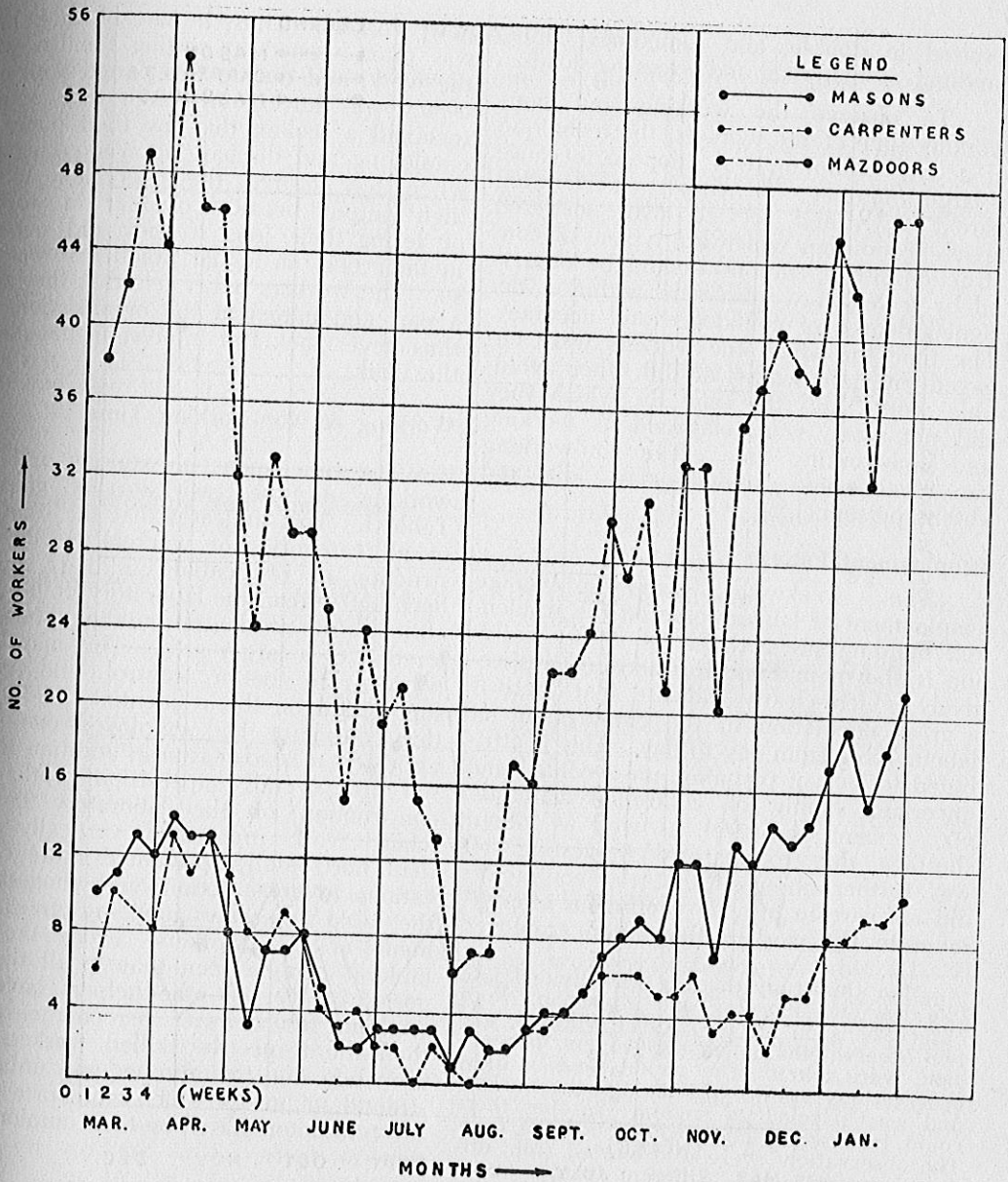


FIG.1 (o). AVERAGE DAILY NUMBER EMPLOYED ON THE RESIDENTIAL QUARTERS SITE

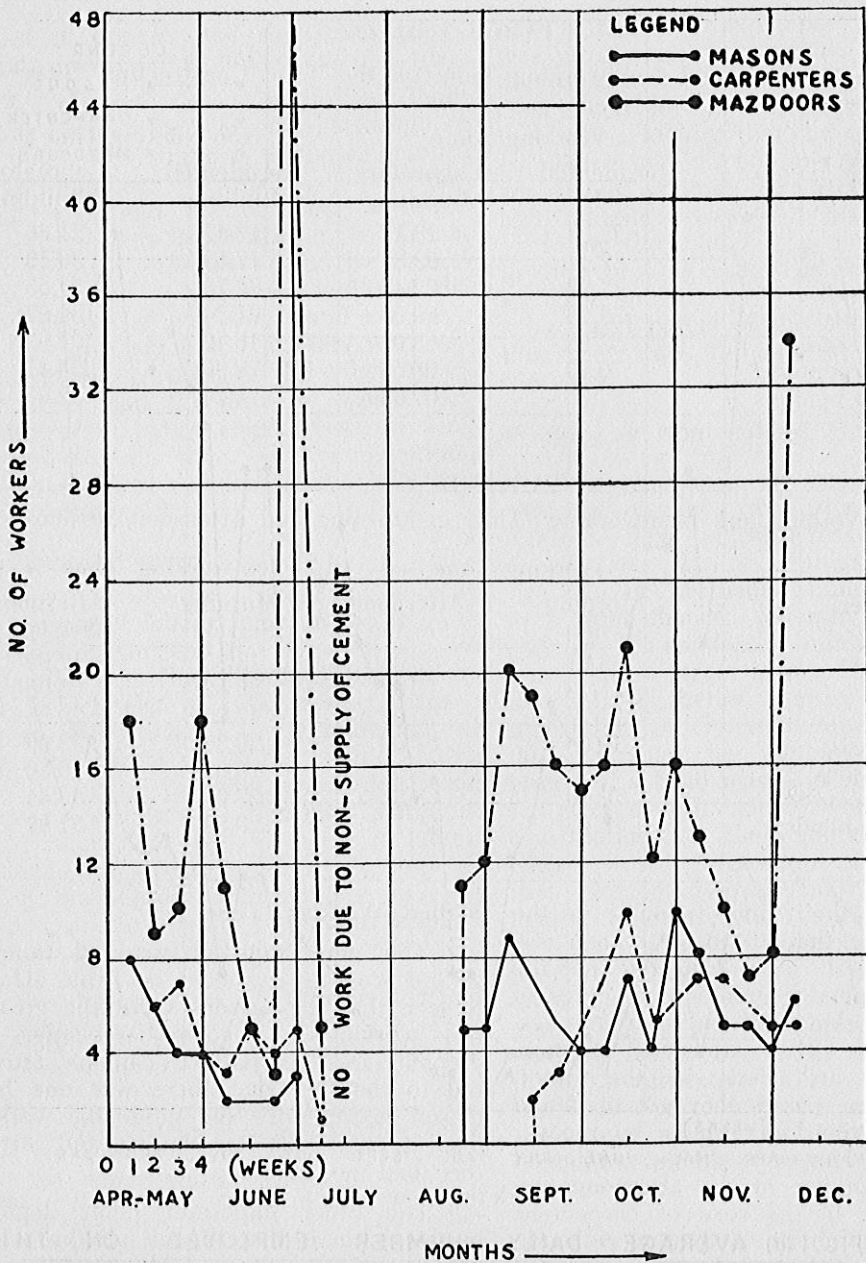


FIG.1 (b) AVERAGE DAILY NUMBER EMPLOYED ON THE LABORATORY BUILDING SITE

TABLE I

Percentage Working and Non-working Time on the Two Construction Sites

| Title of Worker | Working Time % | | Non-working Time % | |
|------------------------|----------------------|---------------------|----------------------|---------------------|
| | Residential Building | Laboratory Building | Residential Building | Laboratory Building |
| Masons | 87.53 | 78.12 | 12.47 | 21.88 |
| Carpenters | 82.47 | 63.81 | 17.53 | 36.19 |
| Bar-benders | 77.22 | 72.47 | 22.78 | 27.53 |
| Waterman (Bhisti) | 78.76 | 69.03 | 21.24 | 30.97 |
| Helpers to Masons | 83.58 | 65.07 | 16.42 | 34.93 |
| Helpers to Carpenters | 70.10 | 65.59 | 29.90 | 34.41 |
| Helpers to Bar-benders | 74.86 | 67.03 | 25.14 | 32.97 |

TABLE II

Percentage Working and Non-working Time in Morning and Afternoon Sessions

| Title of Worker | Working Time % | | Non-working Time % | |
|------------------------|-----------------|-------------------|--------------------|-------------------|
| | Morning Session | Afternoon Session | Morning Session | Afternoon Session |
| Masons | 86.01 | 82.01 | 13.99 | 17.99 |
| Carpenters | 71.18 | 76.92 | 28.82 | 23.08 |
| Bar-benders | 82.77 | 70.05 | 17.23 | 29.95 |
| Waterman (Bhisti) | 79.66 | 67.00 | 20.34 | 33.00 |
| Helpers to Masons | 71.95 | 73.50 | 28.05 | 26.50 |
| Helpers to Carpenters | 72.96 | 63.56 | 27.04 | 36.44 |
| Helpers to Bar-benders | 79.67 | 68.11 | 20.33 | 31.89 |

percentage of their time working in the morning session than in the afternoon session. In general, it is expected that the workers will spend a greater percentage of their time working in the morning session than in the afternoon session, because they are fresh in the morning, and as time passes they get tired and require more time for rest or to recover from fatigue. However, the percentage of time spent working in the afternoon session is higher in the case of carpenters. This is possibly because they were working under a shed, and because some of their morning time was spent in 'make ready' operations, such as sharpening of tools, and receiving instructions.

Skilled Workers' Time

The percentage of working time of skilled workers is shown in Table III. It is seen that the masons spent the greatest time working, followed by bar benders and carpenters. This pattern can be attributed to the fact that there was one head mason to supervise and guide the work of masons, while the bar benders and carpenters had no maistry.

The other important point depicted in this table is that though all the skilled workers spent quite a high percentage of their time working, the effective time spent on the main job has been lower since they have been doing other jobs which

could have been done by unskilled workers as well. The masons and bar benders spent about 9% of their total time on other jobs, and the carpenters about 8%. The main reason for spending such a high percentage of time on other jobs has been due to lack of control on the unskilled workers. The other reasons have been bad workmanship and wrong work which involved dismantling and rebuilding.

Breakup of Non-working Time

The percentage breakup of the non-working time in different elements is shown in Table IV. This indicates that a greater part of time is spent in delays and remaining idle. Delays may be due to the fault of both the management and the worker, while idleness is due to the worker himself. It is seen that delays are maximum in the case of masons, followed

by carpenters and bar benders. All the drawings were not furnished in advance to the contractor, and there were sometimes delays in supplying the same resulting in holdups, and under-utilisation of labour.

It was observed that there was a lack of supervisory personnel, and that most of the skilled workers being unable to read and understand drawings had to wait for receiving instructions at every stage. Also, there were occasional delays due to the non-supply of materials in time, or waiting for other tradesmen to finish the job. The time spent idling was maximum in the case of bar benders, followed by carpenters and masons.

Non-productive Time

As a matter of fact, the time spent by the skilled workers on other jobs should also be considered as non-productive. The non-productive time in the case of masons, carpenters, and bar benders works out to 24.8%, 33.4% and 32.5% respectively. These are rather high percentages for non-productive time. When a worker is employed on daily wages, he is paid his full wages whether he is productive for greater or lesser time. With a high percentage of non-productive time, the cost of labour increases, and the margin of profit to the contractor decreases. Thus every effort should be made to eliminate or minimise the causes of spending skilled workers

TABLE III

Percentage Working Time of Skilled Workers: Main and Other Jobs

| Title of Worker | Total Percentage Working Time | Percentage Time on Main Jobs | Percentage Time on Other Jobs |
|-----------------|-------------------------------|------------------------------|-------------------------------|
| Masons | 83.89 | 75.20 | 8.69 |
| Carpenters | 74.40 | 66.59 | 7.81 |
| Bar-benders | 76.14 | 67.46 | 8.68 |

TABLE IV

Percentage Break-down of the Non-working Time

| Title of Worker | Delay | Idle | Personal | Absent | Total Non-working Time |
|-----------------|-------|------|----------|--------|------------------------|
| Masons | 10.47 | 2.25 | 2.47 | 0.92 | 16.11 |
| Carpenters | 8.10 | 6.08 | 5.28 | 6.14 | 25.60 |
| Bar-benders | 7.85 | 8.97 | 4.96 | 2.08 | 23.86 |
| Helpers | — | — | — | — | 28.25 |

time on other jobs, and the delays and idle periods.

In general, it has been seen that the average worker was productive for only 70.2% of his time on the job. For the remaining 29.8% of his time he was non-productive, and of this one-third was spent on doing some other work necessary for the productive operations, but which could have been done by unskilled workers, and the remaining two-thirds on totally non-productive operations such as delays.

It may be pointed out that the figures presented in this study are only indications of where inefficiencies may exist and of their magnitude. These may differ from site to site, and organisation to organisation, but since, in general, for the middle class firms the organisational structure and the working procedures are more or less similar, it can be safely assumed that the pattern may be similar. However, further studies are necessary for more information about the construction practices, methods, policies, and manpower utilisation. In view of the shortage of skilled workers, their increasing wage rates and keen competition, the magnitude of waste or non-utilisation of labour force presents a significant problem in the construction industry which is increasing day by day. Everywhere the demand is for speed in construction owing to rapid industrialisation, urbanisation, and increased standard of living.

Recommendations

The following tentative recommendations are made:

1. Endeavour should be made to supply all the drawings preferably at the tender stage, or at the most when the construction starts.

2. There should be proper planning at the job site, indicating the various activities, to avoid interference and congestion. This plan should be displayed on the site, so that the supervisory staff can see to it.
3. A detailed scheduling of materials delivery on the site should be prepared, keeping in view the lead time for procurement.
4. A detailed scheduling of manpower on the job site should be prepared, so that the seasonal harvesting and other local factors can be taken into account.
5. Efforts should be made to have continuous employment for the workers, so that they may achieve higher efficiency.
6. The gang strengths should be provided on a rational basis taking into account the various factors, such as the horizontal and vertical movements involved.
7. There should be adequate supervisory staff. It is seen that provision of head mason, head carpenter, and head bar bender is essential.
8. Introduction of incentive schemes may reduce the cost on supervision, and increase manpower utilisation, but since there are no work standards that have been scientifically fixed, it may not be fruitful. There is, therefore, the need for establishing reliable work standards to begin with.
9. There is lack of skilled workers who can understand and read drawings, and therefore some training facilities should be pro-

vided to educate the skilled workers. It is heartening to learn that the Union Ministry of Labour has started such training facilities.

But this effort is insignificant in comparison to the vast needs of the country, and, therefore, more facilities should be provided.

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