
UNIT 2 OPERATING/DEPLOYING EQUIPMENT

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2.1 INTRODUCTION

In Unit 1 you learnt about planning for construction equipment, how to select them, calculate the hire charges and some aspects of financial management.

In this unit you will learn some features regarding operating and deploying construction equipment.

Objectives

By the end of this unit you should be able to explain how

- an organisation is developed,
- personnel for operating the equipment are selected,
- petrol, oil and lubricants are used in construction equipment,
- tyres, batteries, wire ropes and other consumables are ordered and procured,
- an operating schedule is prepared,
- various departments coordinate in a construction project,

- breakdowns of construction equipment affect productivity and the measures taken to reduce them,
- health and safety of workmen are important on a construction project,
- insurance is necessary in construction,
- licences and permits are to be obtained before construction of a project,
- operation manuals are necessary, and
- training of operators is helpful in achieving production targets.

2.2 ORGANISATION SETUP

The preparation of a construction organisation chart is really the first step in planning the entire personnel. Such a chart should be clear cut and fully understandable by all men on the job, and it is a good feature to set it up on a board where all department heads may study it and gain a thorough understanding of their relationship to the entire organisation. A typical organisation setup of a large construction company is shown in Figure 2.1.

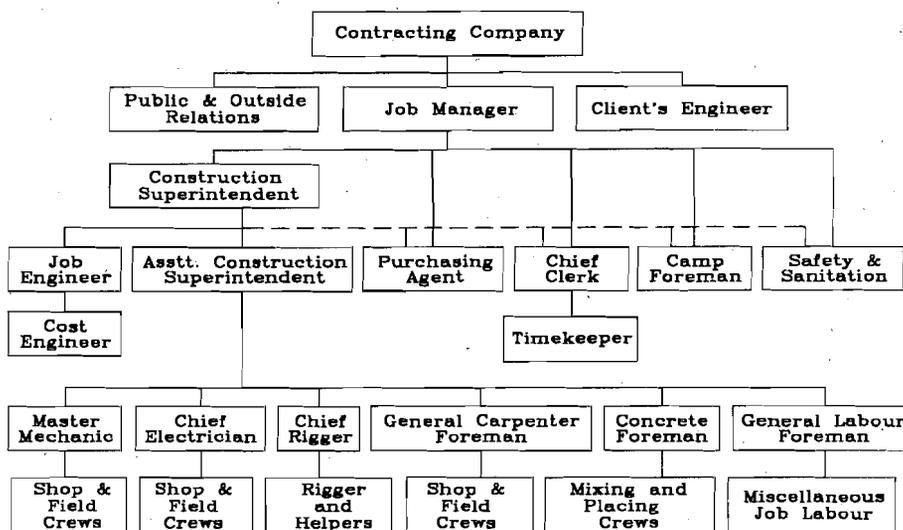


Figure 2.1 : Organisation Chart for a Large Construction Company

The figure shows the various positions of key project personnel.

Each position is filled by a technical specialist with years of experience in his field. The organisation chart can be modified to fit different concepts of organisation or simplified for smaller companies by combining functions and eliminating certain of the engineering positions mentioned.

SAQ 1

What is the purpose of a construction organisation chart?

2.3 OPERATION PERSONNEL

For every job there is a proper way to execute it in the shortest time and without causing damage to the equipment or structure or the operator and without wastage of material. Every construction project will be having a number of equipment for executing the various items of work. Depending on the number of units of equipment of each kind, personnel should be recruited to operate the equipment. Each piece of machinery requires a particular degree of training and skill to operate it. On a new project where a large number of workers are needed, training each worker would be difficult. The best way is to let them see an equipment being actually operated by a skilled operator with some previous experience. This way, a large number of operators can be trained in a short time.

How are the operation personnel recruited on a construction project?

2.4 POL-PETROL, OIL AND LUBRICANTS

The term POL is applied to petrol, oil and lubricants. Petrol is the fuel and is synonymous with diesel. There are certain requirements of POL as applied to construction equipment. These are discussed in the following sub-sections.

2.4.1 Petrol or Diesel

Correct grade and quality of fuel is vital to machine performance and engine life. Fuel suppliers must comply with the manufacturer's recommendations.

Fuel should be protected during storage, transportation, and vehicle refuelling. Improper fuel storage, transport and delivery methods can contaminate the best fuel and cause engine damage resulting in costly repairs and downtime. Fuelling should never take place in extremely dusty air. Tank caps, fuelling nozzles, and tank necks must be wiped clean.

Whenever possible, fuel tanks should be filled after work stoppage to prevent water condensation in empty tanks at night. Draining the condensate from fuel tanks is a regular part of the fuelling operation. It should be frequently drained from storage tanks also.

Fuel spillage should be held to a minimum—it is both wasteful and a safety hazard. Most construction machinery can be equipped with a "Fast-Fill Fuel System". This fuelling method forces fuel under pressure into the tank, without the need to open the tank cap. Thus, spillage and contamination from dirt are avoided. In addition, such a system reduces fuelling time by one half or more.

2.4.2 Types of Lubricants

Petroleum lubricants are broadly classified according to the service for which they are most widely used. They are :

- 1) Circulating oils,
- 2) Gear oils,
- 3) Greases of calcium, sodium, aluminium, lithium or barium base,
- 4) Machine or engine oils, and
- 5) Wire rope lubricants.

Circulating Oils

They are the highest quality lubricant. They have a paraffin or naphthenic base according to the equipment. For turbine, hydraulic, and similar equipment, the former predominates. Either types are used for heavy duty engine service. Circulating oils contain additives to resist oxidation, retard rusting in the system and function under high engine temperature and bearing loads.

Gear Oils

They are mineral oils of varying viscosity or compounded oils containing extreme pressure additives to improve the film strength and load carrying ability.

Greases of Calcium, Sodium, Aluminium, Lithium or Barium Base

They are a combination of a petroleum product, and a soap or mixture of soaps, suitable for lubrication application. The metal used in the metallic soap constituent of a grease denotes its base, e.g., calcium, sodium, aluminium, lithium or barium. In maintenance work the protection of a grease lubricant system is just as important as protection of the bearings or other parts being lubricated. Careless use of tools around fittings, control outlets, lengths of pipes, or inadvertent striking while moving might render one or more outlets inoperative, because of constriction or grease leakage.

Machine or Engine Oils

They are mineral red oils used for general lubrication of external operating parts of engines, pumps, compressors and general equipment. They are a good lubrication for once through lubrication but not recommended for equipment where formation of sludge or gummy residues could add to the troubles of the maintenance engineer.

Wire Rope Lubricants

This lubricant is especially suited for wire ropes which must be exposed to the weather and to low temperature as on aerial ropeways. The construction equipment maintenance engineer is particularly concerned with good wire rope lubricant because strand breakage can require removing the rope from service and installing a new rope. Safety precautions require rigid inspection.

SAQ 3

- i) What are the requirements of a good fuel and fuel storage?
- ii) What are circulating oils?
- iii) What do you understand by the "Fast-Fill Fuel System"?
- iv) What are the various types of lubricants?

2.5 OTHER CONSUMABLES

Many consumables like tyres, batteries and wire ropes, etc. require special attention and care on a construction project.

2.5.1 Tyres

In view of the heavy cost of large pneumatic tyres, specially on an earthmoving project, it is desirable to have special crew with a tyre service truck to take care of the tyres. The truck should be equipped with loading and unloading arrangement for tyres, and all the tools necessary to dismantle, inflate and assemble tyres. The inspection and maintenance of tyres include : Inflation pressure; irregular tread wear or cuts; embedded stones, nails, etc.; and oil and grease contamination; damaged, bent or distorted rims, locking rings or flanges; tightness of valve cap; etc. Healthy practices in operation should be encouraged.

2.5.2 Batteries

Batteries are items on a construction equipment which require proper care and maintenance. A discharged battery on an equipment will not serve any purpose for it will not supply the power it is supposed to provide to the equipment for starting and lighting. Such batteries should be charged for sufficient periods in the battery shop while spare batteries should be available in the shop in fully charged condition for ready replacement on the equipment from which the discharged battery has been removed.

2.5.3 Wire Ropes

Steel wire rope cost constitutes an important portion of total operation and maintenance cost; and proper care of the rope can effect appreciable savings in this cost. Wire rope life can be shortened due to wearing off or chipping of sheaves, etc. These parts should be inspected for corrective action. Sudden shocks, excessive loads, rust corrosion and effects of friction should be minimised. The misalignment may cause excessive wear and strain on the cable. Wire rope compound, if properly applied, extends cable life. However, this should not be applied to cables running in sand, mud or water, such as the drag cable of draglines. Reversing the cables end to end may extend cable life by about 50 percent.

SAQ 4

- i) What are the items of inspection and maintenance of tyres of earthmoving equipment?
- ii) Why are batteries important on construction equipment?
- iii) What are the causes of failure of wire ropes?

2.6 OPERATING SCHEDULES

The primary objective of scheduling is to ensure that the equipment fleet is assigned to its tasks in accordance with accepted standards of utilisation of equipment and personnel. These standards are developed for a particular work environment. Figure 2.2 illustrates the impact of other organisational components upon the scheduling process. Although the figure is schematic and does not reflect all the various organisational entities in a large project, it clearly shows that the roles of the maintenance shops, the sales group, the production shops, and the storage yard operation directly influence the operations manager's schedules. Even the personnel organisation could exert an influence by requiring the attendance of operators at regularly scheduled classes covering various aspects of safety.

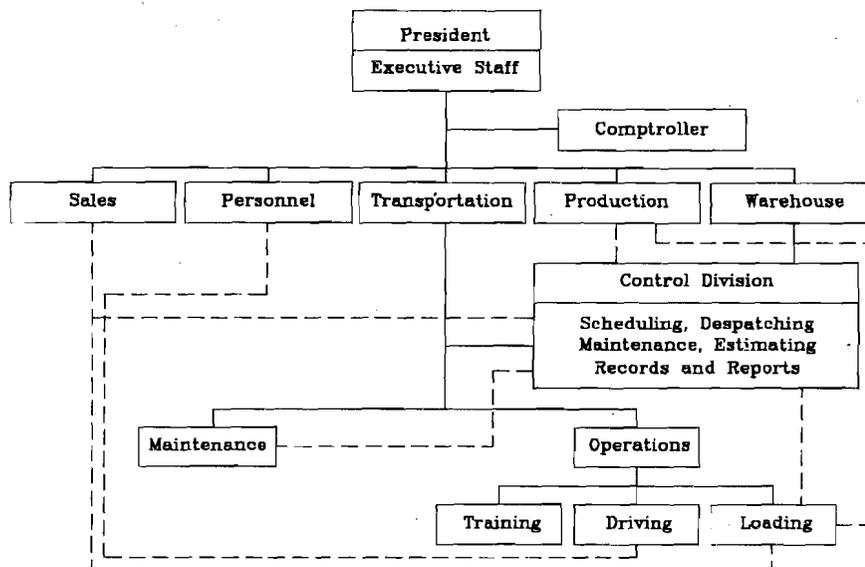


Figure 2.2 : Organisational Structure for Operations with Large Equipment Fleet

Accepting such influences as an integral part of the scheduling process, it is necessary to establish some formal method whereby the requirements of the user may be met. In this way the operations manager can plan the deployment of available equipment so that the proper unit will be able to perform the required task; that the proper material will be loaded; that the storage yard or warehouse will have segregated the load; that the destination will be clearly understood; that the delivery commitments, relative to time, will be met; and that the most economical routing or sequence of operations is selected. In cases involving construction, or materials handling equipment, the use of formal scheduling procedures will ensure that adequate support equipment is furnished to a project supervisor or to the storage yard manager.

Operating schedules should be drawn up to derive full benefits from the equipment planned, selected and acquired according to the best judgement and capability. The success of a mechanised construction should be judged by its low cost, and timely and safe completion.

All equipment must work in coordination, specially when a team work is involved in operation. For instance, the working of machines in the cut and fill areas of an earth construction should be so coordinated that there is no waiting at either place. The capacities

of such equipment should be properly balanced so that the product of one machine is received by the other without loss of time.

Working of auxiliary equipment as also maintenance of environmental conditions should be ensured. For instance, the failure of a pump employed on dewatering a foundation pit may cause the excavator and hauling units to remain idle. Poor maintenance of haul roads may result in increasing cycle time of trucks and scrapers, besides causing more downtime. Properly graded and sprinkled haul roads contribute to the efficiency of the equipment and of the operator, and provide healthy working conditions.

SAQ 5

- i) What is the objective of preparing operating schedules?
- ii) How can the operations manager deploy the available equipment?
- iii) Why is coordination between equipment working as a team necessary?

2.7 COORDINATION WITH OTHER DEPARTMENTS

Since various departments are involved where construction equipment are employed, a proper coordination between them is necessary. Suitable arrangements must be ensured for adequate servicing and maintenance of equipment. Construction equipment is often expensive and is required to work under very strenuous conditions of geology, topography and climate. Unless it is well looked after it will not be productive. The consequences would be increased cost and delayed completion. Arrangements for maintenance, servicing and repairs should include suitable repair shops or maintenance depots with necessary servicing equipment and well trained and conscientious workmen. No amount of facilities and workmen would be enough unless there is proper supervision on the work. Not only the working must be watched to ensure proper operation of equipment and to eliminate delays, but the timely scheduled maintenance should also be ensured. An enlightened supervisor will encourage good work and discourage unhealthy and damaging practices among workmen.

Proper records of operation of equipment should be maintained for production, idle and breakdown hours, consumption of stores and spare parts, repairs, etc. These records are invaluable in cost accounting of equipment and in progress evaluation which serve as basic information for future estimating work.

All the above aspects of project planning requires proper coordination between the various agencies entrusted with the different assignments for project execution.

SAQ 6

- i) Why is coordination between various departments necessary?
- ii) Why are records of operations of equipment maintained?

2.8 BREAKDOWNS

Breakdowns are common with construction equipment. They arise out of a number of reasons such as, lack of proper maintenance, repairs not undertaken at the right time and mishandling of the equipment.

Breakdowns affect the production of an equipment. Where an equipment works with another as a combination the production of one equipment will suffer on account of breakdown in the other. The cost of unit of work will likewise increase with breakdowns. When the frequency of breakdowns increases it may be worthwhile to replace the older machine with a new model with better production rates and either dispose off the older

machine or relegate that machine to a less important work which would not affect the completion of the project or on a job where it can work independently.

Breakdowns are unpredictable and the best way to avoid them is to carry out timely preventive maintenance. Breakdowns may occur during equipment operation and the cause should be ascertained so as to replace the necessary part of the equipment. Necessary tools and accessories should be readily available for carrying out the repairs in the field itself. If that is not possible for want of lifting gears or other tools which are not portable, the equipment should be towed to the workshop for removing the defects and deficiencies.

SAQ 7

- i) Why do breakdowns occur in construction equipment?
- ii) How do breakdowns affect production of an equipment?
- iii) How will you handle breakdowns?

2.9 HEALTH AND SAFETY

On any construction project, two important aspects of employees engaged/employed for various operations include health and safety.

2.9.1 Health

Health services and care of the injured are frequently neglected areas in the construction industry. Construction management is responsible for the prevention and control of industry occupational health hazards. Management should initiate the action necessary to prevent and control anticipated hazards for the type of work being done and with the type of equipment being used. Such action may be based on known hazards and previous experience, or it may anticipate new hazards from unfamiliar equipment, substances and processes. Supervision should be alert to question any suspected exposures, wrong handling or operation, and seeking qualified and competent assistance where advisable. Assistance as needed should be sought from industrial hygienists, industrial physicians, safety engineers and consultants, manufacturers of equipment and substances, insurance carriers, and governmental agencies, including state boards of health.

2.9.2 Safety

Construction does not produce the safest working conditions and maintenance and service are among the most hazardous operations. To make maintenance operations safer, the contractor should provide safe working conditions and proper tools, and make sure work rules are enforced. It should be remembered that accidents reduce profits.

Safety on work is a must. No work is a good work unless it is done safely. Proper traffic control, well lighted work area, high electric wires, and equipment in good condition are some of the things necessary to ensure safety of equipment and workmen. A sound and practicable safety programme should be prepared and enforced on the project.

The significance of safety as it relates to the construction industry is a major concern since the construction industry is largest industry in any country. Because safety and profit have an integral relationship, the discussion of safety itself would become a moot question if construction companies were not making a profit. With at least half of the construction cost consisting of labour, any constructive type of safety programme will result in economies, and be of great importances to the operator, the owner, and to the public as a whole.

Safety inspections should be the responsibility of not only the safety organisation, but of every employee for his own work area. Formal safety inspections should be as frequent as possible, with follow-up inspections of potential hazards. Every production procedures should be analysed, and improper or inefficient work methods should be highlighted.

The care of machinery and equipment must be included in hazard control. Defective equipment not only reduces efficiency but it represents a potential cause of accident or injury. In addition to proper maintenance of machinery, guards must be provided to prevent parts of the body or clothing from being caught in moving parts.

Sanitation and occupational disease control are another important part of hazard control. Care should be taken to provide the employee with a clean environment in which to work.

No amount of personal protective equipment will prevent damage or injury if that equipment has not been maintained and kept in proper working order. Instruction should be provided to each worker who is issued protective equipment on how to service and repair that equipment to provide the protection it was designed to afford.

The construction company, in evaluating its approach to safety, must not overlook any available source of achieving a responsive and responsible safety programme. All of the outside help that is available should be used; but more importantly, the organisation must develop a constant and prevailing internal awareness of values of safety.

Finally, hazard control is best realised by enforcing safe practices. The rules designed to protect life and property will never do the job unless they are enforced 100 percent of the time.

SAQ 8

- i) How do health hazards occur and how can they be avoided on a construction project?
- ii) How will you ensure safety on a construction job?
- iii) How will you guard against hazards from machinery and equipment?

2.10 INSURANCE

Construction involves a large investment in equipment and tool of all kinds that are subject to a variety of dangers. All equipment have specific requirements with regard to insurance.

There are many methods to insure equipment. They can be insured on a blanket basis automatically covering all equipment, or on a specific basis listing all items of equipment and the values they are insured for. Both plans are acceptable, depending on the circumstances.

Equipment can be insured for its full replacement value at the time of loss without deduction for depreciation however caused. This is, in effect, new for old. It can also be insured and usually is on a depreciated value, i.e., the actual cash value at the time of loss reflecting depreciation and obsolescence. Another method is the so-called "agreed value" basis. This is a specific amount agreed in advance to be paid for a total loss. It is most favourable for unique types of equipment when the market value or replacement value is not readily determinable.

These types of insurance values have nothing to do with cost or book values and are measured by rules of their own rather than determined by the usual accounting technique.

There is latitude in this kind of insurance to decide the wording of the policy so as to economise on the premium through the use of various deductible plans. These can be negotiated subject to a deductible applicable to each and every loss or in the aggregate. The policy may be extended to cover certain consequential losses such as loss of use or extra expense to provide duplicate equipment. The ability to quickly secure alternate equipment or the availability of proper repair and parts facilities adjacent to the job will determine this exposure.

The protection afforded may be against named dangers or all risks. Either policy form contains certain standard exclusions, which should be carefully reviewed.

The coverage must cover the equipment whether working or in dead storage. Usually, the insurance company will grant a lower rate for the idle equipment. Depending on the exposure and values at risk, the policy may be broadened to include office contents at project sites and various miscellaneous materials.

Contractors who have equipment of any kind used in reservoirs, rivers or lakes have a different and more complex problem with regard to insuring such equipment.

Another form of insurance is transit insurance. This form of insurance agrees to pay for direct loss or damage to equipment in transit. The coverage may be for named perils or all perils.

SAQ 9

- i) How are construction equipment insured?
- ii) What is meant by transit insurance?
- iii) How are working and idle equipment insured?

2.11 LICENCE AND PERMITS

2.11.1 Licence

Many organisations licence contractors, supervisors, etc. in the mechanical trades. Most licencing laws are directed at contractors and arises in part from the public's concern for the community's health and safety. Incorrect equipment operation, electrical wiring and plumbing connections may endanger the public safety, as may poorly installed structures. Operation of large cranes in project areas may, unless adequate precautions are taken, endanger the public. Consequently, governments sometimes licence electrical wireman, equipment operators, plumbers and pipe fitters, elevator installers, and fitters.

Licences are awarded by licencing boards, which are usually composed of several public members such as medical superintendents, material suppliers, contractors in the specific area of construction, and journeyman representatives. Usually, representatives of contractors and unions do not numerically dominate these boards.

2.11.2 Permits

It is a better practice for the owner of the project to obtain permits for construction, arrange access to the site, approach roads and bridges to the work areas, and handle similar details involving negotiations with local political units. In outlying areas, the contractor's primary concern is the movement of heavy equipment over roads not designed to take heavy loads.

In the city areas, the contractor's problem is more complex. He may have to deal with a large number of departmental officials, and he runs the risk of arousing area business by blocking the normal flow of vehicular and pedestrian traffic. Thus, while he may be able to gain the necessary permits via politically expedient methods, he cannot neglect the important factor of public relations. A well thought out programme of logistics for delivery of equipment and erection of plant is an effective tool that can satisfy local officials and at the same time explain clearly to the public what is going on via the local press.

SAQ 10

- i) Why do contractors have to obtain a licence to practice their trade?
- ii) Who gives licences to construction tradesmen?
- iii) Who arranges permits for the various activities on a construction project?
- iv) How are city areas different from projects outside the town limits in getting permits?

2.12 OPERATION MANUAL/SPARE PARTS MANUAL

All manufacturers of construction equipment provide literature known as the operation manual which contains necessary information for the operation, maintenance, and service of the equipment. Too frequently, this vital information is lost, stolen, or not available to personnel who need it. A well-organised reference library is the best insurance against this. Replacement literature can be obtained through the equipment dealer.

2.12.1 Operating Instructions

Operating Instructions cover proper starting, stopping, and operating procedures. In addition, all prestart checks such as fuel, oil, water, and "walk-around" inspection are included. These are important, because proper machine operation is the first step of preventive maintenance.

2.12.2 Lubrication and Maintenance Instructions

Lubrication and Maintenance Instructions provide the field maintenance personnel with detailed information concerning all scheduled service recommended for the machine. In addition, the types of lubricants, oils, fuels, coolants and filters are specified.

2.12.3 Warning and Instruction Plates

Warning and Instruction Plates are usually mounted on the machine, in clear view. They serve to identify various tanks, valves, pressure taps, points of danger, and access covers. On properly maintained machines, such plates are kept clean and are replaced when lost or damaged.

SAQ 11

- i) What is an operation manual and how is it useful?
- ii) What is the purpose of operating instructions?
- iii) How are lubrication and maintenance instructions useful to the construction manager?
- iv) How are warning and instruction plates on an equipment useful?

2.13 TRAINING OF OPERATORS

Economic operation of the equipment is of vital importance for the success of a mechanised construction project. Where many contractors are entering the mechanised area for the first time, training of operators is of major importance. The equipment once purchased has to be productively used and kept in excellent condition, hence there is a dire need of operating and maintenance skills in a mechanised construction programme. In fact, the success of a mechanised construction programme will depend on the skills of the personnel, on the quality of operation and maintenance of the construction plant and equipment as also on the calibre of supervision. A well-knit field operation and maintenance organisation could be a real asset to a contracting organisation.

SAQ 12

Why should operators be trained ?

2.14 SUMMARY

You have learnt the organisation setup and the operation personnel for construction equipment. Petrol, oil and the various types of lubricants, tyres, batteries and wire ropes have been discussed. Coordination with other departments is an important aspect on a construction project. Licences and permits are required to execute any project. Manuals and instructions for operation and maintenance of the equipment are needed for effective use of the machine besides training of operators. All these have been explained in this unit.

2.15 ANSWERS TO SAQs

Check answers of all SAQs with respective preceding text.