CHAPTER-8
MATERIAL MANAGEMENT

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CHAPTER-8
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8.1 Preview

One of the important factors affecting the finances of STUs is procurement of materials and inventory carrying cost. Since November, 1973, the petroleum prices and cost on spares and tyres-tubes have been rising continuously. About Rs.930.00 crores are spent on materials alone, accounting for about 36% of the total cost on stores. In addition, 75% to 78% of the working capital is also locked up in inventories. The inventory carrying cost which forms about 25% of the average inventory is also taken into account while computing total material cost. This is the third largest element in the total cost structure of ST Undertakings.

Material management in an industry could be defined as "The co-ordinated function responsible to plan, acquire, store, move and control materials for optimising final production and thereby reducing the production cost." Material management in ST Undertakings, however a service function, which helps in optimising road transport operations and achieving the corporate objectives by providing an efficient, economic, adequate and properly co-ordinated transport services to the travelling public.

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Efficient material management would not only reduce the inventory carrying cost, but would also spare funds (about 25% of the average inventory) for the expansion and other developmental activities in STUs. Inventory carrying cost directly increases overhead costs. Efficient and effective material management programme is the way out in minimising the financial losses and contributing to the profitability of the undertakings.

8.2 MATERIAL MANAGEMENT

(i) Material Management in India

Sir James Scat Pelkulthly, who was the head of Munitious Board in India in World War-I, established the Indian Stores Department (Predecessor to D.G.S.& D) in 1922, and was the first Chief Controller of Stores. The Railways had their own stores organisation. Industrial Organisations like TISCO, Jamshedpur was the first to establish Central Purchase Department.

The National Planning Commission after extensive survey of various industries in the country observed that 64% of the total cost of production is on account of materials used for production. It has also been observed that 52% of the capital is invested in Plant and equipments and remaining 48% for working capital. Of this working capital, 90% is locked up in Stores Inventory.

3 Notes on 'Material Management' by Mr. V.G. Gurnani, CIRT, Pune.
A seminar on "Cost Reduction through Material Management" was organised by the Planning Commission in August, 1962. The importance of material management then came to be recognised at the highest level in both the private and public sectors in the country.

ii) Material Management in STUs

In the case of Nationalised Passenger Road Transport Undertakings, progress in evolving a coherent material management policy was rather slow. In the past, storage, handling and control on spare parts were entrusted to Mechanical Engineering Department as it was then considered that being the users, they knew the materials better and had better knowledge of handling and storage. They were also considered better judges to decide what, when and how much stock and quality of spares would be required. Since the Engineers were primarily responsible for the assigned job, the work for materials such as procurement, indenting, handling, stocking etc. was neglected, resulting into irregular supply, incomplete documentation, improper accounting and indenting etc. Consequent upon such irregularities, the importance of material management was realised and specially trained personnel were entrusted with the job.

The STUs have set up their own Stores and Purchase Department under a senior officer directly responsible to the Managing Director / the General Manager.
All the activities involved in procurement and issue of materials used in production of finished product or service, all the aspects of cost, quality supply, conservation and utilisation, planning and programming of materials including capital goods, store keeping and warehousing, transportation and material handling, value analysis, standardisation and codification, and disposal of surplus and obsolete and scrap materials etc. come under the purview of material management.

8.3 Hypothesis

The following hypothesis is framed for in-depth study:

Material management in STUs is so far reasonably effective in reducing the material cost, but still there are possibilities for further improvement in purchase system and inventory control.

In order to test the hypothesis, it is proposed to examine certain techniques of material management applied in STUs.

The saving in material cost can be achieved in the following major areas:-

(i) Purchase of materials.
(ii) Inventory control.
(iii) Disposal of surplus, obsolete and scrap materials.
8.4 Techniques of effective purchasing in STUs.

(i) Purchase of materials

Normally there are two types of purchasing in the business world (i) purchasing for re-sale, and (ii) purchasing for consumption or conversion. The basic principles are the same for both. The basic operating problems are however different. In buying for re-sale, the buyer must select what the final customer wants to buy and sell it at a price which may allow reasonable margin of profit to himself and at the same time satisfy the final consumer.

The maximum scope for any economy measure is in the field of purchase and proper management of material. The scope for reducing the cost of labour is limited because of proliferation of labour laws and regulations, workers' awareness and growing demands for higher wages, increased facilities and amenities to labour. It is also not possible in the case of certain obligations (excise duty, passenger & M.V. tax, sales tax and octroi etc.) which do not provide any scope for savings. Hence 'Purchase' has become a major tool of material management technique in the industrial sphere.

Following are the techniques of effective purchasing used in STUs.

a) Value analysis as a cost reduction technique

b) Centralisation of purchasing

c) Purchase as an important function

d) Pending process - vetting indents commercially and technically

e) Negotiations

f) Purchase of critical and scarce parts from operational point of view from original equipment suppliers

a) Value analysis

Value analysis is a cost reduction technique applied mostly to the purchased items. It is the greatest cost-saving technique in industry today. Lacs of rupees are saved annually from value analysis process. It focuses on the cost side of the quality problem. It seeks to achieve proper relationship amongst price, cost and value received. It constantly strives to reduce the cost by better integrating the technical and economic factors of quality. In value analysis, management attempts to co-ordinate the talents of personnel in engineering, production and purchasing in conducting a meticulous investigation which usually leads to improvement in technical and economic factors. Each possesses unique analytical abilities and develops his own unique pattern of thought. Several general approaches are
designed to stimulate analytic effects. The important among them are (i) value analysis check list, (ii) the functional cost approach, (iii) the use of brainstorming and (iv) the use of suppliers. It is necessary to know what these approaches are and how they prove a potentially powerful set of tools.

Before embarking on a value analysis technique in STUs, we have to form a team consisting of a Chief Engineer, Works Manager, Controller of Stores, Accounts officer and a full time value Analyst.

1) Value analysis check list.

Each industry has to develop some type of check list to systematise the analyst's activity. Hundreds of questions and key ideas appear on these lists. Illustrative questions are:

A) Can the item be eliminated?
B) If the item is non-standard, can a standard item be used?
C) Does the item have greater capacity then required?
D) Can a similar item be substituted?
E) Are tolerances unnecessarily prescribed closer?
F) Is unnecessary machining performed on the item?
G) Will commercial quality do the required function?

In using such check list, the analyst evaluates the component under investigation with respect to each item on the check list. When he finds a question
to which answer is not entirely satisfactory, this becomes a starting point for more detailed investigation. The check list focuses the analyst's attention to those factors which past experience has proved to be potentially fruitful in cost reduction areas.

iii). The functional cost approach

The important feature of this approach is the idea of comparing current performance with typical past performance. A second important feature of the approach is the concept that the cost of performing a function must be reasonably proportionate to the value of the function itself.

Value analysts, on gaining experience establish bench mark costs for performing certain functions characteristically encountered in their industry. After analysing certain types of equipment day after day, value analysts find out in a general way approximately what it costs to accomplish certain functions. As these kinds of data are accumulated, costs of particular functions appearing on a new job can be compared with historical bench marks. If the cost seems excessive, the analysts further investigate to determine the reasons. The analysts aim and continue their search for a lower cost method of performing the function.

iii) Use of brain-storming

Mr. Lamer Lee and Mr. Dabler, eminent Material men have rightly said that
the brainstorming is a process designed to stimulate creative thinking. A group of people meet for the purpose of generating ideas useful in solving a particular problem. At this meeting only recording of ideas is done and no evaluation is done since the objective is to develop spontaneous and positive ideas. It is these ideas that act as spring board that triggers thoughts from others in the group that lead to different and often highly feasible ideas.

After this, the resulting ideas are analysed by the authorities of the several departments in brainstorming session for practical feasibility for cost. The promising ideas are then put to an analyst further development.

iv) The use of suppliers

Suppliers frequently prove to be extremely valuable assets in a firm's total value analysis effort. After-all a supplier knows more about his product and its potential capabilities than do most of his customers. His technical knowledge combined with broad experience in applying his product to hundreds of operations frequently qualifies him to participate in firm's value analysis programme.

Invitation to current and potential suppliers for participation in "Parts Exhibition Programme" is yet another technique to find out which suppliers can offer lower cost items that performs satisfactorily or suggest feasible design modifications which permit the use of lower cost items.

6 Ibid - page 291
* Ibid - page 292
It should be emphasised that solicitation of vendor assistance in a value analysis programme is based on the premise that creative vendors will be compensated for their efforts by receiving more business than they would have otherwise obtained.

Value analysis, thus aims at securing maximum value for money spent. It identifies and eliminates expenditure which does not contribute to the functional utility of the material purchased. Through such analysis, it is possible to find out the most economical product that will do the required job and to avoid anything costlier than what is just necessary to satisfy the function.

It also stops buying higher quality material (of course with higher price) where lower quality can more than satisfy the function. Any reduction in material cost through value analysis techniques must directly reflect in the savings of the undertaking.

In one sense, value analysis is a State of mind. Maximum potential can be realised from a value analysis programme only if every one in the plant is value-conscious and then only if management properly taps these potential resources.

This process now is being universally applied in STUs.

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8 Note on Material Management by V.G. Gurnani, CIRT, Pune.
(b) **Centralisation in Purchasing**

Centralisation in purchasing takes place when the entire purchasing function is entrusted to a single department generally known as Purchase Department. The head of such department is generally known as "Purchase Manager" or "Controller of Stores and / or Purchase". This officer is held accountable by the management for an effective and efficient functioning of the department.

The concept of centralised purchasing is universally accepted by management authorities today. The concept of central purchasing has been generally operative in a large organisation because if the different units of the organisation purchase independently there may not be any uniformity in the quality and the price of materials. Besides this, there may not be saving on account of quantity discount, consolidated transport charges, effective inventory control, vendors offering better prices, discount and after sale service because of reduced expenses on large scale purchase orders, and many indirect financial benefits and conveniences.

(c) **Purchase - an important function.**

Maximum benefit in the purchasing activity could be achieved by keeping in view five important objectives, viz. (i) right quality, (ii) right quantity, (iii) right price, (iv) right time, and (v) right source of supply.

The Ford Motors defined the objectives of their Purchasing Department as under:
To buy parts, materials and supplies of the required quality from the suppliers with adequate capacity and capability for the supply and delivery of materials at the scheduled time, and to negotiate the lowest economical cost consistent with quality and delivery requirements which will permit efficient suppliers to make a fair profit.

i) The right quality can be achieved by drawing up rational specifications.

ii) The main function of any system of material management is to ensure that a constant flow of material is maintained to help uninterrupted production. If this is the only thing to be viewed, then large stock is to be maintained. The maintenance of large stock will create other problems like high inventory carrying cost, locking up of capital, storing and handling problems, problems of breakage, spillage or pilferage, obsolescence etc. Therefore quantity should be decided in such a way that a perennial flow of material is maintained and delivery schedules are prepared.

iii) In modern material management parlours, the concept of price has undergone a change. Price is not assessed in terms of actual money paid, but it is regarded in terms of functional utility it provides. The details have been discussed in the topic on 'value analysis'. The cost of material purchased should be determined, besides the price paid on the basis of (1) the invoice price, (2) packing expenses, (3) forwarding and transport charges, (4) inspection,
storage, handling, inventory carrying cost. The concept of right price must therefore be tested in respect of all these factors related to price.

iv) The deliveries should be at the right time. If delivery is made too early, the unused stock may pile up, occupying storage space. If late, then it would interrupt production.

v) Source development is another important function in a Purchase Organisation. Besides the functional soundness, it is necessary to assess the supplier's ability to supply and standing in the market.

d) Vetting indents commercially and technically.

All the demands are vetted by the Technical Authority from the viewpoint of utility of items and their quantities giving due weightage to their past usage and utility. Based on such vetting and considering the stock and balance of the previously ordered quantities tenders are invited and processed for gradation. The graded offers with samples are then sent to Mechanical Engineering Department for obtaining technical recommendations. Before giving technical recommendations, the Engineers test samples in a laboratory to find out whether metallurgical/chemical basic composition of offered goods is really as per the stipulated specifications. Similarly, tenders are evaluated from the commercial point of view as to whether the rates and delivery period offered are acceptable and
whether the incidental charges are commensurate with prevailing market rates.

The above procedure is in vogue in some form or the other in the STUs such as MSRTC, APSRTC, GSRTC and KSRTC. These STUs have been availing of the benefits of this process.

e) Negotiations

Negotiation is an exchange of views either verbal or written between the buyer and the supplier over quality, rate of delivery, prices etc. in order to reach a conclusion satisfactory to both the parties. Negotiation, generally induces the suppliers to effect good reduction in price. It also enables the buyers to understand the reasons for the supplier’s inability to price reduction. However, efforts to bring price reduction through negotiation should centre round high value items.

Negotiation may take place (i) before obtaining the quotation, (ii) after obtaining the quotations, (iii) when a repeat order is to be placed, and (iv) when there is a price increase.

Negotiation after obtaining the quotation is carried out (a) in the case of standard items of large value when the lowest quotation is considered to be higher than the normal or previously paid price, (b) in the case of sub-contracted components
when the quotation is higher than the standard cost (c) in the case of specially fabricated equipment of large value and in the case of construction project.

The initial step in planning for negotiation is the same as business planning - to establish concrete objectives. The buyer must define his negotiable objectives in specific terms such as lower rate than previous ones, good and careful delivery, satisfactory technical help, performance guarantee and reimbursement in case of failure and breakage etc.

In the establishment of concrete objectives, a thorough buyer develops an objective for every cost element in the contract. Typically, the two opposing positions appear as shown in the figure. The closer the two objectives, the easier will be the negotiation.

![Diagram of negotiation objectives](image-url)

Each party attempts to convince the other that he has arrived at his objective before he actually has. As each party reaches his objective, negotiation becomes difficult. The distance between buyer's objective and supplier's objective can be well called "Essence of negotiations". When the area of objective persuasion ends, skilful negotiations start.

Negotiation has some major objectives: to obtain a fair and reasonable price, to get the supplier to perform on time, to persuade the supplier to give maximum performance guarantee etc.

Some of the STUs have provision for this technique but it is rarely made operative. In public purchase this technique is generally avoided. However, GSRTC has recently introduced this technique for all the purchases. The results of introducing such technique are awaited.

1) Purchase of critical parts from operational point of view

Certain materials by their very nature are directly connected with the safety and precision. They should therefore be of proven quality. Such parts are difficult to manufacture without proper raw material, equipment and testing facility.

Only original equipment manufacturers have such facilities to manufacture and therefore such items in the brake system, steering system and transmission system, engine and fuel injection system are purchased directly from the manufacturers/O.E. suppliers. Almost all STUs follow this practice.
8.5 Purchase Procedure in GSRTC

Since inception, the GSRTC has been following a general policy of inviting open tenders and a limited number tenders in duplicate for purchase of bulk materials. After tenders having been received and processed as per the laid down procedure, they are opened and tabulated.

The Store Purchase procedure in GSRTC has been designed such that all the techniques discussed in this chapter for effective purchasing, have been incorporated and the purchase of materials is strictly made according to the laid down procedure.

In case, the chassis suppliers/or manufacturers are approved by Standing Committee (Supplies & Contracts) of Association of State Road Transport Undertakings, agenda/minutes and technical credentials statements are obtained by the Mechanical Engineering Department. If such parties have quoted advantageous rates, terms and conditions, the same are preferred for orders. If the party/manufacturers approved by the Standing Committee (Supplies & Contracts) of ASRTUs has quoted tender and sample is okayed, material technically acceptable or its O.E. suppliers, and if the suppliers' past record in dealing with STUs is satisfactory, such party/manufacturer is selected for orders.

In the case of offers of new parties responding to the tenders issued by the Corporation or those for which tenders are finalised by the Standing Committee
(S&C) of ASRTUs are otherwise acceptable and competitive, the order for materials up to 10% of the requirements is given to them after obtaining satisfactory inspection report of their factory from the recommending authority in case of 'A' and 'B' category items. For 'C' category items, purchase order for bulk annual/quarterly is issued and recommending authority is required to submit the inspection report of the factory after the placement of the order. In either case the recommending authority is required to submit the conclusive test report preferably before finalising the next purchase.

While finalising the proposals for technically critical items, two concurrent sources are usually maintained and alternative source is earmarked. In case of concurrent sources, the following norms are prescribed for allocation of purchase order:

(a) If the difference of extra expenditure to procure materials from both the parties is less than Rs. 1000/-

(b) Rs. 5000/- up to Rs. 10,000/- the ratio of order is kept as 60:40, 70:30 respectively.

(c) The Corporation is the competent authority for approval of maintaining two sources even if difference of extra expenditure is more than Rs. 10,000/-.
The Corporation used to purchase certain groups of items without inviting tenders from the suppliers with whom the Standing Committee (S&C) of ASRTUs has finalised the rate contract. Also the corporation purchases the critical parts from operational point of view from the O.E. suppliers.

Moreover, as per the instructions of the Government of Gujarat, Department of Industries, Mines and Power, the policy of order preference has been adopted by the Corporation for award of 30% business to the local manufacturers/service units which are prepared to supply the materials at par with the rates of the lowest acceptable tenders.

The Corporation has now revised its purchase policy in 1982. According to the revised purchase policy, tenders for purchase of all items are to be invited. Moreover, it is resolved that the rates accepted by the Standing Committee (S&C) of ASRTUs on regular basis be also tabulated as may be available with the Purchase Department while tabulating the offers received against the tender so that the benefit of the better rates and better terms and conditions, if any, could be obtained by the Corporation.

In the revised policy, the procedure remains the same till the submission of purchase proposals. The effect of change in the policy is that when the proposal is submitted before the Tender & Stores Committee, an element of negotiations has been made operative. At the time of negotiations, the following factors
are discussed and appropriate decision is taken.

(a) Rates
(b) Terms and conditions.
(c) Warranty for premature failure of item.
(d) Results of laboratory test.

The supplier is required to give guarantee for the quality of materials supplied either in terms of period or in terms of kms service. If any of the items failed to achieve the stipulated target service, the supplier has either to reimburse the cost of deficiency or to replace the item as per agreed terms. If party agrees to the above mentioned terms, the business order is given to it.

The following table has been evolved in accordance with the purchase policy after 1982.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of party</th>
<th>Performance guarantee in kms in thousand</th>
<th>Rate of tyre in Rs.</th>
<th>Cost per km in ps.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A</td>
<td>58.28</td>
<td>2000</td>
<td>34 paise</td>
</tr>
<tr>
<td>2.</td>
<td>B</td>
<td>74.14</td>
<td>2150</td>
<td>29 paise</td>
</tr>
<tr>
<td>3.</td>
<td>C</td>
<td>61.29</td>
<td>1900</td>
<td>31 paise</td>
</tr>
<tr>
<td>4.</td>
<td>D</td>
<td>-</td>
<td>2200</td>
<td>not known.</td>
</tr>
</tbody>
</table>
Thus it would be evident that the tyres of supplier 'B' would be most economical though the rate of tyre is as high as Rs. 2150/- i.e. third lowest.

In the same way, the purchase of clutch plates is finalised purely on financial and past experience basis.

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Name of party</th>
<th>Guarantee in kms.</th>
<th>Price per piece (Rs.)</th>
<th>Cost in ps. per 1000 kms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A</td>
<td>1,00,000</td>
<td>140</td>
<td>7.29</td>
</tr>
<tr>
<td>2.</td>
<td>B</td>
<td>no guarantee</td>
<td>145</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>C</td>
<td>80,000</td>
<td>150</td>
<td>5.30</td>
</tr>
<tr>
<td>4.</td>
<td>D</td>
<td>1,20,000</td>
<td>180</td>
<td>6.60</td>
</tr>
</tbody>
</table>

The purchase would be finalised on the basis of the lowest cost per 1000 kms at 5.30 paise which is based on the guarantee in terms of kms. Clutch plate of supplier 'C' would be most economical.

Table below is prepared to indicate finalisation of purchase of bearings with a guarantee in terms of period.
The purchase would be finalised with 'B' party being the lowest in cost worked out on the basis of guarantee in terms of period.

Now let us compare purchase policy before 1982 with that after 1982.

From the table given on foregoing page, it would be seen that the clutch plates were purchased before 1982 at Rs. 140/- per piece being the lowest offer, while according to the revised policy, the cost in paisa has been worked out per 1000 kms based on the performance guarantee of kilometers. The cost thus worked out gives a different result. It would be more economical to purchase the clutch plates at Rs.150/- as the cost per 1000 kms is as low as 5.30 paisa. It might appear that the lowest price offer was not selected, but on performance basis it is advisable to purchase the clutch plates at a price higher by Rs.10/-.

<table>
<thead>
<tr>
<th>Name of Party</th>
<th>Price in Rs.</th>
<th>Guarantee in terms of period.</th>
<th>Cost in Rs. per month per piece.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100</td>
<td>No guarantee</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>130</td>
<td>12 months</td>
<td>10.8</td>
</tr>
<tr>
<td>C</td>
<td>140</td>
<td>10 months</td>
<td>14.0</td>
</tr>
<tr>
<td>D</td>
<td>160</td>
<td>14 months</td>
<td>11.4</td>
</tr>
</tbody>
</table>
The tyres and batteries were always purchased on cost/kms basis even before 1982.

The GSRTC has made some departure from the established purchase policy in that after inviting open tenders in most of the cases, an element of negotiations with the manufacturers/suppliers has been inserted to bring the price of material down or to obtain a competitive performance guarantee. No doubt, this policy is beneficial to the organisation, but in practice it may not work as anticipated for various reasons. Some of these reasons may be stated as under:

(a) Tenderers will not quote realistic rates. Rates will always be higher since tenderers know that during the discussions/negotiations, they still have an opportunity to lower rates to procure business. Thus unhealthy competition creeps in to gain business. This is made possible by lowering the quality. In the initial stages, they would supply the quality goods but gradually quality will be sacrificed in order to earn more profit.

(b) The selected manufacturers/suppliers may back out in case the supplies are subjected to vigorous checks/tests.

(c) It may also encourage dubious dealings.
Performance of Revised Policy in GSRTC

So far the GSRTC has not brought out complete picture of the material purchased under this policy. However it has worked out only for tyres wherein it is said that the change in the policy of purchase has enabled the Corporation to save around Rs. 354 lacs for a purchase value of Rs. 2950 lacs in purchase of tyres for a period of two years i.e. 1982 and 1983. While analysing this statement with the help of inventory, it could be seen that the inventory of tyres-tubes, which remained for 9 days, has gone up to 17 days, i.e. it has nearly doubled.

This policy has however helped to create awareness and cost consciousness among the employees dealing with the subject. Not only this, but the suppliers/manufacturers have also realised that supply of defective or sub-standard material would spoil their names ultimately damaging their reputation.

8.6 INVENTORY CONTROL

Inventory control is another important tool for reducing the cost of materials. The principal objectives of inventory control are to reduce investment in inventories and simultaneously to minimise idle time by avoiding stock outs and storages.

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These two objectives are often in mutual conflict. If inventory levels are too low, the system cannot satisfy demand and must often undertake costly and wasteful efforts to recover from resultant stock out situations. On the other hand if inventory levels are too high, not only the money is spent on inventory which may never be used, but a series of unnecessary expenditure is set in motion on storage, space, personnel and transportation. Storage and receipts/inspection facilities are over-crowded with stocks and excessive inventory is generated which can only be purged from the system at severe financial loss. The crux of good inventory control system thus lies in balancing the two objectives to optimum advantages.12

Techniques/Tools of Inventory Control

There are various techniques and tools of inventory control. Some of them are relevant to our requirement. They are enumerated below:

(a) Selective Inventory control
(b) Standardisation, Codification and variety reduction,
(c) Demand forecasting and materials planning.

Of the three above, two, i.e. (a) and (b) are mostly used in STUs. The techniques mentioned above are not exhaustive. Each of the techniques has its own merits, depending upon the type of organisation and available managerial capability.

(a) Selective Inventory Control

In the selective inventory control, there are various techniques now available such as:

(i) ABC Analysis
(ii) VED Analysis (Vital, Essential, Desirable)
(iii) FMS Analysis (Fast, Medium and Slow moving items)
(iv) GOLF Analysis (Govt. Controlled items open local foreign market)
(v) SDE Analysis (Scarce, difficult and easy to procure items)
(vi) SOS Analysis (Seasonal and off-seasonally available items)
(vii) HML Analysis (High, Medium, low unit cost items)

(i) The inventory classified into ABC group of items are based on past annual consumption value of items. After selection of category of stores for such an analysis, all items are listed and arranged in descending order of their annual consumption in value such as:

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of items</th>
<th>%age</th>
<th>Total value (Rs.in lacs)</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>34</td>
<td>6.0</td>
<td>18.64</td>
<td>76.7</td>
</tr>
<tr>
<td>B</td>
<td>128</td>
<td>22.5</td>
<td>04.42</td>
<td>18.2</td>
</tr>
<tr>
<td>C</td>
<td>405</td>
<td>71.5</td>
<td>02.23</td>
<td>5.1</td>
</tr>
<tr>
<td>Total</td>
<td>567</td>
<td>100.0</td>
<td>24.29</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The group of ABC analysis and VED group analysis are to be combined and grouped as under:-

<table>
<thead>
<tr>
<th>AV</th>
<th>A</th>
<th>E</th>
<th>AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV</td>
<td>B</td>
<td>E</td>
<td>BD</td>
</tr>
<tr>
<td>CV</td>
<td>C</td>
<td>E</td>
<td>CD</td>
</tr>
</tbody>
</table>

On the basis of the above combination and taking into account the cost of items and their functional utility, following service levels are recommended for each combination.

The table given below shows that 'C' class and 'Vital' items are stocked at very high assurance level (99%) meaning more safety stocks as even temporary non-availability would cause vehicle off road resulting in loss of revenue. 'C' class items having less value, would not lock up high level of inventory. In the case of 'A' class and desirable items, one may straight away decide to stock only at 50% level.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>AV</td>
<td>BV</td>
<td>CV</td>
</tr>
<tr>
<td></td>
<td>85%</td>
<td>95%</td>
<td>99%</td>
</tr>
<tr>
<td>E</td>
<td>AE</td>
<td>BE</td>
<td>CE</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>85%</td>
<td>95%</td>
</tr>
<tr>
<td>D</td>
<td>AD</td>
<td>BD</td>
<td>CD</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>75%</td>
<td>85%</td>
</tr>
</tbody>
</table>
Having made this analysis, the reasons for selective control becomes obvious. The items which are in group 'A' are minimum in number and maximum in consumption value. They deserve most concentrated control. The 'C' group items on the other hand deserve least attention.

The financial limit for 'A' group items is determined by dividing the total consumption value in rupees by the total number of moving items and multiplying by 2.5 (an empirical formula).

<table>
<thead>
<tr>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total usage value</td>
</tr>
<tr>
<td>No. of moving items</td>
</tr>
<tr>
<td>Therefore, $\frac{24.29 \times 2.5}{567}$</td>
</tr>
<tr>
<td>= 10709 Rupees.</td>
</tr>
</tbody>
</table>

An item having annual consumption value of Rs. 10,000/- and above is treated as 'A' class. Similarly, financial limit for 'C' class items are worked out by dividing the total usage value by the total number of moving items, but multiplying by 0.25, the result is Rs. 1070 as Rs. 1000 is treated as 'C' class. An item with annual consumption value ranging between Rs.1,000/- and Rs. 10,000/- is treated class.
The above service level is to be fixed by the 'User' for calculating safety stock to be maintained at the Depot level.

To make the ABC system more effective, the ABC categories are further classified into VED (Vital, Essential, Desirable) group by Mechanical Engineering Department according to functional importance or operational criticality.

The vital items are those without which a bus cannot run. Essential items are those which are necessary for better and long performance of vehicles. The desirable items are the running items which do not fall into above categories.

ABC, VED and FMS analysis are followed in the STUs. The function of both the cost (ABC) and criticality (VED) factors is to help the STUs in fixing the appropriate service or assurance level while working out the safety stock.

(b) Standardisation, Codification and Variety reduction

(i) **Standardisation**

Standardisation primarily means setting up standard or 'measuring stick' by which extent quantity, quality, value performance, or service may be gauged or determined and is the crystalised best thought and practice of industry or art into definite form for general usage. According to N.F. Harriman, "Standardisation"

may be defined as the unification of methods, practice, and techniques involved in the manufacture, construction and use of materials, machines, and products for all the lines of endeavour which present the necessity for performing respective work.\textsuperscript{14}

Actions which are repeated rather frequently in pursuit of the organisation objectives must be reduced in number so that only the most effective are prescribed. This necessitates the establishment of a system that is a normal routine for performance of activities. This system consists in setting up of modes of actions and model accomplishment rigidly specified by units of measurements such as quantity, quality, value, time or dimension. The practicability of both the systems and the standards depends upon the respective or non-respective nature of action, the physical and economic feasibility of applying measuring techniques, the care with which precise norms are set, and the exercise of sound judgement wherever exact measurement is impossible.\textsuperscript{15}

This technique has been fully made operative by GSRTC and items required have been reduced from 15,000 to about 2500.


ii) **Codification**

All stock and stores are denoted by their common or proper names. Difficulty arises when the same article is known by different names and slightly different nomenclature may lead to wrong issue. Codification avoids these variations. It is however not without its drawbacks. Codification of materials play vital role in the simplification and standardisation.

A scientific grouping of materials, an easy codification system and maintenance of a proper stores catalogue based on correct nomenclature, are necessary for an efficient working of a Stores and Purchase Organisation.

Normally, Engineering Department allots code or part numbers and these are followed by all indentors, Inventory Control Section, Purchase and Stores Department, and even suppliers indicating in their challans while effecting deliveries.

(iii) **Variety reduction or Simplication.**

The method is used in reducing number of types of products with definite range to that number which is sufficient to meet with the prevailing requirement at a given time. This is specially for raw materials and consumable items of Stores such as nuts.
bolts, rods and other fastenings. This technique along with the technique of standardisation has been made operative in GSRTC and as said earlier considerable reduction in items has been achieved.

c) Demand forecasting and Materials Planning

This method is also used in most of the STUs. While preparing the indents, the following are taken into consideration:

1) Consumption of the previous year.
2) Composition of fleet with age group.
3) Consumption during current period
4) Quantity received.
5) Quantity in stock.
6) Lead time to procure the materials.
7) Future expansion
8) Number of vehicles.

On the basis of this data, the indents are prepared and vetted by senior officer of Mechanical Engineering Department. The demand forecasting in this way has no scientific base, still however, it is popularly used by most of the STUs including the GSRTC. The method has proved to be useful in controlling
purchase and consumption of materials.

The materials planning for the workshops is made on the basis of production programme for building new bus bodies and reconditioning programmes for buses and assemblies and retreading of tyres for which a bill of materials forms the basis for demand forecasting of materials.

Inventory holding: A Comparison

The Gujarat, Maharashtra and Karnataka STUs inherited the policy and procedures of erstwhile BSRTC. The comparative data of Stores inventory for the year 1983-84 speak that the Stores inventory in KSRTC is the lowest for all the items except the batteries in terms of days. It is Rs. 108.6 lacs in terms of value. It is 6.63% of the total consumption of materials on the last day of the year. The inventory per vehicle is also low at Rs. 9888/- However, the cost of materials per km is 108.6 paise per km. out of 38.0 paise total cost per km. It means that the cost of material forms 43.92% of the total cost of operation.

The stores inventory in MSRTC as on last day of the year 1983-84

* Reference is invited to table No. 3.8
is of the order of Rs. 154.0 lacs forming 11.1% of the total consumption. The material cost in the total cost is Rs. 154.0 lacs forming 34% in the total cost of operation, while the inventory held per vehicle is Rs. 15067/- which is higher by Rs. 5679/- than that of KSRTC.

The material cost in GSRTC is the lowest among those in all of the STUs in the country (Paise per km Diesel .71.07, Lub oil 4.2, Auto parts 8.2, Tyre-tubes 23.1, Battery 0.9). The stores inventory holding is Rs. 112.6 lacs forming 9.90% of the total consumption and material cost per km is 112.6 paise, i.e. 29.9% of the total cost. Further, stores inventory as on the last day of the year per vehicle is Rs. 10762/- while the average fleet held by the GSRTC is 7021 vehicles. In comparison of stores inventory vehicles held by KSRTC, MSRTC has locked up an amount of Rs. 628.6 lacs, whereas the GSRTC has locked up Rs. 61.36 lacs in the year 1983-84. If the stores inventory is maintained at an optimum level, the amount could be used for other developmental purposes.

The reason for low inventory per vehicle in KSRTC is perhaps the awareness for the delivery schedules in the last quarter of the year. This results in minimum level of inventory per vehicle on the last day of the year.
The concept of inventory control incorporating techniques shown at (i) and (ii) was introduced in GSRTC in the year 1973-74 and has been vigorously followed since by series of meetings of Unit Heads and Stores Officers. To review stock position, meetings were arranged periodically and all the necessary actions to transfer surplus, slow moving materials to needy units and the purchase orders quantity were also controlled.

The inventory of auto-spares held as much stock as could be required for consumption up to 10 months and 18 days and total auto inventory was the highest for the consumption up to six months and 5 days, claiming Rs. 28447/- per vehicle locking up a total amount of Rs. 732.8 lacs in the year 1965-66. In the year 1970-71 it was for 4 months and 20 days locking up an amount of Rs. 629.6 lacs and per vehicle inventory was Rs. 16740/-.

(a) The concept of inventory control policy was introduced in the year 1974-75 and 1975-76, when inventory was at the level of the period of only 1 month and 20 days locking total amount of Rs. 545.7 lacs and per vehicle an amount of Rs. 10767/-. Since then, year after year it went on decreasing up to

* Reference is invited to table Nos. 3.6 and 3.7.
consumption for one month and 12 days locking an amount of Rs. 588.0 lacs (even at high price at 146% of the basic year 1970-71), and inventory per vehicle was Rs. 8050/-, the lowest in the year 1981-82. However, inventory was increased in the year 1982-83 as much as of the consumption for one month and 20 days worth of Rs. 673.8 lacs and inventory per vehicle at Rs. 8798/-.

The inventory level was the lowest in the year 1981-82 as the Corporation Board changed the entire purchase policy and introduced strict economy measures. The expansion was stopped and the new vehicles were used in replacement of overaged vehicles. It increased in the next year as some material was required to be purchased for running the vehicles. This has exceeded the ceiling of the inventory at optimum level.

Thus inventory control has played an effective role in bringing down the inventory level and thereby reducing the inventory carrying cost without affecting the STU operations.

(b) In order to ensure optimum inventory per vehicle it should be ensured that -

1. Delivery schedules are so planned that there remains continuous flow of supply of materials and no occasion arises for stock out at any time.
2. Instead of keeping 'A' category items at divisional level, a group of 3 to 4 divisions should be formed and such item should be stored at one of the places (Region) and supply should be made from this place so that maintenance of inventory of costly items at all divisions is avoided.

3. The chassis suppliers/ manufacturers should be prevailed upon to hold about 3 months stocks of 'A' and 'B' class items at their warehouses (instead in the STUs), which might result in substantial savings to STUs.

8.6 Surplus, Obsolete and Scrap materials

Surplus, obsolete and scrap materials play an important role in material management. These items account for 15 to 20% of the total inventory carrying cost. In GSRTC in the year 1980-81, auto-parts and tyre-tubes were of the order of Rs. 3230.42 lacs against which Rs. 245.85 lacs were realised by sale of surplus, obsolete and scrap materials. This amounted to 13.13% of the total auto-parts and tyre-tubes consumption. Similarly it was to the tune of 12% in the year 1981-82.\(^{16}\)

\(^{16}\) Annual Administration Report of GSRTC 1981-82.
Losses due to redundancy are unavoidable in any organisation where material is required to be stocked in order to ensure smooth and uninterrupted flow of manufacturing or similar productive activity. No system of inventory control howsoever efficient, can entirely eliminate these losses though a good system can certainly reduce losses.

"Surplus" is a state when stock is likely to last longer than a reasonable period or when it is no longer required for use.

Items which are out of date, mostly superseded by a later design, are known as 'obsolete' items.

Surplus and obsolete stocks are similar in one respect as both are in a serviceable condition and are capable of being used as and when need arises. Scrap is a term which applied to such material or equipment as is no longer serviceable and has been discarded. The cost of material lying in stock goes higher with lapse of time. Even if we consider inventory carrying cost of any material at a moderate estimate of 25%, the holding cost of material which lies in stock will go up at least by 25% every year. It is therefore profitable to sell such materials at 20% below the market value.
Rs. 10762/- MSRTC, Rs. 15067/- and KSRTC, Rs. 9888/- per vehicle. The KSRTC could maintain the lowest inventory level at Rs 9888/- per vehicle, while MSRTC has Rs. 15067/- per vehicle and GSFTC has Rs. 10762/- per vehicle. This variation shows that despite the fact that all the three STUs are particular for inventory control they have different levels of inventory per vehicle.

In view of the above, it appears that there is scope for improvement in both the areas, i.e. in purchase policy and inventory control.

(i) Developing ancillary industries through local enterprises, by providing technical know-how and finance, and procuring from them the requirements at the time actually required. This will go a long way in reducing inventory and also ensuring quality of materials. The price will be relevant to production costs.

(ii) For 'A' Category items, instead of keeping them at divisional level, a group of 3 to 4 divisions may be formed and such items may be stored at one of the places. Supply may be made from this place so that maintenance of inventory of costly items at all divisions is voided.

It is therefore concluded that, although material management has been effective in reducing cost, there are still possibilities for further improvement in purchase system through substantial savings and effective inventory control in the STUs. The hypothesis is found to be in order.
Most of the STUs have implemented techniques discussed in purchase policy and those shown for inventory control for reduction in material cost. However, inventory level differs from STUs to STUs. This difference may be on account of reasons such as consumption trend, age composition of vehicles, fluctuating production and supply position, purchase policy and the last but not the least important the human factor.

The GSRTC, MSRTC and KSRTC have more or less common working procedures as part of their operational area was integral part of erstwhile BSRTC and hence they have more or less inherited common policy and procedures. However on examination of the table No. 8.1, it would be seen that the material cost, inventory level and inventory per vehicle show much variation even when the major items of inventory have no relation to each other. The material cost in GSRTC is 112.6 paise per km, while it is 154.0 paise per km in MSRTC and the same is much lower in KSRTC at 108.6 paise in the year 1983-84.

All these STUs having different material cost and inventory levels, and different inventory level per vehicle, e.g. GSRTC.