Figure 4.6: Construction Phase
Fig. 4.7: Material Requisition Process for Miscellaneous Material
**Construction Phase**

**Construction Team/Warehouse**

1. Material delivered to warehouse
2. Inspect material
3. Material stored
4. Pre-fab material
5. Material deliver to site

6. Store &/or install

7. Material can be either send to pre-fab shop or field.
   - if material is going to be used for pre-fabrication it is send to pre-fab shop or storage, if it is a critical item ordered very early. Else send directly to site.
   - in certain case material may be send to sub contractor palace, due to lack of space at site.
   - in some cases material is shipper to manufacturer to get it filled into a major assembly

8. Material delivered to site
   - Material can be either send to pre-fab shop or field.
   - if material is going to be used for pre-fabrication it is send to pre-fab shop or storage, if it is a critical item ordered very early. Else send directly to site.
   - in certain case material may be send to sub contractor palace, due to lack of space at site.
   - in some cases material is shipper to manufacturer to get it filled into a major assembly

9. Inspect material foreman
   - Receive & verify material received against the Package slip sent by supplier.
   - Inspect material for damage & storage of quantities.
   - Fill problem sheet if material is damaged or quantity received are less than needed.
   - Send packing slip to accounts for payment and as acknowledgement of material received.

10. Generate Prob. sheet, send to Purchasing

11. Fill problem sheet to S/D/M purchasing

12. Forwarded problem sheet to supplier/ distributor or manufacturer to replace damaged material and or supply additional material not delivered.

13. If additional materials are needed, because of initial ordering 70-80% estimated, prepare a pre-req and send it to the P.M.
   - Negotiate prices with supplier
   - Award contract to supplier.
   - Request material release as needed

---

**Fig 4.15 (B), Detailed material management flow chart**
Figure 7.1: Decision Process for the “Material to Buy” Decision Node
How Much To Buy

Select model based on how much to buy

Parameters
Yearly demand
Holding cost rate
Ordering cost

D.M. Calculate Economic order Quantity uses the EOQ model

Estimate quantity needed

EOQ batch size

Is the EOQ batch size smaller than the estimated quantity needed?

Parameters
Purchasing Discounts
Transportations Ordering
Holding Shortage
Progress of Work Productivity
Uncertainty in schedule Work to be done
When to use the material Planned vs. Actual
-Extra work
-Changes
Quantity to install Order to install
Order to store Waste (%)
How prone to damage

D.M. How Much to buy

Optimal batch size

Consider to buy the EOQ amount

Figure 7.2 “How Much To Buy” Decision Process
When to buy

Parameters
- Prefabrication strategies

D.M. When to place an order for major material

Material to be used in pre-fabrication

Optimal Time when to place an order

Parameters
- Progress of work
- Productivity
- Uncertainty in schedule
- Work to be done
- When to use the material
- Planned vs. actual
- Extra work
- Changes
- Quality to install
- Order to install
- Order to store
- Others

Figure 7.3 “When to Buy Material” Decision Process
Figure 7.4: “When to Deliver” Decision Process

When to Deliver

1. Does the supplier late deliveries cause delay in activities?
   - Yes
   - No

2. Is the supplier a reliable source and delivers as requested?
   - Yes
   - No

3. D.M. Optimal time to deliver

Parameters
- Storage space available
- Material availability
- Penalties for late delivery
- Project delay
- Possibility of damage
- Storage cost
- Backorders
- Storage space
- Schedule
- Progress of work
- Installation rate
- Others

Parameters
- Supplier’s performance
- Material availability
- Backorders
- Storage space
- Schedule
- Progress of work
- Installation rate
- Uncertainty in schedule
- Work to be done
- When to use the material
- Planned vs. Actual
- Extra work
- Changes
- Quantity to install
- Order to install
- Order to store
Figure 7.5: “Where to Deliver” Decision Process
Figure 7.6 “Where to store” On Site Decision Process
Figure 8.4: The SPARCS Hierarchy
Figure 8.5: The SPARCS Model for Decision on How Much to Buy
Figure 8.6: SPARCS for What Material to Buy Decision
Figure 8.7: SPARCS for the Where to Deliver Decision
Figure 8.8: SPARCS for the Where to Store on Site Decision
Figure 8.9: SPARCS for the When to Deliver Decision
Figure 8.10: SPARCS for the When to Buy Decision
Figure (A II.3): Flowchart Contractor B
Figure (A II.4) Flow Chart for Contractor C
Purchasing department sends bids from manufacturers unless the manufacturer is specified in the contract.

- A quotation request is sent to suppliers to ask for prices for the materials.
- Bidding is more beneficial because companies can get better prices when manufacturers are competing against each other.
- Suppliers coordinate with job sites for material deliveries.
- Packing slips are sent to purchasing for payment purposes.

**Yearly Contracts**

- Request bids from suppliers for a yearly price. Based on volume expected.
- Bids are received.
- Contract awarded to suppliers for a yearly contract.

A list of materials like wire, fitting, pipes, etc. are sent to the warehouse to check availability. If available, the warehouse will supply material to the site. Otherwise, additional quantities needed are purchased from suppliers.

- If the warehouse has a small amount of the materials needed, all the materials are purchased from the supplier.
- Supplier known in advance through yearly contracts.
- Temporary PO given to the supplier for contract agreement, valid only upon approval of submitted.
- Sometimes orders are split (i.e., requested on multiple orders) to avoid overstocking on site.
- Purchasing department coordinates suppliers and job sites for material deliveries.
- Packing slip is sent to purchasing for payment purposes.

The supplier delivers the material directly to the site. Additional material needed is supplied by the warehouse if it is available on-hand.

If there are problems with the material delivered, the PM contractors contact vendors.

Temporary PO is sent to purchasing for payment purposes (weekly basis).

The remaining material (surplus) is sent to the warehouse. The project gets a credit if the material is in good condition.

**Fig. AII.6: Flow Chart for Contractor E**
Figure (AII.7): Flowchart for Contractor F