



PROJECT MATERIALS MANAGEMENT PLANNING GUIDE

Texas A & M University
Materials Management Task Force

© 1987 Construction Industry Institute™.

The University of Texas at Austin.

CII members may reproduce and distribute this work internally in any medium at no cost to internal recipients. CII members are permitted to revise and adapt this work for the internal use provided an informational copy is furnished to CII.

Available to non-members by purchase; however, no copies may be made or distributed and no modifications made without prior written permission from CII. Contact CII at <http://construction-institute.org/catalog.htm> to purchase copies. Volume discounts may be available.

All CII members, current students, and faculty at a college or university are eligible to purchase CII products at member prices. Faculty and students at a college or university may reproduce and distribute this work without modification for educational use.

Printed in the United States of America.

PREFACE

This report is a source document of the Construction Industry Institute, and, in addition, is a chapter in the Project Materials Management Handbook. The Handbook will be published incrementally starting July 1987. Individuals and companies reviewing this report should request a copy of the Handbook from the Construction Industry Institute if they are not already on automatic distribution. The instructions and Table of Contents of the Handbook are explained in that document.

ACKNOWLEDGEMENTS

This report was prepared by a subcommittee of the Materials Management Task Force. The following members wrote the report and assisted by editing and reviewing the text:

Glenn Dodd, Brown & Root, Inc. (Team Leader)
Norman Nunn, Fluor Daniel
Edward Ischy, Houston Lighting & Power
G.S. Fitzgerald, ARCO Oil & Gas Co.
George Stukhart, Texas A&M University

**PROJECT MATERIALS MANAGEMENT
PLANNING GUIDE**

TABLE OF CONTENTS

	Page
1.0 INTRODUCTION	
1.1 General	1
1.2 Purpose of the Planning Guide	1
1.3 How to Use This Planning Guide	1
1.4 Proactive Integrated Materials Management	2
 2.0 PROJECT DEFINITION AND STRATEGY DEVELOPMENT	 3
2.1 General	3
2.2 Project Definition	4
2.2.1 Facilities to be Constructed	4
2.2.2 Project Location	4
2.2.3 Existing Facilities	4
2.3 Responsibilities	4
2.3.1 General	4
2.3.2 Owner's Role	5
2.3.3 Division of Responsibilities	5
2.3.4 Organization	7
2.4 Business Considerations	7
2.5 Prefabrication Considerations	7
2.6 Schedule & Cost Considerations	8
 3.0 MATERIALS REQUIREMENTS PLANNING	 9
3.1 Introduction	9
3.2 Key Concepts	9
3.2.1 Responsibility	9
3.2.2 Material Types	9
3.3 Planning for Engineered Materials	10
3.3.1 General	10
3.3.2 Source of Information and Basic Plan	10
3.3.3 Major Equipment Materials Cycle	10
3.3.4 Considerations	13
3.3.5 Forms and Procedures	13
3.4 Planning for Bulk Materials	13
3.4.1 General	13
3.4.2 Bulk Materials Cycle	14
3.4.3 Approach to Quantification	14
3.4.4 Schedule Implications	16

3.4.5 Use of Purchase Agreements	16
3.4.6 Responsibility Matrix	17
3.4.7 Bulk Materials Controls	17
3.4.8 Sources of Data	18
3.5 Planning for Prefabricated Materials	18
3.5.1 General	18
3.5.2 Fabrication Approach	20
3.5.3 Engineering and Materials Takeoff	20
3.5.4 Source of Materials	20
3.5.5 Prefabricated Materials Controls	21
 4.0 PURCHASING PLANNING	 21
4.1 Introduction	21
4.2 Approved Vendors List	21
4.3 Terms and Conditions	22
4.4 Forms and Procedures	23
4.5 Major Equipment	23
4.6 Value Engineering	24
4.7 Surplus Utilization	24
4.8 Subcontracting	24
4.9 Construction Site Purchasing	25
 5.0 EXPEDITING PLANNING	 25
5.1 Introduction	25
5.2 Proactive Expediting	26
5.3 Reactive Expediting	26
5.4 Status Reporting	26
5.5 Selection of The Approach	26
5.6 Project Interaction	27
5.7 Materials Management Systems Updating	27
 6.0 QUALITY PLANNING	 28
6.1 Introduction	28
6.2 Design Phase	28
6.3 Pre-award Phase	28
6.4 Post Award	30
6.5 The Inspection Plan	30
 7.0 TRANSPORTATION REQUIREMENTS PLANNING	 31
7.1 Introduction	31
7.2 F.O.B. Terms	31

7.3	Route Alternatives and Constraints	32
7.4	National Agreements	32
7.5	Local Traffic and Transportation Constraints	32
7.6	Shipping Alternatives (Routing Guide)	32
7.7	Courier Service	32
7.8	Site Personnel Transportation	33
7.9	Special Loads	33
7.10	Foreign Shipments	33
	7.10.1 Commercial Considerations	33
	7.10.2 Export Preparation	33
	7.10.3 Freight Forwarding	34
	7.10.4 Export Permits	34
7.11	Communication, Tracking and Reporting	34
8.0	SITE MATERIALS MANAGEMENT PLANNING	34
8.1	Introduction	34
8.2	Site Access/Security	35
8.3	Field Procurement	36
	8.3.1 Scope and Requirements	36
	8.3.2 Field Expediting	36
8.4	Receiving	36
	8.4.1 Quality Control Receipt Inspection	36
	8.4.2 Receiving Considerations	36
8.5	Storage Facilities	37
	8.5.1 Laydown Area Planning	37
	8.5.2 Warehousing Facilities and Storage	37
8.6	Equipment Storage Protection/Maintenance	39
8.7	Inventory Control and Reporting	41
8.8	Material Issuance and Return	41
	8.8.1 Materials Issue	41
	8.8.2 Work Packaging	41
	8.8.3 Returns	41
8.9	Surplus	42
9.0	AUTOMATED SYSTEMS PLANNING	42
9.1	Introduction	42
9.2	Defining System Requirements	42
	9.2.1 Materials Scope of Work	42
	9.2.2 Multi-Office and Multi-Entity Projects	43
	9.2.3 Project Phase Requirements	43
9.3	System and Component Selection	44
	9.3.1 System Features and Capabilities	44
	9.3.2 Common Data Base	45
	9.3.3 System Sources	46
	9.3.4 Options Checklist	46

9.4 Planning for Systems' Management	46
9.5 Materials Management System Flow Chart	46
 10.0 SUMMARY AND CONCLUSIONS	 48
 APPENDICES:	
A. REFERENCES	49
B. MATERIALS PLAN OUTLINE	50-57

LIST OF FIGURES

	Page
1. Example Materials Responsibility Chart	2
2. Example Detailed Division of Responsibilities Matrix	6
3. Milestones for Engineered Items	11
4. Example Equipment Status Report	12
5. Milestones for Bulk Material Items	15
6. Example Material Status Report	19
7. Example Vendor Quality Appraisal Form	29
8. Temporary Facilities Plot Plan	38
9. Example Materials Management System Flow Chart	47

PROJECT MATERIALS MANAGEMENT PLANNING GUIDE

1.0 INTRODUCTION

1.1 General

The cost of materials represents more than half of the total cost of today's typical capital project. Lack of materials when needed at the job site is typically the single most frequent cause of construction delays. Given the impact on cost and schedule, it is easy to see the positive influence that effective materials management can have on the cost of construction.

Research conducted by the Construction Industry Institute indicates that adequate planning may be the single most important determinant of effective project materials management.

1.2 Purpose of the Planning Guide

The primary purpose of this planning guide is to promote the development of a project materials plan. It is designed to be used by the owner, engineer, and constructor, or other participants in the construction process for any type project or contractual arrangement.

Before project materials planning can begin, it is important to understand the basic philosophy of materials management. Project Materials Management should be thought of as a process rather than an organization. In fact, the activities of the materials cycle cross all organizational lines of the project and begin with the specification of the material which is primarily the responsibility of the owner and engineer. The materials cycle, as illustrated in Figure 1, continues on through installation and startup in the field. Recognition of this process is essential in planning the integration and management of the materials function.

1.3 How to Use This Planning Guide

This Planning Guide consists of two basic parts:

- a. A narrative discussion of the various considerations to be taken into account in planning the materials function.
- b. An outline which is intended to be used as the basis for development of the actual written materials plan for any given project.

The narrative is not a set of instructions for completing the outline but rather a discussion of the normally significant factors which must be considered in the development of a plan. The outline is intended to prompt the documentation of the functions, systems, requirements and facilities that constitute the specific plan for a project. Obviously, the best developed plan is useless unless communicated to the participants at all levels of the project. The outline is intended to aid in this purpose.

Use of this guide will not result in procedures for the detailed activities of the materials management function, but rather the establishment of the framework within which detail procedures can be developed and subsequently carried out.

	Conceptual Design	Estimate	Specify	Design	Quality	Quantity	Procure	Inspect	Receive	Store	Install	Test/Start-Up	Reconcile
Owner	A	A	A	A	A								
Engineering	P	P	P	P	P	S		P					
Materials Management		S	S		S	P	P	P	P	P			P
Construction			S	S	S	P	P	S	S	S	P	P	S

A - Approve

P - Primary Responsibility

S - Secondary Responsibility/Participation

Figure 1 - Example Materials Responsibility Chart

1.4 Proactive Integrated Materials Management

Given that the overall materials function is a process crossing organizational lines, those responsible for materials management must be able to integrate functions even though many of these are performed within "non-materials" organizations. Such integration must be achieved across organizational boundaries regardless of the contractual arrangements for engineering, procurement and construction. It is also essential that a proactive integrated system be established to track and monitor the effect of changes on materials.

2.0 PROJECT DEFINITION AND STRATEGY DEVELOPMENT

2.1 General

The materials plan must fit within the framework of the overall project plan and take into account the limitations, constraints, and overall project strategies. Before the materials plan can be developed certain basic project information is required. General project descriptions and parameters such as type, size, and location will begin to define the overall project plan. Those responsible for materials management should be identified at this stage and actively participate in the development of the various project strategies. Some of the more significant strategic elements are:

- o Use of existing materials
- o Approach to procurement of critical equipment
- o Use of existing owner, engineer or constructor purchase agreements
- o Use of foreign supplied materials
- o Bulk material quantification - takeoff/estimate
- o Approach to procurement of engineered materials
- o Timing for first bulk materials takeoff and subsequent takeoffs
- o Approach to and supply of materials for prefabrication
- o Schedule implications/expediting support
- o Responsibility for procurement of bulk materials, both the first buy and the subsequent purchases
- o Inspection by the owner, engineer or contractors using permanent staff or contracted personnel
- o F.O.B. point
- o Approach to materials shorts, changes, and surplus
- o Spare parts philosophy; including commonality of equipment with existing plant and other contractors
- o Responsibility for procurement of materials for temporary facilities
- o Extent of field warehousing considering use of available supplier inventory systems
- o Role of subcontractors in procurement of materials
- o Use of min-max warehousing versus buying from take-offs

Project size, location, schedule, cash flow constraints, owner philosophy, and number of project participants are only some of the factors that will influence these strategies.

2.2 Project Definition

Development of materials strategies and subsequent detailed planning cannot begin without certain basic information about the project itself.

2.2.1 Facilities to be Constructed

A clear description of the facilities to be constructed is needed in the early stages. Descriptions of major equipment including size and ratings, main buildings or structures, or major piping and electrical systems provide a basis for determining the volume of engineered equipment purchase orders as well as an approximation of the bulk materials involved.

2.2.2 Project Location

The project location provides the basis for site access planning, discussed in detail later under Site Materials Management Planning, and is necessary for initial investigation of possible local vendors, fabrication shops, and subcontractors. Project location will also influence the extent of preassembly and modularization, mode of transport, permits, and in general, the entire traffic plan. Location will have an impact on method of storage and disposal of certain materials and may require special permits and licenses. Vendors supplying such services may be specified as sole source by local or state governments.

Actual jobsite conditions are an important consideration. Access to the site, total area available for storage, condition and layout of site roads, and numerous other details discussed later under Site Materials Management Planning, have a significant impact on materials planning. The local environment and climate also need to be known. It is important to know the rainfall, flooding conditions, snowfall, and temperature by months for past years. Any special logistics problems will also be evident once the location and climate is known.

2.2.3 Existing Facilities

If the project is not "grass roots" the existing facilities can play an important role in how the construction site functions. Storage areas may be limited in size and access; off-site storage may be required; additional security may be required; and existing plant rules and procedures may have to be adhered to by construction. It may also be necessary to purchase equipment to match existing facilities in order to maintain spare parts uniformity.

2.3 Responsibilities

2.3.1 General

A major effort of project materials planning is the establishment of specific responsibilities for materials and equipment. Owners must determine these responsibilities in the conceptual planning phase in conjunction with the project priorities, goals, and contract strategies. This guide discusses some basic considerations in establishing these strategies and responsibilities. In particular, owners must evaluate the benefits and risks of assuming the role of providing materials.

2.3.2 Owner's Role

According to CICE project report A-7, (Business Roundtable 1983) "The most successful construction contracts have one fundamental characteristic in common: thoughtful and meticulous preparation by the owner before the contract is let. It is crucial that all elements of the owner's organization which have an impact on a project be represented". From a materials planning viewpoint this means that the owner must carefully determine, and define in the contracts, the scope of materials-related services for each contractor. If done properly, this type of planning will do much to eliminate confusion and duplication of effort, reduce disputes and claims, and generally improve project communication, all at a lower cost to the owner.

The most substantial impact owners can have on successful materials management is simply how much emphasis they place on this area of project management. Owners must insure that materials management is recognized as a critical project management function by both their own organization and by the engineering and construction contractors. By stressing the importance of materials management activities and by setting specific criteria for evaluating proposed systems, the Owner will establish a solid foundation for carrying out the materials management function.

2.3.3 Division of Responsibilities

Responsibilities for all materials activities should be defined during the planning effort. All participants should be consulted, including the owner(s), prime contractor or managing contractor, engineering contractor(s), shop fabricators for prefabrication, construction contractor and the field subcontractors. It is recommended that a responsibility matrix be developed to consider all project materials as follows:

- o Process equipment and engineered items
- o Bulk materials
- o Construction materials
- o Construction infrastructure (including temporary facilities)

A sample of this type of matrix is shown in Figure 2.

Specific attention should be given to the role of the construction contractor and subcontractors in the gray area between direct materials and construction consumables. Confusion is minimized when a detailed list of materials is considered. For each class of materials, participants' responsibilities should be defined including developing specifications, materials takeoff, inquiries, purchasing, inspection, expediting, shipping, invoicing and closeout.

A detailed matrix developed with input from all participants can significantly impact the success of the project. The project benefits because each participant has a clear understanding of their materials management responsibility. It promotes proper communication since each participant understands the role of other project participants. This matrix may change and become more detailed as the project evolves, but the initial effort can be used by project participants to plan their portion of the work with a basic understanding of the responsibilities of the other organizations.

9

PLANT _____		LOCATION _____												
DESCRIPTION		SPECS & DATA SHEETS	CONST. DRAWINGS	MATERIAL TAKE OFF	MATERIAL CONTROL	INQUIRY	BID TABULATE	REQUISITION	PURCHASE	EXPEDITING	QUALITY CONTROL	TRAFFIC	VENDOR DATA	RECEIVING
UNDERGROUND PIPING	SANITARY AND PROCESS SEWERS													
	V.C. PIPE													
	OTHER PIPE													
	FIRE PROTECTION													
	MAINS AND BRANCHES													
	HYDRANTS													
	VALVES													
	INDICATORS													
	MONITORS													
	EXTINGUISHERS													
	OTHER PIPE													
PILING	LOAD BEARING													
	PRECAST													
	TIMBER													
	PIPE													
	H - PILE													
LEGEND														
A - CLIENT _____														
B - ENGINEERING CONTRACTOR _____														
C - ENGINEERING THIRD PARTY _____														
D - CONSTRUCTION CONTRACTOR _____														
E - CONSTRUCTION SUBCONTRACTOR _____														
F - OTHER (SPECIFY) _____														

Figure 2 - Example Detailed Division of Responsibilities Matrix

2.3.4 Organization

After the responsibility matrix has been established, the organization for carrying out the responsibilities can be structured. The responsibility and position of all key personnel for each project participant (company) is best illustrated on organization charts developed for the specific project. The charts promote a better understanding of the different organizational groups participating in the work and allow a clearer understanding of the authority of key personnel including the line of command. Including these organization charts in the materials plan communicates the role of the key personnel to all project participants in the contractor's and owner's organizations.

2.4 Business Considerations

The materials strategies for a project should be based on the project definition, business considerations, constraints, project goals, and other outside factors which will impact the execution of the work. The project definition including the type, size, location and complexity of the facilities directly determines the types and quantities of equipment and materials needed for support and construction of the desired facilities.

Constraints and project goals which often appear interchangeable, depending on the nature of the project, need to be identified prior to development of the basic materials plan. Included should be most if not all of the following points:

- a. Government constraints which may include:
 - Use of small and small disadvantaged and women-owned businesses.
 - Permit limitations for wildlife, road use, etc.
 - Labor restrictions for field wage rates which impact the extent of field fabrication
 - Preference of local communities which may encourage or discourage the use of local labor or camps.
- b. Project completion objectives which determine whether fast-track scheduling or routine scheduling may be utilized.
- c. Business constraints which may include:
 - Financing and cash flow limitations that determine the rate of procurement and delivery of materials.
 - Procurement from local suppliers.

Significant outside factors, typically beyond the control of the project team, can have a major impact on the project. The principal points usually include economic and market conditions which affect the cost and availability of needed labor, services, equipment and materials.

2.5 Prefabrication Considerations

Prefabrication of plant equipment and materials in the form of packages, modules or preassemblies (including pipe spools and structural steel members) can have a significant

impact on the field labor requirements, project cost and performance. Early in the project, the owner, managing contractor or engineering contractor (as appropriate) should complete a detailed analysis to determine the optimum extent of prefabrication. The effort begins with route surveys to determine upgrading requirements and module limitations, both size and weight. Winter shipping limitations on the road beds may be a significant limitation on certain projects.

There are other factors which may contribute to the analysis and decision for extensive prefabrication including:

- o High field labor cost
- o Remote jobsite location
- o Restricted labor supply
- o Limited jobsite space or facilities
- o Weather limitation on transportation and/or construction
- o Operating plant safety restriction

The prefabrication analysis should include an evaluation of the total cost and schedule impact on the project as well as performance, risk and socioeconomic issues. Various scenarios for contractor and fabricator responsibilities will have different impacts on cost, schedule, and performance.

Whatever the justification, extensive prefabrication demands an early planning effort to define the specific goals and limitations of the project's prefabrication program. All project participants must be operating under the same rules and guidelines. Specific elements of the prefabrication program include the following:

- o Location of jobsite versus prefabrication sites.
- o Determination of materials specification, design and takeoff responsibilities.
- o Determination of prefabrication materials and equipment procurement responsibilities considering scheduling limitations.

2.6 Schedule and Cost Considerations

There are various cost and scheduling concerns that the materials management team should consider to effectively execute their responsibilities. Foremost is a clear understanding of all key project milestones, including but not limited to:

- o Work release
- o Start of engineering
- o Major and critical commitment and delivery milestones
- o Field move-in (all major field contractors)
- o Engineering completion
- o Mechanical completion
- o Construction completion
- o Startup

The materials plan should define these requirements as well as other cost goals and priorities, including major components of the project budget and the relative importance of

schedule versus cost in the decision process. The importance of completing the project as scheduled including cost impact must be communicated to all project participants. The cost impact may be in the form of contractor liquidated damages or penalties, or may result from lost production (not meeting supply contracts) or shifting completion into a different tax base year.

Other cost requirements for the project include responsibility for assigning project cost codes to materials documents and breakdown of material takeoffs/pricing to support area/unit cost reporting and control. The latter also applies to support of planning and scheduling. Materials groups can have a significant impact on total cost and should be aware of cost change alert procedures.

3.0 MATERIALS REQUIREMENTS PLANNING

3.1 Introduction

The Materials Requirements Planning function in a project environment includes the activities associated with the definition and quantification of all materials for the project. The function spans the organizational groups of owner, engineer, and constructor. The process includes the definition and selection of materials based on constructability, availability and economics which are best accomplished by the combined efforts of engineering and construction. It includes planning for and managing toward schedule requirements for all projects materials. It includes controlling materials and managing toward minimum surplus while meeting project schedule requirements.

3.2 Key Concepts

3.2.1 Responsibility

It is important to realize that the owner, engineer, and constructor must all participate in the activities that make up the material cycle. Figure 1, Materials Responsibility Chart, Section 1.2, illustrates the major activities and participants in the materials acquisition cycle.

3.2.2 Material Types

To appropriately manage materials acquisition activities, project materials are categorized into three groups. Planning for these materials will be covered in more detail in the following paragraphs. Each category requires a different approach during the planning as well as execution phases of a project:

Engineered Materials - Engineered materials are broadly defined as those items of material with a uniquely assigned number (or tag) such that they can be uniquely referred to and so identified throughout the entire life of the project. This group is often further divided into 1) Major Equipment - those items which are engineered and fabricated specifically for the project (e.g., tanks, heat exchangers, pumps, etc.), and 2) Minor Equipment - those items which are manufactured to an industry specification and often stocked by the manufacturer or distributor but for control purposes are uniquely tagged and identified (e.g., control valves, instrumentation, specialty items, etc.).

Bulk Materials - Bulk materials are those items of materials manufactured to industry standards, and purchased in quantity. These materials include such items as pipe, fittings, wiring, and cable.

Prefabricated Materials - Prefabricated materials are items which are typically engineered and fabricated per engineered specification at a fabrication shop or site separate from the construction site. Materials constituting these fabricated items may, depending on project goals, be quantified, procured and delivered to the fabricator by the contractor. These materials include modules and preassemblies (including ladders/platforms, structural steel, pipe spools, large and small process modules, control stations, etc.).

3.3 Planning for Engineered Materials

3.3.1 General

The basic objective of planning for engineered materials is to insure that they are acquired and delivered to meet the overall construction schedule. Planning includes a review of the items needed, their relationship to the schedule, establishment of a status mechanism for reporting and control, and a plan for initiating the acquisition of the materials.

3.3.2 Source of Information and Basic Plan

The first step in planning for engineered items is a determination of the engineered items required for the project. Although equipment specifications may not be completed until the detailed engineering phase, it is important that planning for these items begin during conceptual engineering since these items will drive the entire project schedule. For example: The design of tie-ins cannot be completed until vendor drawings are completed. Vendor drawings cannot be completed until a purchase order for the major equipment is placed and so on back to identification of the various major equipment items.

During the conceptual design phase a major equipment list is developed to which lead times for vendor data, fabrication, and delivery should be added. This then can be used as input to the development of the engineering schedule so that long lead items can be specified early and the overall project schedule optimized.

3.3.3 Major Equipment Materials Cycle

Another step that must be accomplished early in the project is the development of the steps or milestones required in the acquisition cycle of engineered items. An example of the milestones typically required for an engineered item is illustrated in Figure 3. The establishment of the exact steps to satisfy the needs of the project is a joint effort including the owner, engineer, and constructor, if known.

A method of statusing and reporting against these milestones must also be planned. For purposes of management control and statusing, a tool to track where an item is in the cycle compared to where it should be is required. Often this is done using computerized systems with the ability to "model" duration cycles. Figure 4 illustrates a basic report from such a system which calculates scheduled and projected milestone completion dates. As actual

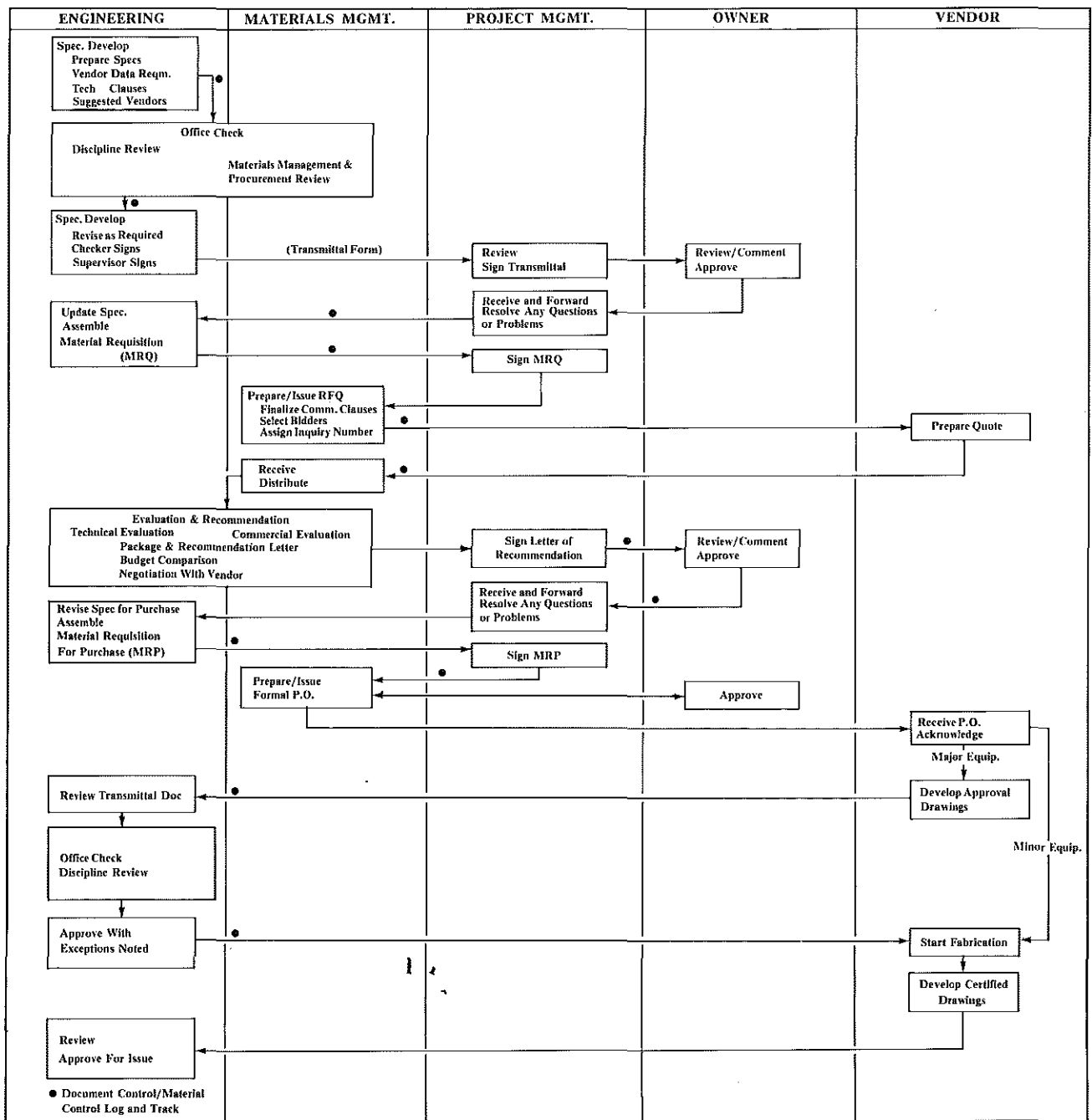


Figure 3 - Milestones For Engineered Items

REPORT DATE: 09/08/86
 CLIENT: Prototype Data
 Polypropylene Plant
 ENGINEERING MANAGER:
 AREA FACILITY

EQUIPMENT STATUS REPORT BY INQUIRY NUMBER Page: 1

* Indicates a 'Manually' Projected Date
 S=Scheduled Date, P=Projected Date, A=Actual Date

12

INQUIRY NUMBER: BC-00061 (4)		PO NUMBER: ASHE-3011 (5)		VENDOR: ROSEMOUNT INDUSTRIES/HOUSTON		PO NEED	FIELD NEED	AHEAD SCH.	LAST CHANGE
SPEC. NUMBER: SHE-3011		MODEL NO.: 2		BACKWARD PASS: YES		01/08/87	03/01/87	47	05/22/86
DESCR: SURGE TANK				PROMISED: 02/15/87		REMARKS: CERTIFICATE OF COMPLIANCE NEEDED.			
EQUIPMENT NO.: ZZ-1366		BUDGETED: \$	0.00	ACTUAL: \$	0.00	VARIANCE: \$ 0.00			
TRK. EVENT	1	2	3	4	5	6	7	8	10
	SPEC-ST	SPEC-COM	SPEC-APV	RFQ-COM	PO-ISS	REC-APP	RTV	RCV-CERT	SHIP
S	10/27/86	11/06/86	11/11/86	11/17/86	11/26/86	11/29/86	12/14/86	12/26/86	01/04/87
P	10/01/86	10/25/86	*10/23/86	11/05/86	11/14/86	11/17/86	12/02/86	12/14/86	12/23/86
A	10/15/86	10/18/86	10/30/86	/ /	/ /	/ /	/ /	/ /	01/13/87

INQUIRY NUMBER: BC-00361 (4)		PO NUMBER: ASHE-4011 (5)		VENDOR: INDUSTRIAL INC./FAIRFIELD		PO NEED	FIELD NEED	AHEAD SCH.	LAST CHANGE
SPEC. NUMBER: SHE-4011		MODEL NO.: 2		BACKWARD PASS: NO		01/08/87	04/01/87	229	05/22/86
DESCR: GENERATOR				PROMISED: 04/15/87		REMARKS: VENDOR TO BE SUPPLIED SPEC.			
EQUIPMENT NO.: DZ-2366		BUDGETED: \$	0.00	ACTUAL: \$	0.00	VARIANCE: \$ 0.00			
TRK. EVENT	1	2	3	4	5	6	7	8	10
	SPEC-ST	SPEC-COM	SPEC-APV	RFQ-COM	PO-ISS	REC-APP	RTV	RCV-CERT	SHIP
S	06/01/86	06/11/86	06/16/86	06/22/86	07/01/86	07/04/86	07/19/86	07/31/86	08/09/86
P	*05/15/86	05/11/86	05/16/86	05/07/86	06/01/86	06/18/86	07/03/86	07/16/86	07/25/86
A	05/01/86	/ /	05/01/86	05/23/86	06/15/86	/ /	07/04/86	/ /	/ /

INQUIRY NUMBER: BC-00161 (4)		PO NUMBER: ASHE-3111 (5)		VENDOR: GENERAL INDUSTRIES/BEAUMONT		PO NEED	FIELD NEED	AHEAD SCH.	LAST CHANGE
SPEC. NUMBER: SHE-3111		MODEL NO.: 1		BACKWARD PASS: YES		02/03/87	03/03/87	345	06/09/86
DESCR: CENTRIFUGAL PUMP				PROMISED: 02/15/87		REMARKS: NEED HARD COPY OF P.O.			
EQUIPMENT NO.: AZ-3456		BUDGETED: \$	0.00	ACTUAL: \$	0.00	VARIANCE: \$ 0.00			
TRK. EVENT	1	2	3	4	5	6	7	8	10
	SPEC-ST	SPEC-COM	SPEC-APV	RFQ-COM	PO-ISS	REC-APP	RTV	RCV-CERT	SHIP
S	11/08/86	11/08/86	11/18/86	12/08/86	12/11/86	12/17/86	12/26/86	01/07/87	01/22/87
P	01/05/87	12/01/86	12/25/86	01/14/87	01/04/87	01/10/87	01/25/86	02/06/86	02/21/86
A	12/01/86	12/15/86	/ /	01/01/87	/ /	01/16/86	/ /	/ /	03/23/86

INQUIRY NUMBER: BC-00261 (4)		PO NUMBER: ASHE-4111 (5)		VENDOR: SAMPSON INC./ORANGE		PO NEED	FIELD NEED	AHEAD SCH.	LAST CHANGE
SPEC. NUMBER: SHE-4111		MODEL NO.: 1		BACKWARD PASS: NO		02/03/87	05/03/87	404	05/22/86
DESCR: HOLDING TANK				PROMISED: 03/15/87		REMARKS: WITNESS INSPECTION NEEDED.			
EQUIPMENT NO.: BZ-4456		BUDGETED: \$	0.00	ACTUAL: \$	0.00	VARIANCE: \$ 0.00			
TRK. EVENT	1	2	3	4	5	6	7	8	10
	SPEC-ST	SPEC-COM	SPEC-APV	RFQ-COM	PO-ISS	REC-APP	RTV	RCV-CERT	SHIP
S	12/12/86	12/12/86	12/22/86	01/11/87	01/14/87	01/20/87	01/29/87	02/10/87	02/25/87
P	*01/06/87	01/05/87	01/15/87	*02/04/87	02/07/87	02/13/87	02/22/87	03/06/87	02/23/86
A	01/05/87	/ /	/ /	/ /	/ /	/ /	/ /	02/08/86	/ /

Figure 4 - Example Equipment Status Report

activities are completed, the system should have the ability to provide exception reporting as required, for example, a list of all items behind schedule. The decision to use any automated system versus a manual approach is strictly one of volumes, reporting needs and economics.

3.3.4 Considerations

In developing the plan for acquisition of major equipment, one must consider what will be acquired in addition to the basic item of equipment itself. Some of the considerations include:

- o Spare Parts - is there a need to acquire start up and/or operational spare parts?
- o Vendor Assistance - is vendor assistance needed for installation, startup, or training?
- o Warranty/Guarantee - what operational or functional guarantees are required?
- o Vendor Data - what vendor documents are required?
- o Inspection - what is the approach to inspection, testing, or other quality assurance methods?
- o Transportation - will cost of shipment be to buyer or seller?
- o Commercial Terms - what are requirements for retainage and payment schedule?

All of these items will become specific at inquiry and purchase order time. However, contractual arrangements between owner and contractor will establish the ground rules for many of them and the overall philosophy should be set during the planning stage. As specific items reach the inquiry stage, specific terms and conditions will be selected with inputs from the owner, engineer and construction.

3.3.5 Forms and Procedures

Once the basic plan, approach, and philosophy are established, the details of specific forms and procedures should be planned and established. It is not the intent of this guide to describe forms and formats of various documents such as specification, inquiry, and purchase order. Suffice it to say that the owner and contractor will use forms which are already in place or used on previous projects, perhaps modified to meet the specific needs of the project.

3.4 Planning for Bulk Materials

3.4.1 General

Planning for bulk materials is more complex than engineered items. Quantities required are never exactly known until the job is over. Additionally, changes in design often void the best laid plan, or at the least, part of the plan and any associated efforts that might have been undertaken to acquire those materials. Existing (owner furnished) materials must also be included in the equation for bulk materials acquisition as well as the overall project schedule. The plan will be influenced by such factors as materials availability, market conditions, storage facilities, transportation, material sourcing and cash flow. Experience and judgement play a significant role in planning bulk materials for a project.

In an optimum environment for bulk materials planning, all engineering will have been completed and actual bills of material created. The overall project schedule would be such as to allow sufficient time to consolidate the required materials then purchase and deliver them to the jobsite before construction ever begins. In this scenario planning is simplified. This