



ATTRIBUTES OF MATERIAL MANAGEMENT SYSTEMS

by
George Stukhart, Texas A&M University
and
Lansford C. Bell, Auburn University

A Report from CII Task Force 83-7,
Material Management

Funded by
the
Construction Industry Institute

Source Document 1
April 1985

© 1985 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.

CONSTRUCTION INDUSTRY INSTITUTE
MATERIALS MANAGEMENT TASK FORCE REPORT
PHASE I RESEARCH - MATERIALS MANAGEMENT PERFORMANCE

TABLE OF CONTENTS

SUMMARY.....	ii
ACKNOWLEDGEMENTS.....	iv
I. INTRODUCTION.....	1
II. SCOPE OF MATERIALS MANAGEMENT IN CONSTRUCTION.....	3
Materials Management	
Construction and Manufacturing Materials Management	
III. GOALS OF MATERIALS MANAGEMENT STUDIES.....	6
The Construction Industry Cost Effectiveness Project	
The Construction Industry Institute Materials Management Task Force	
IV. CII TASK FORCE RESEARCH.....	8
General	
Measures of Performance: the Attributes Study	
Results of the Attributes Study	
Other Significant Findings	
V. SUMMARY LIST OF ATTRIBUTES.....	12
VI. DISCUSSION OF ATTRIBUTES.....	14
Preproject Planning and Communications	
Material Requirements and Engineering Interface	
Vendor Inquiry and Evaluation	
Purchasing	
Quality Assurance and Quality Control	
Expediting and Shipping	
Warehousing, Receiving and Distribution	
Field Material Control and Surplus	
Computer System	
VII. CONCLUSIONS.....	22
VIII. FUTURE RESEARCH.....	24
IX. REFERENCES.....	26

SUMMARY

In the last decade there have been substantial national efforts to achieve two major goals:

1. Improve labor productivity
2. Achieve more cost effective materials management in manufacturing

These endeavors are helping U.S. firms become more competitive; progressive companies and industries are using state of the art technology and modern management techniques to improve their long term competitive position, not only in the U.S., but also in the world.

Construction materials and equipment, which comprise 50-60% of the cost of a project, have received little attention, either as a contributor to productivity, or as a resource which needs to be more efficiently managed. Materials Management suffers from "benign neglect" until major problems develop in materials delivery, impacting the schedule.

The Business Roundtable Construction Industry Cost Effectiveness Project (CICEP) conservatively estimated that labor productivity gains of 6% were possible, and surplus reductions of 1.8% could be made through better materials management. These estimates were a first step in revealing the potential improvements in this area. These estimates indicate that managers must rethink the role that materials can play in revitalizing productivity and in reducing costs.

Progress in managing materials has been slow for several reasons:

- Improvements involve time and money which are scarce in today's competitive market.
- The industry has tended to focus its attention on improvements in work methods and labor efficiency, under the tacit assumption that materials will be on hand when and where required.
- To justify the expenditures there has to be some means of measuring comparative performance; that is, some set of attributes or standards for the industry.

Construction materials management comprises the integrated functions of materials takeoff, purchasing, quality management, expediting, shipping, receiving, warehousing, and issue. When these functions are not properly managed individually and collectively, shortages and surpluses occur. More importantly, costly labor delays result when the required quantity or quality of materials are not on hand when needed. In order to achieve a smooth, timely, efficient flow of materials, all parts of the system must function well; this means that there must be early emphasis on good planning and excellent communications, especially between owner, design engineer, and contractor.

Attributes are characteristics which serve as a qualitative scale for deciding whether one company's system is preferable to another's. This report is the result of a study to determine such attributes of materials management in construction. This report also provides some important findings about the state of the art and trends in materials management that were not discussed in the Business Roundtable CICEP.

Included in this report are the list and discussion of attributes and other significant findings of the Construction Industry Institute Materials Management Task Force. The entire committee has actively supported this study, through contacts with knowledgeable individuals in their companies and by contributing their own experience and time.

The studies of the Materials Management Task Force support the objectives of the Construction Industry Institute. This report and future efforts are designed to bring information on materials management to the entire industry. The Task Force plans another study phase to demonstrate the value of carrying out improvements in materials management. When these studies are completed there will still have to be programs to educate owners engineers and contractors on the procedures for managing materials properly.

ACKNOWLEDGEMENTS

This research and background information was supported by grants from the Construction Industry Institute. Members of the Materials Management Task Force were especially helpful in providing briefings, information and access to their company staffs. The following members of the Materials Management Task Force of the Construction Industry Institute contributed valuable information to this paper: Richard L. Carr, Brown & Root, Inc; John Cato, H.B. Zachry Company; James Early, B E & K Construction Co.; S.J. Kniffen, Scientific Design; M.G. Kostner, Fluor Engineers, Inc.; G.G. Minnich, Owens-Corning Fiberglas; Preston Jones, Stearns Catalytic; T.H. Pinson, Atlantic Richfield Co.; R L. Wootten, E.I. du Pont de Nemours & Co.

I. INTRODUCTION

In a well-publicized book (27) dealing with the problems of manufacturing productivity and materials planning, the author, Oliver Wight, makes a very significant point:

"As a result of the inability to schedule well a great deal of effort is expended, but isn't well integrated and it isn't directed toward well defined goals. This means the productivity of the entire organization is affected. And that's particularly significant since most productivity solutions dwell on the productivity of direct labor and ignore the fact that it is a relatively small percentage of the overall cost of running a manufacturing business."

Peter Drucker (7) summarized the productivity problem, and the means that must be taken to improve productivity:

"From now on, all resources will have to be managed better for greater productivity."

Poor labor efficiency has been blamed for virtually all construction productivity problems, but management must share the blame. The Business Roundtable Construction Industry Cost Effectiveness Project (CICEP) focused on this problem in its study on Modern Management Systems (3); Materials Management was identified as one of the four major management systems essential to improving construction.

In commenting on the role and scope of materials management, the study said that

"the construction industry lags far behind the manufacturing industry in applying the concepts of materials management",

implying that the problem of integrating materials into a schedule is less developed in construction than

1. The other basic management systems studied were Planning and Scheduling; Cost Estimating, Budgeting, and Control Accounting; and Quality Assurance.

manufacturing. This is singularly obvious when one attempts to research the state of the art in construction materials management.

The CICEP study on materials management is the only substantive work to date on the subject; texts on materials management mention construction applications only in passing. Construction texts devote only a few pages at most to the rudiments of materials management. One does not frequently read of construction materials problems even though the materials management process is far more complex than portrayed and delays in material delivery or misallocation of materials have significant potential impact on the construction cost and schedule.

The cost of materials and equipment amounts to approximately 50-60% of the total cost of construction projects (3); the CICEP respondents estimated that 6% of the construction labor cost could be saved were materials and equipment on hand when needed, and that surpluses averaged 1.8% of total project material costs (4). In manufacturing industries proper materials management provides potential productivity increases on the order of 5-10% (27). It seems reasonable that such an increase, or considerably more, is possible in construction, but the data are not currently available to support such a claim.

With these possible savings one wonders why materials management research has been so long neglected; it is evidently an underdeveloped, but potentially highly important, field of investigation. To rectify this situation, The Construction Industry Institute, organized by major owners and constructors, has undertaken a study of materials management as one of the fields of inquiry to be researched. The Materials Management Task Force was organized in January 1984 and has pursued the initial phase of research into construction materials management, defining goals, problems, and attributes.

This paper will trace the development of relevant construction materials management research to date, emphasizing the role and achievements of the Construction Industry Institute Materials Management Task Force in fostering this significant effort. Since there is virtually a complete lack of construction materials management literature, the reference section of this report includes relevant books and articles on the subject of materials management in manufacturing.

II. SCOPE OF MATERIALS MANAGEMENT IN CONSTRUCTION

Materials Management

"Materials Management" is a concept that needs further definition. Many people believe materials management to be synonymous with purchasing or procurement, when, in fact, it is much broader, encompassing not only the functions of acquiring goods and services but, more importantly, the planning and controlling of all steps necessary to insure that the objectives of price, quality, and quantity are met when and where required. The recommended goals of materials management are:

- a. Obtaining the best value for purchased materials.
- b. Assuring supplies are on hand when and where required.
- c. Reducing inventory to the lowest amount required.
- d. Assuring quality requirements are met.
- e. Providing efficient low cost movement of supplies to the site and within site storage areas.

Materials Management is the set of components coordinated to accomplish a set of goals. These components were discussed in the CICEP report on materials management (4).

The fact that materials management involves numerous components, each of which has its own objectives and organizational counterparts makes it very difficult to determine overall effectiveness or efficiency. The first step is to determine the measures of performance of each component or subsystem and whether these are truly related to, and optimize the management process performance; then, using these measures of performance or attributes, determine the overall performance.

These components, as identified in the CICEP study, are:

- materials planning and scheduling
- specifying of goods and services and determining quantities
- purchasing
- tracking, expediting, and reporting
- quality control
- site materials management

- a management and control subsystem

The Construction Industry Institute Materials Management Task Force has amended this list to include communications and the supporting computer system.

Construction and Manufacturing Materials Management

Materials requirements planning (MRP) and manufacturing resource planning (MRP II) are names applied to manufacturing resource tools which are designed to improve productivity and inventory control. They include integrated scheduling, simulations, procedures, decision rules, and records designed to translate a master schedule into time-phased net requirements (8,17,27). MRP uses project schedules information to calculate requirements for materials, so is highly dependent on the "quality" of the forecast, including not only the accuracy of the original plan, but also the ability to modify the plan if the forecast changes. A highly desirable feature of MRP is feedback between the actual progress and the plan. These features have only been introduced in the last decade as a consequence of the expansion of computer capabilities. The more advanced construction materials organizations are using many of the same concepts, but such ideas have not permeated construction operations to any great degree.

The principles of MRP are applicable to construction, and may be used to solve some of construction's most critical materials management problems (8).

" The application for MRP in construction is obvious. Construction is really a kind of manufacturing where the tools are moved to the work rather than having the work moved to the tools. This makes construction even more challenging to schedule properly."(27)

Despite this generalized statement, there are differences between construction and manufacturing. The major difference is the emphasis on continuity in manufacturing.(8) Construction, with its emphasis on projects, is rarely able to establish long-term materials requirements. The emphasis in MRP is on reduction in inventory levels and improving responsiveness. In construction the emphasis is on delivery and traceability; nevertheless, there is a similarity in that both are heavily dependent on forecasting shortages, overages and delivery times. Both must estimate the impact of changes, and both

must rely heavily on the training of materials people to be effective.

Why compare manufacturing materials management with construction materials management? One reason is that MRP has evolved through and overcome many of the same experiences as construction materials management. For example, the modern techniques employed in manufacturing are (23): "Just in Time" production; greater use of kits and modules; automatic identification devices; quality circles; and organizational improvements. These techniques are in the early stages of use in construction.

The varied organizational responsibilities for materials management tend to inhibit progress in meeting performance objectives regardless of the products involved. This is true in manufacturing (23, 24) and construction. The CICEP study on materials management in construction emphasized that varied organizational responsibilities for materials poses a problem in system management. The materials manager form of organization, combining planning and control, purchasing, distribution and transportation, has become prominent in many organizations. There are numerous advantages, primarily (28):

- Reducing conflicting objectives
- Better use of on-line computer facilities
- Streamlining procurement
- Visibility of the materials function

Materials managers are necessary to oversee the life-cycle of materials, to coordinate all the functions, to make improvements, and to be sure that materials planning and training functions are well ahead of time.