



COSTS AND BENEFITS OF MATERIALS MANAGEMENT SYSTEMS

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The Construction Industry Institute
The University of Texas at Austin
3208 Red River
Suite 300
Austin, Texas 78705

Costs and Benefits of Materials Management Systems

**Prepared by
The Construction Industry Institute
Materials Management Task Force**

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SUMMARY

Construction professionals are recognizing the need to focus on the materials management process as a proactive, identifiable entity which has a significant impact on the cost of construction. In recent years both construction contractors and owners have developed integrated materials management systems that combine and integrate the takeoff, vendor evaluation, purchasing, expediting, warehousing, and distribution functions.

The costs and benefits of integrated materials management systems have been examined by researchers at Auburn University and Texas A&M University as part of a recently completed CII research project. After examining data from 20 construction projects, the researchers concluded that properly designed and implemented materials management systems will produce tangible benefits in the areas of improved labor productivity, reduced bulk materials surplus, reduced materials management manpower, and cash flow savings. The most significant benefits occur in the area of improved labor productivity. A basic materials management system can be expected to produce a 6% improvement in craft labor productivity. When sophisticated computer controls are implemented and the crafts use the system to plan their work around bulk material availability, an additional 4-6% in craft labor savings can be expected.

The costs associated with system development and implementation are substantial, and are frequently questioned by top management. It is not uncommon for a contractor to spend \$500,000 to develop a computer-aided system which will track bulk materials on a requisition line-item basis from the initial quantity takeoff to field installation. This same system also will have substantial costs associated with computer use, data transmission, and personnel training. However, the old adage, "You have to spend money to make money" has never been more true. The general knowledge of materials management concepts and the development of the state of the art has reached the point that with a reasonable amount of planning by the owner and the contractor, a cost-effective materials management system can be put in place. The alternative is the continuation of the costly process of materials handling that has too long haunted project costs — for materials do exist and are required, and they will be handled in some inefficient, unplanned way *unless* owners and contractors require a planned materials management effort on their projects.

This publication is intended as a guide to the construction industry to understand materials management concepts, the cost of the efforts, and the positive results which can be expected.

INTRODUCTION

The 1982 Business Roundtable Construction Industry Cost Effectiveness (CICE) Report titled "Modern Management Systems" stated "the construction industry lags far behind the manufacturing industry in applying the concepts of materials management." The report further claimed that "senior management of firms in the construction industry has not always recognized the significant contribution that materials management can make to the cost effectiveness of projects." In an effort to address these and other critical conclusions of the report, the Construction Industry Institute (CII) established in January 1984 a Materials Management Task Force composed of owners, contractors, and academicians knowledgeable in construction materials management. The task force undertook the task of developing and disseminating information and concepts which prove the value and cost effectiveness of what the task force has defined as "integrated and proactive" or "total-concept" materials management systems.

The CII Materials Management Task Force has directed a number of studies and investigations, including two formal research projects conducted jointly by Auburn and Texas A&M.

The results of the research, which was conducted in the real world of construction project execution, established several basic premises.

- Materials management is a clearly defined task that, when properly planned and executed, provides project management with an invaluable tool to optimize schedules and improve labor productivity.
- Substantial savings will accrue to both the owner and the contractor, with the CICE estimate of 6% savings on project craft labor costs being conservative for most applications.
- As with any management system, however, top management support is required. A major hurdle is the resistance to accepting the obvious cost of a well-planned materials management effort. This cost will always be less than the hidden cost of historical material handling and material control.
- Training is an essential element in the successful application of the materials management concept. Training must include not only the materials management organization itself, but even more importantly, the users at all levels of the project management team.

The objective of the first research project (Phase I) was to define and examine the attributes of properly designed and executed materials management systems. To address this objective, the construction site and home office locations of four major contractors and four industrial construction owners were visited. Materials managers, project managers, purchasing agents, warehouse supervisors, craft superintendents, and others were interviewed to determine how materials management functions are being performed on major industrial construction projects.

The Phase I research was completed in April 1985. The results are summarized herein as background, and are also addressed in more detail in References 3, 5, 8, and 9. The Phase I research report, Reference 9, may be obtained directly from the Construction Industry Institute.

The Phase I research documented an almost universal belief that the single most important factor relating to the effectiveness of any materials management system is its support from top management. Throughout the research, some owner and contractor executives expressed concern about the cost effectiveness of the systems they had developed, were developing, or planned to develop in the near future. The CII Materials Management Task Force, therefore, decided that the best way to solicit top management support would be to demonstrate the cost effectiveness of materials management systems. As a result, a second project (Phase II) was requested and approved to develop specific data which could be used to predict both the costs and the benefits associated with materials management systems. It was decided that the research could best be conducted by examining a number of specific case study projects.

This publication discusses the attributes of materials management and specifically the research on costs and benefits that accrue to materials management systems that incorporate these attributes. Included are the analysis of the research data by Auburn and Texas A&M and the conclusions and recommendations drawn by the task force.

MATERIALS MANAGEMENT SYSTEMS

Materials Management Functions

Materials management can best be defined as the planning and controlling of all necessary efforts to insure that the correct quality and quantity of materials and equipment are appropriately specified in a timely manner, are obtained at a reasonable cost, and are available when needed. The materials management process combines and integrates the individual functions of project planning, material takeoff, vendor inquiry and evaluation, purchasing, expediting and transportation, field material control, and warehousing. To achieve a well-coordinated orchestration of all these functions on most construction projects, some type of computer-aided system usually is required. It should be emphasized, however, that the computer is only a part of the materials management system, and is not the system itself.

The Phase I research established the basic attributes of each of the materials management functions. These attributes are not necessarily incorporated into each system, depending on the contractual relationship between the owner, engineer, and contractor. The attributes, however, represent a compilation of the system attributes that must be addressed by some part of the project team if the project is to be executed in a cost-effective manner.

Project Planning and Communications

Planning and communications are probably the two most important elements of any effective materials management system. The materials-related responsibilities of the owner, engineer, contractor, and all subcontractors must be clearly defined early in the project. Quite often these responsibilities are defined such that the owner and/or engineer assume responsibility for engineered equipment (major items that are given a unique identification number on design drawings), and the construction manager, contractor, and/or the subcontractors assume all responsibility for the bulk materials. Occasionally, the materials responsibilities are defined such that the contractor has the overall materials management responsibility, but the owner assumes responsibility for one or more materials management functions. This arrangement should be approached with care because it tends to produce a fragmented, as opposed to an integrated, materials management system.

Early in the project planning stage, the owner must communicate to the contractor the specific project characteristics or constraints which may alter the scope or cost of the materials management effort. Examples of such constraints include restricted site access and laydown areas, the use of multiple design engineers, schedule compressions and changes, cash flow restrictions, anticipated design changes, purchasing approvals, and audit requirements. The contractor must, in turn, communicate to the owner, engineer, subcontractors, and the crafts the materials procedures that will be implemented on the project.

Takeoff and Engineering Interface

Before a material takeoff is executed, materials specifications and coding systems must be established. Since industry-wide standards for coding bulk materials have not as yet been established, coding systems and specifications established by individual designers must be unified and transferred to the materials management system. This data conversion and transfer process often is accomplished via magnetic computer tape, with supplementary interface programs being used to convert commodity codes as required. As computer-aided design systems become more common, the takeoff process will become far less time consuming, and standard commodity codes may evolve eventually.

Initial material takeoffs may be executed from plot plans or flow sheets, and then updated as more definitive design information becomes available. After the takeoff is completed, a consolidated bill of materials is created. Most effective materials management computer-aided systems are capable of tracking materials from requisitions, performing requisition sorts, and identifying material requirements by material category, by fabrication shop or craft need date, by craft or subcontractor responsibility, or by drawing, system, or line number. Effective systems also are capable of responding quickly to design changes, field changes, and other factors that arise in a dynamic project environment.

Materials management systems differ in the ways in which material requirements are created. Some systems rely on drawing takeoffs executed by the contractor, while others rely on equipment lists or requisitions furnished by the design engineer. Generally, the design engineer provides input to the materials management system, but the engineer also may rely on the materials management system for data pertaining to construction and fabrication schedules. This information aids the design engineer in issuing design drawings and equipment requisitions in the desired time sequence.