

Warehouse Management

Computer support for organizing and managing warehouses has become imperative for timely, efficient processing of logistic requirements within a company. The Warehouse Management (WM) application within MM provides flexible automated support that lets you do the following:

- Manage highly complex warehouse structures and a multiplicity of warehousing facilities including:
 - Automatic warehouses
 - Custom-designed storage areas
 - High rack storage
 - Bulk storage
 - Fixed bin storage
 - All other commonly used storage areas
- Define and adapt a limitless variety of storage bins for use in your specific warehousing complex
- Process all relevant warehousing activities such as:
 - Goods receipts and goods issues
 - Deliveries
 - Internal and external stock transfers
 - Automatic replenishment of fixed bins
 - Material staging to production areas
 - Stock difference handling
- Use random slotting for multiple owners of goods in a fully integrated warehouse
- Optimize capacity and material flow using storage units in the warehouse
- Monitor and display stocks on hand and summary evaluations of all goods movements using warehouse controlling tasks
- Implement a variety of putaway and picking strategies including self-designed strategies
- Support the storage and retrieval of hazardous materials and all other goods that require special handling
- Process multiple goods movements simultaneously with transfer requirements papers and delivery documents
- Maintain up-to-the-minute inventory records at the storage bin level with the aid of stock transfer verification
- Archive records of all goods movements and inventory activity
- Support the use of bar code scanners, RF technology, AS/RS, and automated forklift systems for all stock movements through an automated warehouse control interface

- ❑ Interface to an SAP R/2 host system using the R/3 System's user-friendly screens and menus
- ❑ Fully integrate your Warehouse Management application component for instantaneous interaction with other R/3 application components including Inventory Management (IM), Production Planning (PP), Quality Management (QM), and Sales and Distribution (SD)
- ❑ Set up "forward pick" areas and production supply areas with automatic continuous replenishment from case, kanban, or reserve storage when stock quantities reach a certain threshold

Beginning with the planning phase, WM makes stock availability checks whenever transactions are initiated in each of the respective system components. Although you can print material documents for each separate transaction in the warehouse, WM facilitates automatic flow using warehousing tasks that are virtually paperless.

Integration with Other SAP Application Components

Integration is the key that makes the SAP's Warehouse Management component stand above the competition.



Fig. 9-1: Integration of the WM Application Component with Other SAP Components

WM is fully integrated into the SAP R/3 System. While quality assurance is an overall issue, transactions initiated in other application components result in corresponding open tasks in the WM application component that start the actual physical transfers within the warehouse.

A few of these activities include:

- ❑ Material movements and changes in material status, such as releasing goods from inspection
- ❑ Material staging to production supply areas
- ❑ Shipping goods for sales orders

Here are three examples:

1. When goods that are to be inspected are received in the warehouse, the Quality Management (QM) interface to WM lets you track and process inspection lots stored anywhere in the warehousing complex, both before and after they have been released from quality inspection.
2. When you process a sales order in the Sales and Distribution (SD) Shipping component, an open order to pick the required materials appears in WM.
3. When you initiate a request for component items required in the manufacturing process using Production Planning (PP), the WM application component performs the tasks that are necessary to move the needed components to the production supply area. Once the materials have been delivered and used in production, the material usage posting in PP balances the stock figures automatically in both WM and in the Inventory Management (IM) application component. At the same time, the system calculates all accounting figures and records them in the appropriate systems.

The Warehouse Management application component is integrated with the SAP Logistics Information System (LIS) to support workload analysis in the warehouse. Warehouse Controlling evaluates and reduces extensive information from Warehouse Management to a few essential performance measurements. Consequently, this allows an analysis of weak areas with the aid of graphics. Evaluations for Warehouse Controlling are integrated with the Inventory Controlling menu as standard analyses. These analyses are based on statistical databases in the Warehouse Controlling module – called information structures – into which important, up-to-date performance measures are written directly from the warehousing applications. This data can be used for performance planning purposes.

Warehouse Controlling

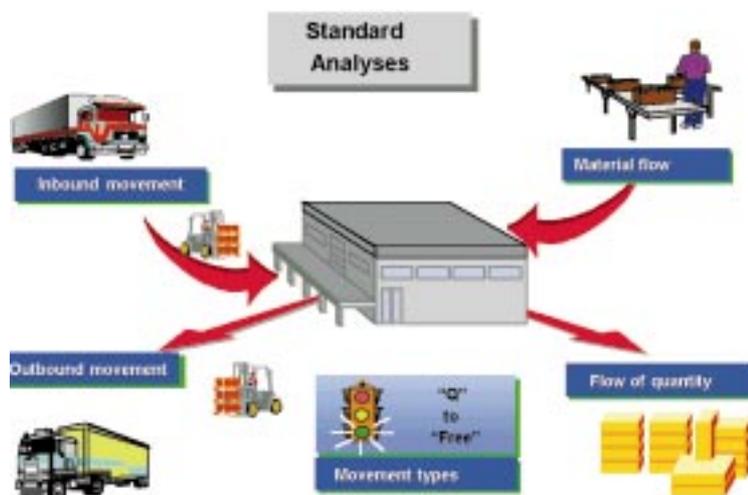


Fig. 9-2 Analysis of Material Flow in the Logistics Information System (LIS)

The following five standard analyses for Warehouse Management exist in Inventory Controlling:

Stock placements and removals

For this analysis, the system displays the total weight and quantities of goods that were stored, picked, or returned.

Quantity flow

This analysis displays the quantities and weights of goods that moved in the warehouse. It also includes information about frequency and average time expired between transfer requirements or delivery creation and transfer order creation.

Material placement and removal

This analysis is based on storage and picking of a specific material or range of materials. It includes quantity and weight information for a given period.

Material flow

Quantity, weight, and time required for material movements are considered in this analysis.

Movement types

This analysis is based on movement type and the types of storage areas into or from which stock is placed or removed.

Warehouse Structure

You can design the warehouse structure to match your individual requirements. The physical storage facilities of a company may exist in one or more physical buildings. It can consist of several types of storage (for example, high rack storage, bulk storage, picking areas). It can also include other areas within the warehousing complex (such as interim staging areas for inbound and outbound movements).

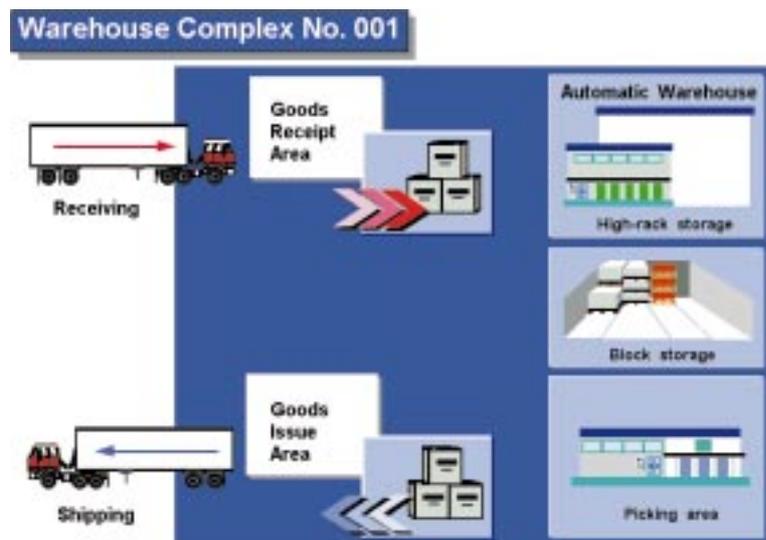


Fig. 9-3: Physical Structure of a Warehouse

You can define an entire physical warehousing complex in the Warehouse Management application component using a single warehouse number.

Warehouse Complex

Each of the storage facilities or areas that make up the warehousing complex can be defined as a type of storage area or storage type by its spatial, technical, and organizational factors.

Storage Type

Each storage type can be divided into storage sections. A storage section generally includes all bins that have certain characteristics in common (such as bins for fast-moving items near a goods issue area). You can set your criteria for grouping bins into a storage section.

Storage Section

Each storage type and section consists of several storage spaces or slots. These are called storage bins in the WM application component and are the smallest addressable unit of space in a storage type. Storage bins are identified by coordinates that refer to the exact position where goods can be stored in the warehouse.

Storage Bin

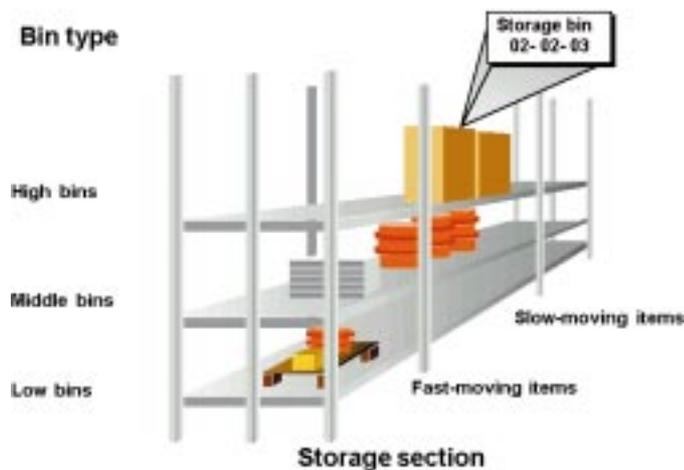


Fig. 9-4: Bin Type and Storage Section

The bin type identifies the shape and size of a storage bin and is used in the storage bin search when the system implements storage placement and picking strategies.

Storage Bin Type

In the Materials Management (MM) component of the R/3 System, you can define several different units of measure (stock keeping units) for each material that are all considered in the WM application component.

Units of Measure

The base unit of measure is the basis for inventory management and evaluation. Alternative units of measure, such as the order unit, issue unit or WM unit of measure, are used to identify packages or containers for smaller units of measure such as cartons, boxes, bottles, barrels, or pallets. Quantities in alternative units of measure are always converted to the base unit of measure using a conversion factor for calculation purposes.

The system recognizes all related units of measure for processing. For example, if the weight of a particular material is managed in kilograms, the system can make calculations based on the input of weight measures such as grams, ounces, pounds, or tons.

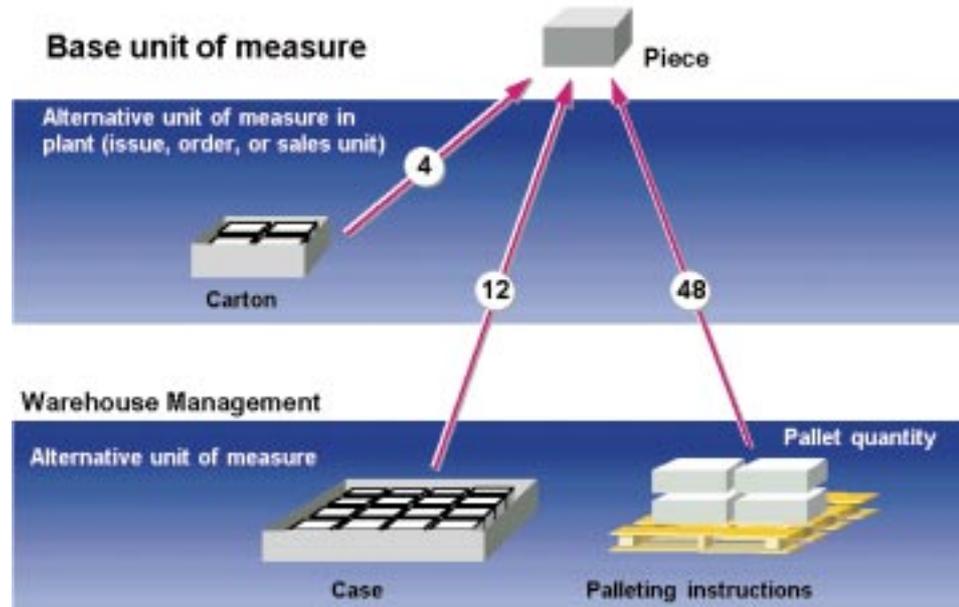


Figure 9-5: Units of Measure in the Warehouse Management System

Integration of WM into MM

Figure 9-6 shows an example of how you can integrate the structure of the WM application component into the structure of MM. You can set up this structure to match your company's needs.

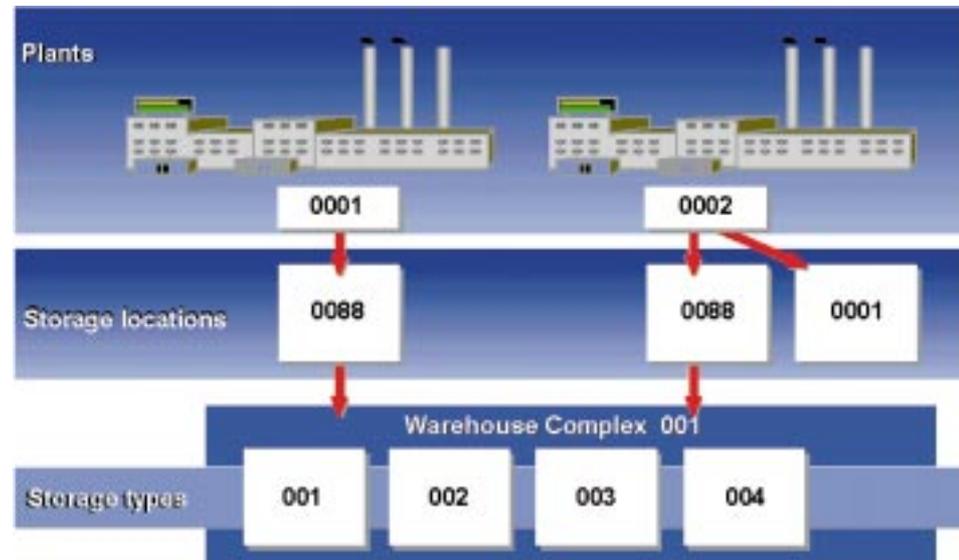


Fig. 9-6: MM-WM Integration Structure

How is the warehouse structure defined in the SAP system?

- A complex warehouse is defined in the system as a single warehouse number and subdivided into storage types, storage sections, and storage bins (for example, depending on the warehouse technique). A storage bin is the smallest addressable unit of space in a warehouse.
- Warehouse movements are controlled by table entries.

Goods Movements

Transfer requirements and orders are the means by which all goods movements are planned and carried out in the SAP Warehouse Management system.

Transfer requirements provide an intermediate step of control in the goods movement process and are used to plan and initiate stock movements. They represent an existing requirement to move a specific quantity of material into the warehouse, out of the warehouse, or from one storage bin to another within the warehouse.

Using transfer requirements as planning documents, the system creates transfer orders that are used to execute physical stock movements. The distinction between the planning (creating a transfer requirement) and the execution of a stock movement (creating and confirming a transfer order) lets you find out whether a stock transfer should occur, has already started, or is finished. A transfer requirement can answer several important questions about a planned stock movement:

- What should be moved?
- How much should be moved?
- Who or what caused the movement?
- How much stock has already been transferred?

Transfer requirements are normally created automatically as a result of a transaction in another SAP component. This can be:

- Processing of a goods receipt for a purchase order in Materials Management (MM)
- Release of a production order in Production Planning (PP)
- Automatic replenishment of fixed bins in a forward picking area

Depending on the type of movement, you can set up the system to process transfer requirements automatically. This way, only the transfer requirements that you want to control will be available for manual processing in WM.

Transfer Orders

Transfer orders used in the WM application component are move orders that contain all the information needed to carry out the physical movement of goods from one place to another in the warehouse.

Transfer Requirements

Transfer orders contain the following information:

- Material number or designator
- Quantity to be moved
- Source and destination storage bins

The WM application component can create transfer orders automatically for both transfer requirements and deliveries so that no intervention is necessary by warehouse administrators.

Confirmation and Cancellation

When you confirm a transfer order, you inform the system that it has been processed and that the goods have arrived at the intended destination. Depending on the movement type, not all transfer orders must be confirmed. If necessary, you can cancel transfer orders that have been created but not confirmed in WM.

Inbound Movements

Figure 9-7 shows a possible scenario for an inbound movement (goods receipt) with a transfer order (TO).

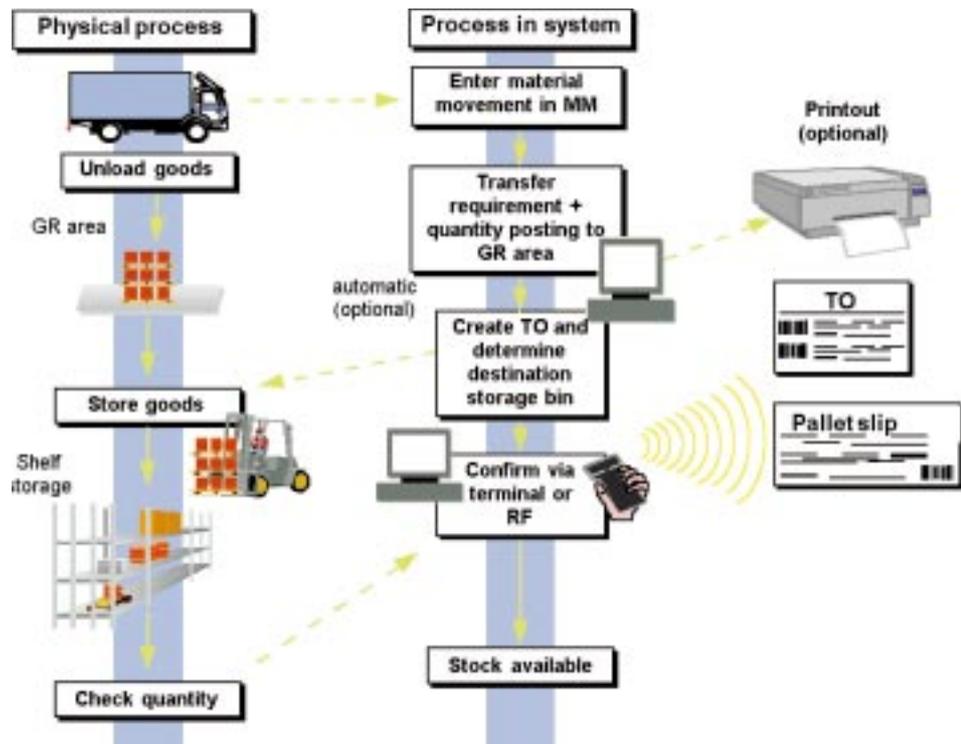


Fig. 9-7: Processing Goods Receipts

Outbound Movements

Examples of outbound movements (goods issues) include:

- Issues to a cost center, project, and so on
- Material staging for production
- Delivery of goods to customers

Depending upon entries in the material master record and the way you configure the movement types and picking strategies in WM, you can streamline and

optimize picking in your warehouse. In conjunction with the configuration of other SAP application components that are interfaced to WM, there are several options that can initiate automatic processing for goods issues in WM.

The R/3 Sales and Distribution (SD) shipping component, for example, can initiate the picking of goods in WM when a delivery is created. In randomly organized warehouses, the system creates one or more transfer order items for each delivery item. Data about the picking process and its status is automatically transferred into the delivery to provide up-to-date information. The picked quantities are then reflected in the delivery items in SD when the transfer order is confirmed in WM.

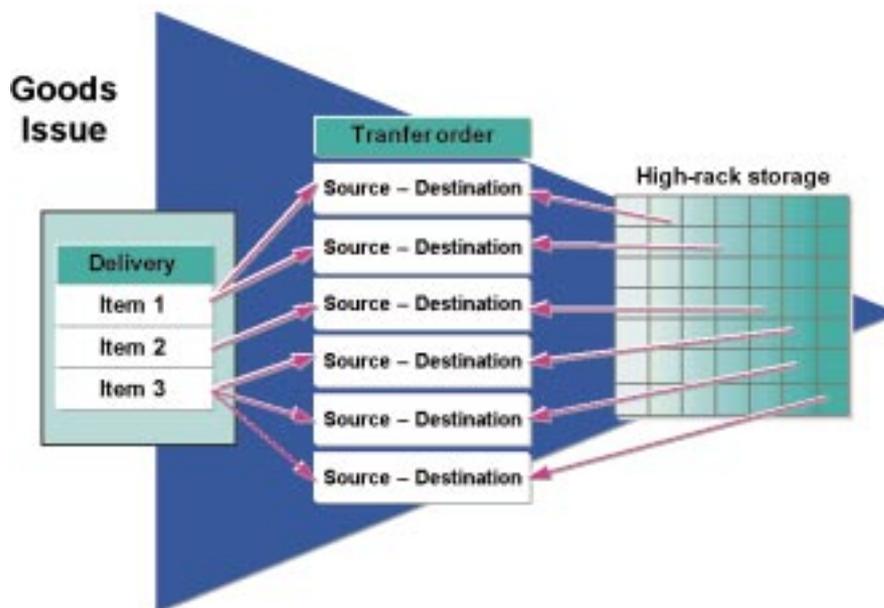


Fig. 9-8: Picking with SD and WM

Sometimes, changes in material status must be reflected in the WM application component and occasionally require physical stock movements. Posting changes are made for several reasons:

Posting Changes

- Release stock from inspection into available stock
- Convert blocked stock to inspection stock
- Designate available material as inspection stock
- Convert special stock, such as consignment stock or returned stock, into the company's own stock
- Change ownership of stock in the same warehouse from one plant to another

The WM application component is used to process internal stock transfers for the following reasons:

Internal Stock Transfers

- Replenish fixed bins in picking areas or production supply bins
- Renovate or repair storage bins containing stock
- Optimize warehouse capacity by combining materials from two or more partial pallets

Rapid replenishment is vitally important to the effectiveness of today's modern warehouse. The WM application component is designed to implement both automatic, continuous replenishment, and manually operated RF techniques to replenish storage bins in production supply areas and fixed-bin picking areas.

Differences

When goods movements are processed, differences are sometimes determined (for example, when a storage bin does not contain the stock that is on the books or if part of the goods are damaged during the transfer). If the actual quantity transferred is not the same as the planned quantity when you confirm the transfer order, a pop-up dialog window appears that allows warehouse workers to immediately enter the difference. The WM application component updates the total stock figures in the appropriate system components.

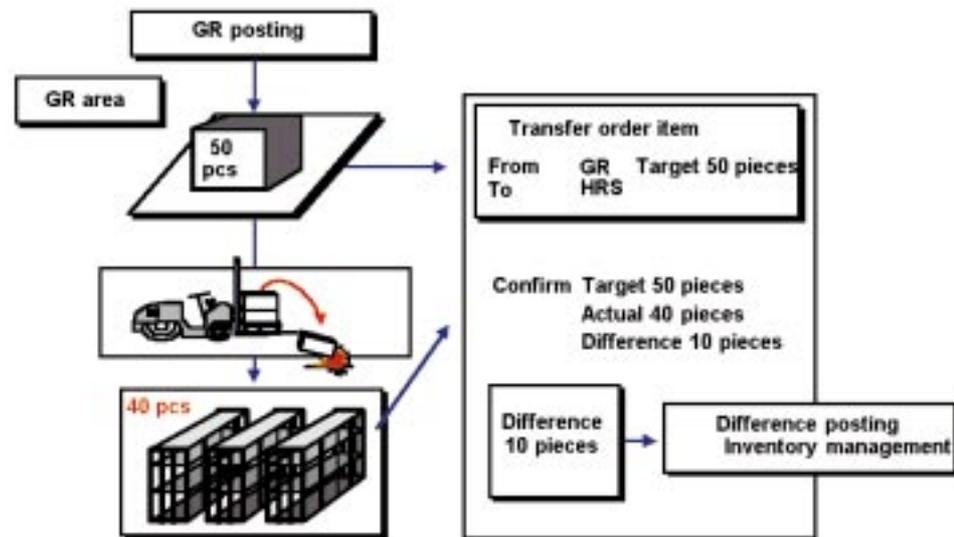


Fig. 9-9: Differences Determined During a Stock Placement

Print Control

Even though today's electronic warehouses are becoming increasingly paperless, extensive print control functions in the standard WM application component enable you to define when and on which printer warehouse documents are to be printed.

The WM application component provides the capability to print several variations of the following material documents:

- Transfer orders and pick lists
- Storage unit contents documents
- Container or pallet slips
- Multiple picking lists
- Warehouse inventory lists

Stock Placement			
TO Number 0000003976 0001		Repeat print	
		Date 10/21/1996	
 <small>00-0000 3976 0001 0001</small>			
Material AJ578-1015	0001	Apple juice, 100% pure w/o sugar	
Receipt date 10/21/1996		GR number	4900506528
From 902 001		GR area	850 gal.
To 007 001		02-04-14	850 gal.

Fig. 9-10: Example of a Simple Printout of a Single Transfer Order

What are the functions of transfer requirements and transfer orders in Warehouse Management?

- Transfer requirements constitute a “to do” list and are used to plan and initiate goods movements in WM.
- They contain information about the quantity of the goods to be transferred and the reason.
- The transfer order is the primary means that is used to control stock movements in the warehouse.
- It contains all the information needed to carry out the physical movement of stock.
- The confirmation of a transfer order verifies that the transaction has been completed.

Putaway and Picking Strategies

In the Warehouse Management (WM) application component, you employ stock placement and removal strategies used by the system to search for storage bins in the most expeditious manner. For inbound movements, in conjunction with controls entered in the material master record, these strategies assist the WM component to use the available warehouse capacity and automatically assign optimum locations for goods received in the warehouse. For outbound movements, the system uses similarly user-defined controls to execute the appropriate stock removal strategy. The system assigns the best picking location while, at the same time, maintains lot control and shelf life expiration date integrity. If you decide to manually process certain stock movements, you can change source and destination storage bins that are automatically proposed by the system.

Storage Type Search	You can specify into which type of storage each material is to be placed. For example, you can set up the system to store raw materials in high rack storage area One and bottled gas in special storage area Two.
Storage Section Search	For each material, you can specify a storage section indicator in the material master record that directs goods to a particular section of a storage type. For example, based on the section indicator, the system stores fast-moving items in storage section One and slow-moving items in storage section Two.
Bin Type Search	In one storage type, you may have storage bins with different characteristics. When the system places goods into storage, it can search for a storage bin that will accommodate a specific storage unit type (that is, standard pallet or wire basket). The system then only selects bins that match the storage unit or pallet type for putaway.
Putaway Strategies	<p>The WM application component uses the following stock placement strategies to optimize the placement of materials into available storage bins:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Next empty bin The system searches for a suitable empty bin. <input type="checkbox"/> Fixed bin A fixed bin is assigned to the material. <input type="checkbox"/> Manual entry If you want to manually select the location for certain materials, such as extremely flammable liquids or radioactive materials the system waits for your input. <input type="checkbox"/> Addition to existing stock The system searches for a partially filled storage bin that already contains the material to be stored and attempts to add the stock to this bin. If there is no partially filled bin with sufficient capacity, the system searches for the next empty bin. <input type="checkbox"/> Bulk storage The system uses this strategy to store materials in blocks or rows (for example, large quantities of bottled beverages or tires) that would otherwise take up too much space in the warehouse. <input type="checkbox"/> Open storage The system uses this strategy to find storage bins in an open storage area. Open storage is a type of warehouse organization in which you define a single storage bin for a storage section. <input type="checkbox"/> Storage unit (pallet or container) type Some warehouses are set up in such a way so that each storage section can take on different types of containers or pallets, depending on the container characteristics (for example, three European pallets or two industrial pallets). This strategy stores goods in storage bins based on the characteristics of the containers or pallets used. <input type="checkbox"/> Customer-defined strategy In case the strategies already available in the WM application component do not completely satisfy the needs of the customer, you can define your own strategies using the customer exit function.

The WM application component uses the following stock removal strategies to find goods that are stored in the warehouse: **Picking Strategies**

FIFO (first in first out)

This strategy removes materials with the oldest goods receipt date first.

LIFO (last in first out)

This strategy removes materials with the most recent goods receipt date first.

SLED (shelf life expiration date)

Using this stock removal strategy, the system ensures that materials with the shortest remaining time before the expiration date is picked first.

Partial quantities

If a storage type has storage bins with both full pallets and partial pallets (or other containers with partial quantities), the system searches for a bin that contains partial quantities first.

Large/small quantities

This strategy is based on whether the quantity required is large or small. The system decides whether it is dealing with a small quantity or a large quantity, based on a control quantity entered in the material master record. It picks the quantity from the appropriate storage area accordingly.

What is the purpose of putaway and picking strategies in Warehouse Management?

- Putaway strategies store inbound goods consistently in preferred storage bins.
- Picking strategies quickly find required goods in the warehouse.
- Putaway and picking strategies optimize storage capacity and material flow in the warehouse.

Physical Inventory

The practice of taking an annual inventory count at the end of the fiscal year often requires an enormous effort for large warehousing complexes. The costs to a company are high and the physical counting process in the warehouse is labor intensive. In many companies, an annual inventory count would result in a significant loss of productivity because of the effort required. Therefore, under certain circumstances, the law in most countries allows several variations to the conventional annual inventory count.

The Warehouse Management (WM) application component uses real-time continuous inventory techniques to attain accuracy rates approaching 100%. Inventory is checked at the storage bin level on a continual basis. It is regarded as completed if an inventory has been taken for every storage bin in the warehouse at least once during the fiscal year. The inventory procedure can be defined individually for each storage type, which lets you consider specific technical and organizational aspects of the storage facilities.

The following inventory procedures are supported by the system:

- Annual inventory count
- Continuous inventory
- Continuous inventory during stock placement
- Continuous inventory based on zero stock check
- Inventory based on sampling procedures
- Cycle counting

The inventory results are recorded in the system as follows:

Inventory Indicator	The inventoried storage bin is marked with an inventory indicator that serves as a record of the inventory procedure that was used. This indicator also serves as proof that inventory was taken.
Differences	Any differences between the book amount and the counted amount are automatically posted to an interim storage area for clearing. The Inventory Management component has access to this interim storage record and can also clear differences in the system.
Inventory History	The WM application component creates an inventory history for each storage bin. To facilitate auditing, you can access this record as long as necessary.
System Inventory Record	<p>Inventory counts are supported by using the system inventory records that are automatically generated by the system.</p> <p>The WM application component provides you with the required functions to do the following:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Plan the inventory by selecting the storage bins individually or a range of bins for which you want to take inventory <input type="checkbox"/> Create and activate the system inventory record <input type="checkbox"/> Print the warehouse inventory list <input type="checkbox"/> Enter the counted results <input type="checkbox"/> Initiate a recount <input type="checkbox"/> Investigate differences in inventory amounts <input type="checkbox"/> Clear the inventory differences from the WM application component and record them in Inventory Management <p>Additionally, the WM application component provides the capability to use batch input to process inventory count results.</p>

What are the features of the WM inventory procedure?

- Inventory is taken at the storage bin level.
- The inventory procedure is defined for each storage type.
- Besides standard inventory procedures, several automatic, continuous inventory techniques are supported.

Storage Unit Management

Storage unit (SU) management in the WM application component lets you optimize warehouse capacity and control material flow using storage units within the warehouse.

A storage unit, sometimes called a unit load, is a logical grouping of one or several amounts of material including the pallet or container that can be managed within a warehouse as a unit that belongs together. Storage units can be either homogeneous (containing one material) or mixed (containing two or more product items).

All storage units, whether the materials are stored on standard pallets, in wire baskets or other containers, are assigned an identifier — a number — which is maintained in the system as the storage unit number. Consequently, at any given time, you know where each storage unit is located in the warehouse complex, the amount of material contained in it, and which operations have been processed or planned for it.

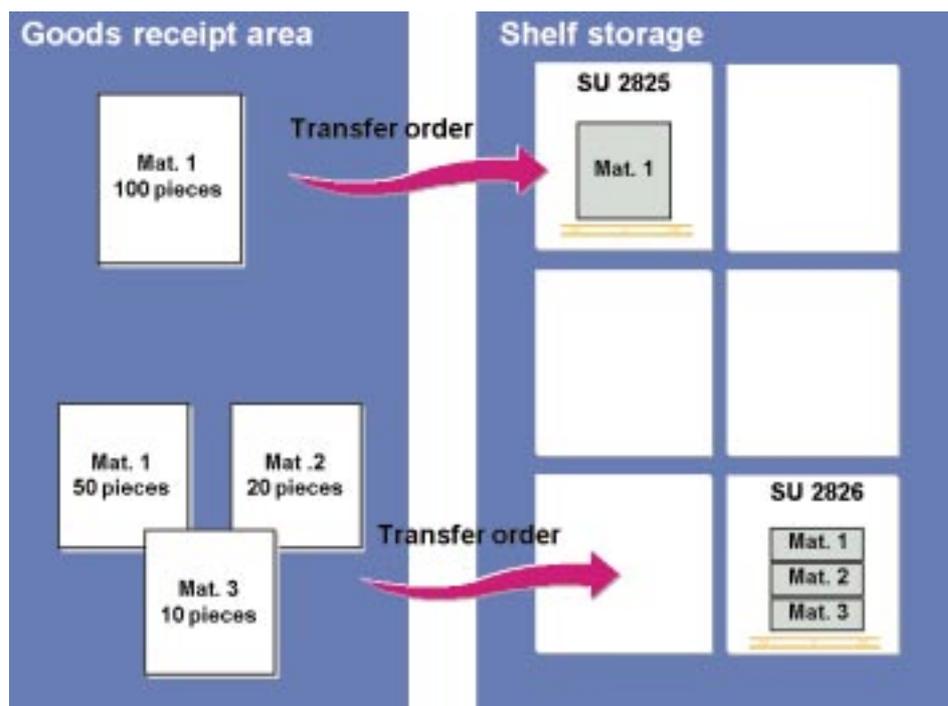


Fig. 9-11: Introducing Storage Unit Management in a Warehouse Complex

Using SU management, you can:

- Create homogeneous and mixed storage units
- Place materials into storage using an identification point
- Create transfer orders and confirm stock movements for storage units
- Transfer whole storage units internally

- ❑ Add stock to existing storage units
- ❑ Print documents to accompany the storage unit
- ❑ Plan goods issues (for example, to stage materials in replenishment storage bins in production)
- ❑ Interface to automated storage and retrieval systems (AS/RS) without having to maintain material data in the external systems

What is the task of storage unit management?

- ❑ The primary task of SU management is to control material flow using storage units within the warehouse.
- ❑ SU management simplifies the identification of material quantities using a storage unit number.
- ❑ Several product items can be managed and transferred within the warehouse as a single numbered unit.

Decentralized Warehouse Management

For customers who already have an SAP R/2 host system, Decentralized Warehouse Management provides the ability to manage all warehousing activities using the R/3 System user interface. With this interface to the R/2 host, the WM application component can be used as a stand-alone system. Data updated in the R/3 System's user interface can then be transmitted to the R/2 host later.

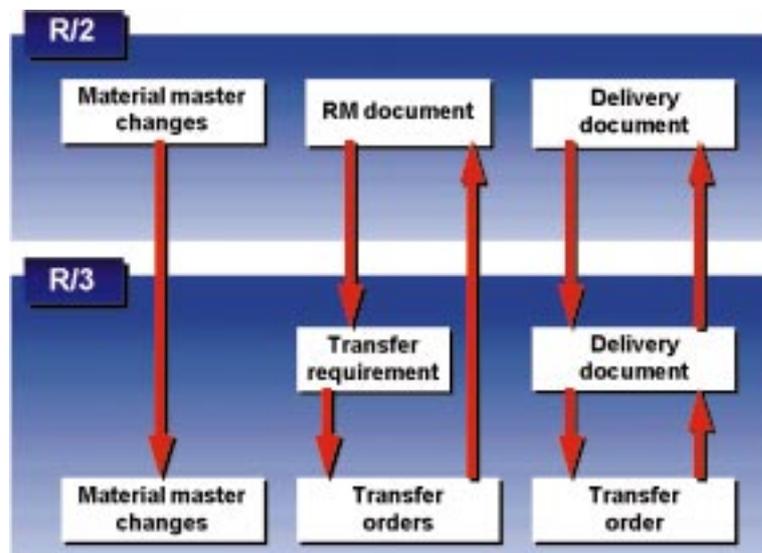


Fig. 9-12: Overview of Decentralized Warehouse Management

Close integration with the R/2 System applications in Materials Management (MM) and Sales and Distribution (SD) is ensured by an asynchronous communication link.

For customers using the R/2 System, the advantages of implementing the decentralized WM application component include the following:

- ❑ 24-hour availability
During normal operating hours, the host system can be shut down and most operations in the R/3 WM application component can continue.
- ❑ Reduction of system load in the host
The host system is relieved of all warehousing functions, thus improving system performance.
- ❑ Independence from the host system
Breakdowns or unavailability of the R/2 host do not affect operations that are being performed in the decentralized WM application component.
- ❑ R/3 user interface
The decentralized WM application component offers the same user-friendly menus that are used in the integrated version of WM in the R/3 System.
- ❑ Ability to work with two systems simultaneously
You can log onto both the R/2 and R/3 Systems and work with both systems simultaneously on one monitor screen.

The decentralized WM application component is linked to the Inventory Management (MM-IM) component and the Sales and Distribution (SD) shipping components so that all normal transactions associated with warehousing can be performed. If the host system is not available, any discrepancies or goods receipts from the production department are entered in the decentralized system. The posting is executed in the host system when it is active again.

What is meant by decentralized Warehouse Management?

- ❑ The user-friendly menus of the R/3 Warehouse Management application component can be used as a decentralized system linked to an R/2 host system.
- ❑ All transactions available in the integrated R/3 System can be carried out to meet all electronic warehousing requirements.