

Data Requirements for Planning of Material Flow Systems

Description and Explanation

Summary

This document describes and explains the most important requirements for customer data as a base for planning material flow systems.

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1 Introduction

This document describes and explains the most important requirements for customer data as a basis for planning material flow systems. Data analysis is a fundamental step in the planning of material flow systems because it converts raw data into understandable and usable planning information. Different systems can have different requirements with respect to scope and depth of data analyses, yet the general information requirements for planning remain largely identical.

The data analysis process can be complex and error-prone, and the quality of the resulting planning information is highly dependent on the quality of the available input data If you have questions about the raw-data requirements, please contact us before preparing the data extract. This can help avoid unnecessary iterations.

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2 Objective of Data Analysis

The optimal design of material flow systems is closely tailored to the specific requirements of the customer. In addition to a thorough understanding of these process requirements, the analysis of customer data serves as a critical foundation for making informed design decisions. This data-driven approach also informs the system's scaling and capacity planning.

Since data analysis primarily relies on historical data, it is essential to adjust and extrapolate this information based on growth forecasts. However, given the inherent uncertainty in predicting growth, the resulting planning assumptions should be regarded as approximations of future needs.

3 Required Data Sets

Different data sets are required as input for the data analysis. The table below provides an overview. More detailed explanations are provided in the following subsections.

Data Set	Short Explanation	When needed?
Master Data	A data table containing all relevant products (**S**tock **K**eeping **U**nits, SKUs) and their physical properties, such as dimensions, along with specific storage requirements like temperature and risk classifications.	Always
Order Data	A data table containing customer orders, ideally with complete timestamps for key process stages, including order receipt, order release, picking, and order completion, if available. Other transaction data (e.g., internal stock transfers) may be requested depending on project scope.	Always
Working Hours per Day	The daily working hours available to carry out logistics operations.	Always
Growth Expectations and Design Year	The material flow system will be designed to accommodate future business needs. Therefore, it is essential to consider growth projections up to the target *design year*, ensuring that the system remains scalable and capable of supporting evolving operational demands	Always
Inventory Snapshots	Inventory snapshots are data tables that capture the state of inventory at a specific point in time. These snapshots typically include key details, such as product Stock Keeping Units (SKUs), current stock levels, and location information.	Depending on project scope

3.1 Master Data

The master data, or item master file, consists of a table detailing all relevant SKUs along with their physical properties and storage requirements. Relevant SKUs include those that need to be considered in the design of the material flow system.

Experience shows that master data is often incomplete and, even more frequently, inaccurate. While we perform plausibility checks (e.g., identifying items with improbable weights or dimensions), it is clear that higher-quality raw data results in better planning outcomes.

When implausible data is identified, it must be decided how to handle such discrepancies. If only a small number of SKUs are affected, particularly those with low throughput and minimal impact on system design, it may be agreed with the customer to exclude these data sets. However, deleting larger volumes of incorrect data can distort the results of the analysis. In such cases, it may be more appropriate to make reasonable assumptions, such as replacing missing or erroneous dimensions with average values derived from other SKUs.

In any case, a brief discussion about master data quality and how to proceed after initial plausibility checks will be necessary.

3.1.1 Data Requirements

Type of Data	Explanation
Required Data	
Item Number	The unique identifier of each SKU, typically a numerical or alphanumeric code.
Item Name	The plain text name of the SKU
Weight	Weight of the SKU. Make sure that the physical unit used is the same across all SKUs (i.e., always gram OR always kilogram OR always ton). Importantly, the unit to which the stated weight refers must be clearly identified – for example, the pick unit, sales unit, case or pallet.
Length	Length of the item. Use a consistent unit of measurement across all SKUs, such as millimetres. Importantly, it must be clear whether the stated length refers to the pick unit, sales unit, case or another packaging unit.
Width	Width of the item. Use a consistent unit of measurement across all SKUs, such as millimetres. Importantly, it must be clear whether the stated width refers to the pick unit, sales unit, case or another packaging unit.
Height	Height of the item. Use a consistent unit of measurement across all SKUs, such as millimetres. Importantly, it must be clear whether the stated height refers to the pick unit, sales unit, case or another packaging unit.
Pick Unit	Statement about the physical pick unit, e.g., an individual piece, a box (containing several pieces), or a pallet (containing several boxes).
Depending on the specific project, the following data may be required:	
Number of pick units per transport (replenishment) unit	The number of pick units per superordinate transport unit – such as the number of individual cans per carton of canned beans – is crucial data, especially when the replenishment process operates with different units than the pick unit. For instance, if the picking zone is

	replenished with full cartons but pickers are tasked with selecting individual items from these cartons, understanding this unit relationship is essential for accurate planning.
Pallet Ti	The number of cases (transport units) per layer on a pallet
Pallet Hi	The number of layers per pallet
Sensitive Item / Crash Class	In certain projects, it is essential to identify whether SKUs are particularly sensitive or can withstand being dropped during the picking process. This information is critical for performance considerations, storage system design, and the development of efficient picking concepts. In some instances, items may need to be classified into crash classes to establish appropriate picking and packing sequences. Therefore, the crash class designation for each item should be included in the master data to facilitate informed decision-making regarding handling procedures.
Dangerous Good / Product Group	In certain projects, it is necessary to flag items as hazardous, flammable, or explosive goods, requiring them to be stored in designated separate areas. When dealing with diverse product groups that have specific storage implications, it is important to document these classifications in the master data. This ensures compliance with safety regulations and facilitates the appropriate design and setup of the storage system.
Temperature Zone	If SKUs have particular temperature requirements, this information needs to be provided as part of the master data.
Other characteristics	Any other characteristics, data or information with potential implications for the material flow system design.

3.1.2 Exemplary Extract from Master Data

Item Number	Item Name	Weight [g]	Length [mm]	Width [mm]	Height [mm]	Pick Unit	Pieces per Case	Temp Zone
295220	Fusilli Pasta	500	400	400	20	Case	4	Ambient
223481	Roll-on Deodorant	484	155	104	115	Case	6	Ambient
386995	Milk	1100	90	59	206	Piece	8	Chilled

3.2 Order Data

The order data encompasses all customer orders relevant to the new material flow system. This data is essential for determining the dynamic performance requirements of the material flow system.

Depending on the project, order data can generate extensive data sets. It is recommended that order data cover at least two full months of customer orders, and it is rarely necessary to exceed one year. Instead of broadening the time horizon, it is more critical that the selected period is representative of the requirements for the material flow system.

When there is a significant disparity between 'average days' and 'peak days' (such as during the Christmas season), it may be beneficial to utilize separate data sets to capture one average period and one peak period. Alternatively and preferably, extending the timeframe to encompass both periods can provide a more comprehensive understanding of the system's performance needs.

3.2.1 Data Requirements

Type of Data	Explanation
Required Data	
Order Number	The unique identifier of each order, typically a numerical code or alphanumeric code.
Item Number	The unique identifier of each SKU, typically a numerical or alphanumeric code.
Date	The order data should include the date of order registration in the system, as well as the dates of picking and shipping. This information is crucial for understanding the order processing timeline. Ideally, both the picking date and shipping date should be represented in separate columns within the order data, especially if there is a significant time difference between them. Moreover, it is important to capture not only the date but also the specific *time* to provide a detailed overview of the order fulfillment process. (See next row).
Timestamp	It is essential to differentiate between order time, picking time, and shipping time in the order data. The precise timings are particularly important when the load on the material flow system fluctuates throughout the day. Some IT systems capture both the start time and end time of picking activities, which can be valuable for analyzing the congestion levels in picking aisles, should this aspect be of interest. This data can help optimize picking processes and improve overall efficiency in the material flow system.
Quantity	The number of items picked. Additionally, information about the exact pick unit is necessary (see below).
Pick Unit	The order data should include a statement about the physical pick unit, such as whether it is an individual piece, a box (containing several pieces), or a pallet (containing multiple boxes). Understanding the physical pick unit is crucial for determining if items are picked and

	shipped in varying units. For instance, items may occasionally be processed as single pieces, while at other times, they may be picked and shipped as full cartons containing several pieces. This information is essential for effective inventory management and optimizing the material flow system.
Depending on the specific project, the following data may be required:	
Customer Number	The unique identifier of the customer
Shipping Load Number	If the analysis needs to include detailed goods-out sortation and similar, it will be necessary to know shipping load numbers so as to be able to understand sortation requirements.

3.2.2 Exemplary Extract from Order Data

The data set should contain all order lines in chronological order, that is every SKU ordered as part of each order for the given time period represents a separate line in the table.

Order Number	Date of Pick	Time of Pick	Item Number	Pick Quantity	Pick Unit	Customer
FR20201012	2020-05-02	08:35:45	295220	1	Case	JEB6203
FR20201012	2020-05-02	08:35:59	223481	2	Piece	JEB6203
FR20201013	2020-05-02	08:36:22	295229	4	Piece	JMB1188
FR20201014	2020-05-02	08:36:47	293441	2	Pallet	KWH3001

3.3 Inventory Snapshots

Inventory snapshots are specific records that capture the status of inventory at a particular point in time. These snapshots provide a detailed overview of stock levels, allowing businesses to assess their inventory situation efficiently. They are crucial for various operational activities, including inventory management, supply chain optimization, and financial reporting.

3.3.1 Components of an Inventory Snapshot

An effective inventory snapshot typically includes the following components:

- Stock Keeping Units (SKUs): A unique identifier for each product, allowing for easy tracking and management.
- Current Stock Levels: The number of units available for each SKU at the time of the snapshot. This is a critical metric for inventory management and replenishment decisions.
- Location Information: Details about where each SKU is stored within the warehouse or distribution center.
- Lot Numbers: For products that require tracking, including lot numbers can be necessary for the planning process.
- Safety Stock Levels (if applicable): The minimum quantity of inventory that must be maintained.

3.4 Working Hours, Growth Expectations and Design Year

In order to understand the performance requirements the material flow system needs to fulfill, it is necessary to know the daily working hours. They should be provided in simple table format.

Day	Morning Shift	Day Shift	Night Shift
Monday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Tuesday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Wednesday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Thursday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Friday	05:00 – 13:00	13:00 – 21:00	-
Saturday	05:00 – 13:00	13:00 – 21:00	-
Sunday	05:00 – 13:00	-	-

New systems are seldom designed to accommodate the current status quo; rather, they are intended to meet future requirements. Given that there will be a time lag between the extraction of raw data from IT systems for analysis and the operational launch of the new material flow system, it is crucial to establish a design year along with the anticipated annual growth rates leading up to that year. The design-year requirements may subsequently provide a basis for performance specifications and acceptance criteria. The applicable test conditions and acceptance procedure must be agreed separately.

4 Requirements for Data Format

The format of the raw data can be flexible, provided it is compatible with commonly used systems and does not require the purchase of proprietary software for accessibility.

Common formats include

- .txt or .csv files
- .xls or .xlsx files (Microsoft Excel)
- .mdb or .accdb files (Microsoft Access)

Receiving the data in formats other than those specified may necessitate additional time and effort for processing. Therefore, please ensure that all columns are appropriately named or documented in a separate file to facilitate easy identification by the data analyst.