Know Your Actual **YIELD**

Setting realistic expectations on your ROI

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By AHS Staff

Have you purchased and implemented a material handling system based on the equipment's ability to meet a certain rate, only to discover the system doesn't meet your expectations or your Return on Investment (ROI) model? Understanding the difference between a system's machine rate versus the actual system yield rate is crucial when planning, designing, and implementing a material handling system.

Machine Rate

Machine rate is the maximum sustainable rate of product handling that can be achieved under ideal conditions for an individual machine, conveyor line, shipping sorter, or central merge. Machine rate is often referred to as a machine's rated capacity and is expressed by the type of product on a per-minute basis. Types of product include units, cartons, cases, packages, parcels, parts, pieces, pallets, picks, packs, lines, orders, touches, and totes. When looking at the manufacturer's stated machine rate for a piece of equipment (such as an in-line case sealer), it is important to understand how the size of the product impacts the machine rate. In the case of a case sealer, the machine rate of the equipment will decrease as the length of the carton increases.

$$\text{Machine Rate} = \frac{\text{Maximum Sustainable Rate}}{\text{Minute}}$$

Other industry terms such as "design rate," "sustainable rate," "system rate," "peak rate," and "throughput rate" are nebulous terms that have historically been used to refer to maximum machine rate, yield rate, or anything in between.

Burst Test Method of Rate Verification

An ideal method of rate verification of material handling equipment is the short duration "burst" test. To conduct a proper test to verify the machine rate, it is necessary to create ideal conditions to eliminate machine losses and operational inefficiencies. These tests typically last only two to five minutes in duration and provide accurate snapshots of equipment's maximum machine rate.

Example 1: Central Merge

To test the machine rate of a typical conveyor system's central merge, the upstream conveyor lines often need to be preloaded with the best quality average length size cartons. Reloading cartons eliminates possible upstream operational issues, and using the best quality cartons eliminates product conveyance issues.

Several important points should be noted:

1. Average length cartons are necessary for a valid test because shorter length cartons often produce higher than anticipated rates. For the same reasons, longer cases usually produce lower than anticipated rates.
2. The "best quality cartons" can be defined as those cartons which have smooth, flat, conveyable bottoms. In this case, carton flaps are sealed, product inside the cartons is stable, weight is evenly distributed, and the center of gravity is located at the center of the carton or below. The carton's longest dimension is the length, followed by width, and the shortest dimension is the height.

Example 2: Shipping Sorter

To test the machine rate of a typical conveyor system's shipping sorter, often special software algorithms need to be written to prevent consecutive diverts to the same sort line to balance the sortation process over all available sort locations. This eliminates lane-full conditions and product re-circulation. In a typical sortation system, the machine rate of an individual sort line is only a fraction of the machine rate of the sorter itself. For a maximum machine rate test for a sorter to be valid, the upstream conveyor system must have the ability to deliver product to the sorter, and the downstream sort lines must have the ability to convey the product away from the sorter.

Yield Rate

Yield rate is the **actual rate** of product handling achieved under normal operating conditions for an entire conveyor system, individual machine, conveyor line, shipping sorter, or central merge.

$$\text{Yield Rate} = \frac{\text{Actual Rate}}{\text{Time}}$$

Yield rates can be substantially less than equipment machine rates when normal machine losses and operational inefficiencies are considered.

Machine Losses

Normal machine losses typically make up only a small percentage of rate degradation (less than 2%) from machine rate to yield rate. Some of the following issues may be responsible for machine losses:

- Merge delays
- Scanner no-reads or tracking errors
- Re-circulation of product
- Equipment malfunctions
- Downtime due to component failure
- System response time delays

Operational Losses

Operational losses typically make up the majority of rate degradation (greater than 98%) from machine rate to yield rate. Typical operational losses are the result of the following issues:

- Improper staffing
- Lack of management
- Jams due to carton issues
- Product characteristics
- Ergonomic issues
- Poor layout design
- Improper training
- Inexperienced employees

Summary

Planning a material handling system is a major undertaking, and the development of your ROI model is the foundation of the project's success or failure. The actual return realized will be based on what the system ultimately produces or yields. Setting realistic expectations on what your system will likely produce (yield rate), not what it can produce (machine rate), will lead to superior results. Understanding the difference between a system's machine rate versus the actual system yield rate is the crucial first step when planning, designing, and implementing your future material handling system.

Contact our experts at AHS, LLC for help!

Call us at **800-891-5504** or email us today at **info@ahs1.com.**