

RAISING PRODUCTION QUALITY BY TOTAL CONTROL IN BUFFER STORES, STORAGE AND AUTOMATIC CONVEYING FACILITIES

Maurizio Bardi

R&D Director of Gruppo Barbieri & Tarozzi

The scenario relative to production process and material expedition common to most top tile manufacturers is basically as follows:

- Important concentrations are taking place, which have led to great specialisation in the production units.
- Production lines, thanks to development in equipment and materials as well as with a view to specialising even further, are attaining ever-greater production volumes and reaching levels that were unthinkable only a few years ago.
- An ever-tougher market and fierce competition require substantially enhancing customer service by:

Reducing delivery times.

Reducing product order size.

Asking the producer ever more often to prepare the customer's order.

Requesting greater accuracy as far as items and despatched quantities are concerned.

Owing to these factors, a clear need has arisen to have the parameters regarding the production process and product storage controlled much more rapidly, accurately and efficiently than would have been acceptable only a few years ago. It is undoubtedly useful to relate the data and situations of one section, with those of another inside the same production process, in order to allow taking fast decisions while at the same time accounting for the greatest possible number of variables.

For the collected data to be truly useful, several factors need to be especially considered which play a key part:

- Data must be updated in real time with the least possible delay.
- Information from the various departments must already be related or easily relatable without requiring long complicated preparation.
- The product must be identified and easily localisable inside the process, if possible at the most primary stage.

The evolution of computerised management systems in recent years, flexibility of cutting edge internal handling and conveying systems, and consequent easy application to the various manufacturing process stages enable performing ever-better integrated, more fitting control.

A single data processing and control station can monitor and manage a great many production process stages, from the glazing lines to the expedition of the finished product.

Machine Log							
Unloading machine Kiln entry no. 1							
Registr. Number	Registr. Date - Time	Box Number	Material Code	Customer Code	Description	Box Creation Date - Time	Event Code
1294	21/Oct/96 09.32.31	202	1	0001	First Green Product	21/Oct/96 09.29.29	1
1295	21/Oct/96 09.52.01	107	1	0001	First Green Product	21/Oct/96 09.44.59	1
1296	21/Oct/96 10.07.44	143	1	0001	First Green Product	21/Oct/96 10.00.38	1
1297	21/Oct/96 10.25.03	134	1	0001	First Green Product	21/Oct/96 10.17.37	1
1298	21/Oct/96 19.54.30	3	1	0001	First Green Product	21/Oct/96 19.52.41	1
1299	21/Oct/96 20.10.23	200	1	0001	First Green Product	21/Oct/96 20.08.53	2
1300	21/Oct/96 20.13.20	158	1	0001	First Green Product	21/Oct/96 20.11.31	4
1301	21/Oct/96 20.31.28	216	0			21/Oct/96 20.23.09	1
1302	19/Jun/97 14.56.26	17	1	0001	First Green Product	19/Jun/97 14.53.35	5
1303	19/Jun/97 15.15.11	18	1	0001	First Green Product	19/Jun/97 15.02.10	15

1303

Search Line

From 1294

To 1303

Print

Previous Line

Previous Page

Last Line

Following Line

Following Page

Exit

Standard pallet storage and conveying facility layout

The system directs and integrates the following functions:

- Automatic product conveyance and storage by automatically guided vehicles.
- Travel of products to the firing kilns and sorting lines
- Automatic moving of pallets with finished products from head and tail of the packaging and labelling line.
- Finished product store management, traditional floor stacking of an intensive and semiautomatic kind, or fully automated systems with transporting elevators.

- Order and expedition management connected to a central control system.

Each product that is moved and processed in the facility receives a code and identification with a view to ensuring easy location inside the whole production cycle. The product register contains all the management and operating data, which can be automatically called up by the central management system.

Setting Production Codes - Artistw -

Dati relativi ai Prodotti

Creation Date	Last modification Date	Code no.	Customer Code	Description	Park. Green	Pieces Row	Rows Plain	Plains Box	Pieces M²	Kg al M²	Cycl. Min.
04-Sep-96 15.46.08	08-Jan-98 22.44.23	1	0001	First Green Product	A	4	5	50	1.0	1.0	60
13-Sep-96 20.50.51	08-Jan-98 22.44.33	2		Second Green Product	J	4	5	50	1.0	1.0	60
13-Sep-96 20.54.09	08-Jan-98 22.44.41	3		Third Green Product	A	4	5	50	1.0	1.0	60
	08-Jan-98 22.38.08	08-Jan-98 22.40.24	4								
			5								
			6								
			7								
			8								
			9								
			10								
	04-Oct-96 17.16.07	08-Jan-98 22.35.26	11								
	19-Jun-97 15.04.10	08-Jan-98 22.35.29	12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

1

First Green Product

Find no.

Find Name

Print

Exit

Gruppo Barbieri & Tarozzi Formigine (MO) Italy - All Rights Reserved

Ver: 6.77

Article register table

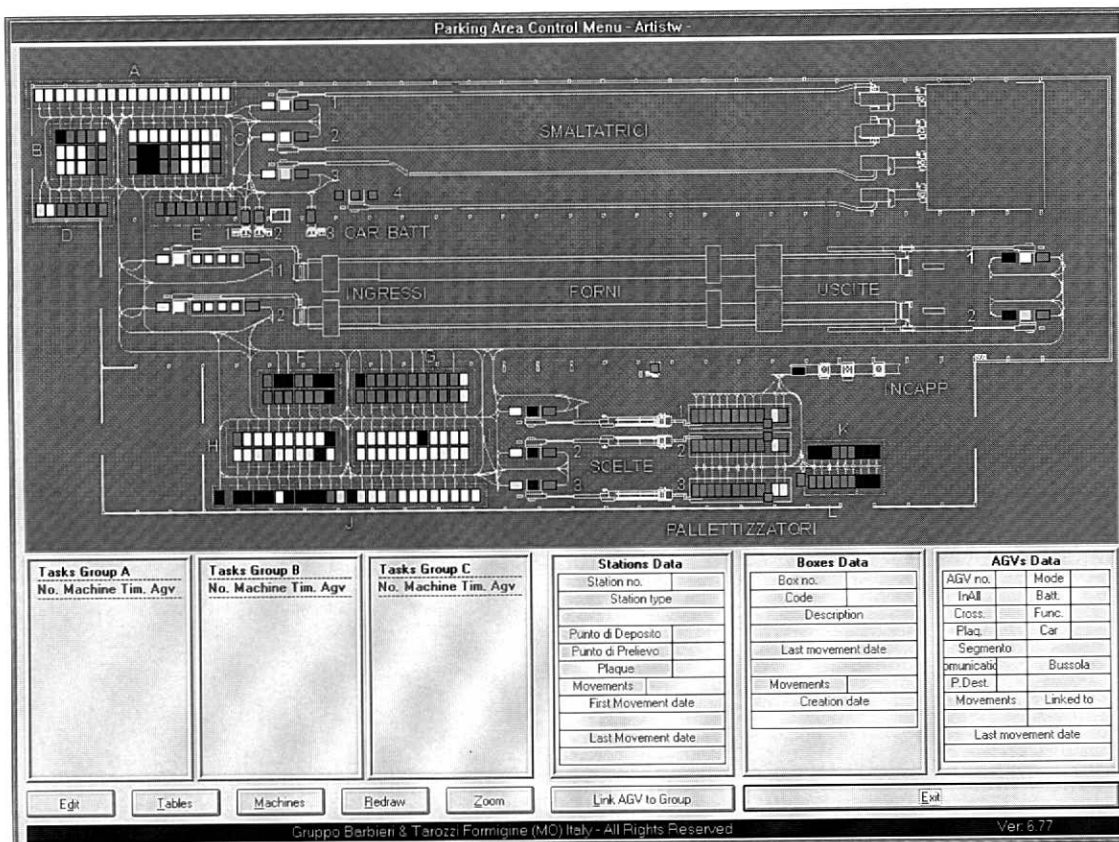
We will now start with an analysis of each of the system's functions, from the storage facility, which has for some time been running almost exclusively with automatically guided cars instead of the traditional shuttle cars, carrying green and fired ware more and more frequently.

At the system's computerised management station, there is a production table of each machine point to be found in the plant, which allows programming the production plan of the next 16 products.

Thus, each machine knows the product it is processing and is able to communicate the data relative to the ware contained in the box, with each box change, to the conveying system.

Each box is coded and numbered and the following data are provided, together with a further series of data of a management and operational nature.

- Code and description of the product contained.
- Quantity of product contained, in terms of number of items and square metres of product.



Production table of a box-loading machine

Edit Production Table - Artistw -

Piazza

1 2 3 4 5 6 7 8 9

Materiale da Portare alla Unloading machine Kiln entry no. 1

Creation date	13-Sep-96 12:54:23	Logica FIFO+DELAY	OFF
Last modif. date	17-Jun-97 14:14:29	no. of boxes produced	1382

Pos.	Code	Description	Box no.	Change	Edited on
1	1	First Green Product	< All >	1 - Man	15-Oct-96 18:53:35
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Delete Table Portare / Prelevare Codici Formature Other Table Print Exit

Gruppo Barbieri & Tarozzi Formigine (MO) Italy - All Rights Reserved Ver. 6.77

Synoptic PC layout showing box data

- Line where the product was manufactured.
- Date and production starting and finishing time.

Production Control Menu - Artistw -

gruppo Barbieri & Tarozi

Status of the boxes in Parking Area

Code	Description	Box no.
1	First Green Product	26
2	Second Green Product	2
500	Empty Box	58
501	First Fired Product	19
502	Second Fired Product	5
801	Fourth Fired Product	10
1000	Empty Box	9

Goods in Parking Area

Print Goods in Parking Area

Production per Machine

Cancellazione dei Box Liberi

Report print

☐ Automatic print enabled

Print Empty Report

Exit

Gruppo Barbieri & Tarozi Formigine (MO) Italy - All Rights Reserved Ver: 6.77

Table summarising quantities per product model.

Information is thus available in real time regarding park content, summarised in terms of type of product and quantity present in the park, thus providing a basis for establishing the production plans of each machine point at the kiln entrance, or by selection, choosing as well storage box quantities or square metres of product to be sent to the machine.

Each movement made inside the store is monitored, controlled and recorded, so that production statistics and reports can be drawn up for each machine point, with production dates, times and quantities, thus allow tracing and locating each production lot.

The system is designed to carry on a dialogue with the other machines present in the plant, such as presses, glazing machines, kilns, sorting and palletising systems, in order to collect or transfer data relating to the product or to the running manufacturing process.

At a change in production, the code of the new product can be sent to the kiln, so that the kiln can then proceed to self-regulate the possible different parameters, or to the sorting lines so that they already know the next product that is to be produced.

Moreover, in the transport route between sorting line and palletising line, a sealing

or bar code labelling machine can be hooked up to electronically mark each product box, in order to recognise it in successive handling stages by special readers.

The above functions use the previously mentioned product register to eliminate any keying-in errors that operators might make during their intervention, which are quite common in these stages.

We will now proceed with an analysis of the system with the conveyance of pallets of finished products at the end of the sorting and palletising lines, which in the most complete version ends with automatic delivery of the finished product to the store.

This internal movement stage can be automated by using automatic forklift cars that are directed and synchronised by the same store facility control station.

These vehicles can perform the following tasks:

- Palletiser emptying service, taking away full pallets and conveying them to the pallet packaging line.
- Palletiser feeding service, providing the palletiser with new pallets, whether as pallet stacks or single empty pallets.
- Local parking of pallets that are not yet full, because a colour has ended, and which are left in a special park near the palletiser so as to be able to put them back again when the same colour comes through again.
- Local parking of pallets that are not yet full because production has ceased, in order to form groups with the contents of several pallets on just one pallet, prior to final packaging.
- Printing of the pallet card that sets out product identification data, by applying a special bar code for the electronic marking of the pallet with the product, indispensable for the following automatic control and management stages in store of the finished product.
- Picking up full pallets at the end of the packaging machine to create a kind of pre-store with these pallets, at various levels, which allows local storage for product from one or more work shifts, or allows pallets bearing the same product to be stacked in two tiers, in order to cut back on forklift car trips to the store where the finished products are left.
- Automatic delivery of the finished product in the pre-store area, with a direct in-line connection to the central management computer system.

We can now proceed to analyse the process stages relating to the finished product store.

The store at a tile manufacturing facility usually consists of:

- A large area, often in the open air, for pallets containing cellophane-wrapped products, where pallets are stacked up to various heights on top of each other.
- A smaller, usually covered area, where pallets that are not yet full, or containing special pieces or trims, and pallets with decorated tiles, are left in multi-storey racks.
- A typical covered area where the products are picked in making up the customer's order.

The store has acquired ever greater importance and plays a key role with regard to management costs and level of service to the customer, besides achieving such high production flows and stocks, that they have become difficult to manage by traditional or normal methods.

When the store reaches a considerable size it will certainly be profitable to:

- Computerise store management in real time.
- Progressively automate all the automatable cycles.
- Upgrade the system by providing computer assistance in all the stages that are still being manually controlled.

With this in mind, the following series of products has been developed and applied by integration into the computerised management system:

- Radio frequency terminals fitted on board the manual forklift cars and three-sided cars used in manual picking, suitable for the computerised transfer in real time of the operations to be conducted by the operators in order to facilitate the work, reduce errors and raise individual productivity.
- Bar code readers to be connected to the terminals on board of the manual cars to allow reading the bar codes present on the product and obtain the conformity and updating, in real time of the situation in the store.
- Systems of standard racks of considerable height, in which to set the pallets that are not yet complete, placing the pallets with special pieces or trims and decorated tiles in lower areas than were occupied previously.
- Automatic transporting elevators for automatically moving and storing pallets bearing products, suitable for aligning the pallets in special picking areas on the ground or for putting on board an operator in a special cabin, to allow direct picking in the lane.
- Transporting and channelling systems for automatic pallet aligning in the picking positions, which facilitates the work of the operator working in a fixed area on the ground, with the consequent rise in individual productivity.
- Auxiliary systems in the picking areas, such as elevator platforms and compensated handling systems.

- Adequate auxiliary systems for facilitating container loading operations.

All the above are assisted by a series of software modules integrated in the computerised system with the following functions:

- Interaction with the central management system for introducing the load preparation orders.
- Interaction with the central management system regarding the execution of the orders.
- Interaction with the central management system of the store situation.
- Dynamic management of the locations in the ground stockpiling store.
- Dynamic management of the locations in the intensive store racks.
- Network management by radio frequency.
- Management of resources and movements.
- Picking management and filing.
- Management of automatic operations and collection logistics.
- Optimisation of vehicle routes.
- Filing of store resources.
- Stock management.

The system is run by means of applying a network of computers, in which each has specific integrated functions, connected by a couple of servers in mirroring, which ensure the functional continuity of the facility, even in the case of one breaking down.

The interaction and connection with the central operating system can be carried out in different ways, from the slow, simplest and most traditional terminal channelling, to the most flexible, fastest, modern dialogue network.