# TIRE DIVISION

STRATEGIC AND TECHNOLOGICAL
TIRE INNOVATION

cassioli
TIRE DIVISION

# AUTOMATED
## TIRE HANDLING & STORAGE
# SOLUTIONS

# WELCOME TO A NEW ERA OF PRODUCTION

Cassioli, an Italian company established in 1943, is today an important partner for leading world-wide tire manufacturers. Manufacturing high quality tires requires the intelligent management of internal logistics, attention to product quality standards and competitive delivery times.
Cassioli systems, accurately designed and implemented with the best automation technologies, make it possible to obtain maximum return from tire processing, thereby accelerating production and delivery times while maintaining product quality in all the processing stages.

ISO 9001 - ISO 14001
ISO 45001 - SA 8000
BUREAU VERITAS
Certification

SILVER | Top 15%
ecovadis
Sustainability Rating
JUN 2024

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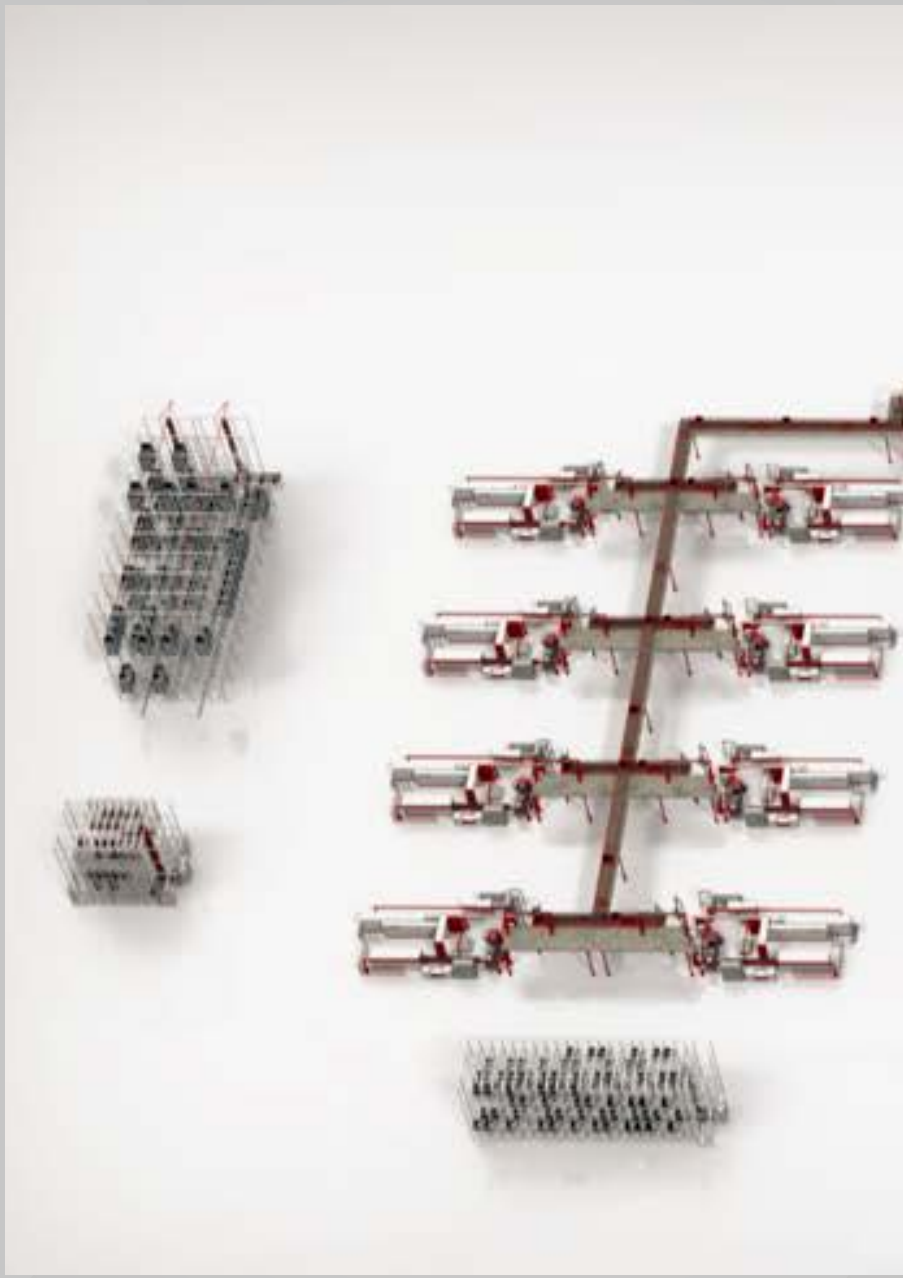
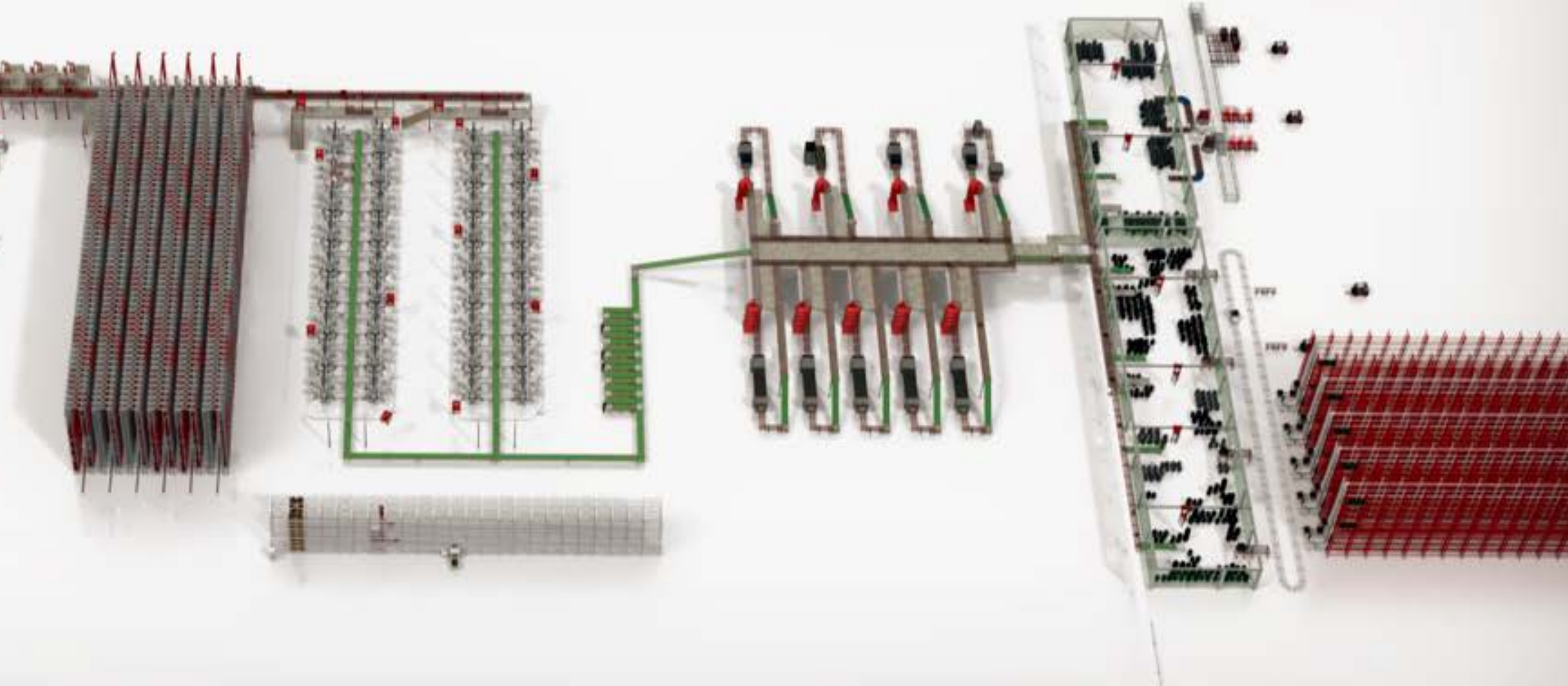
Cassioli services include development of the solution, layout design and simulation to verify the solution. Automation of the handling system, from TBM (Tire Building Machine) to automatic storage of the finished product permits maximum use of all the system's machines, reducing production down-times or stoppages. Increasing the material flow to the presses is the key to maximizing production and saving time, all of which while ensuring a working environment that is safe and risk-free for the operators; the continuous availability of tires for curing, makes it possible to make maximum use of the presses resulting in a substantial increase in production throughput. Technological innovation, research, reliability, user-friendly maintenance and flexibility are the major advantages that lead to the choice of a Cassioli system, a leader in the realization of manufacturing and distribution systems at the forefront of modern industry.



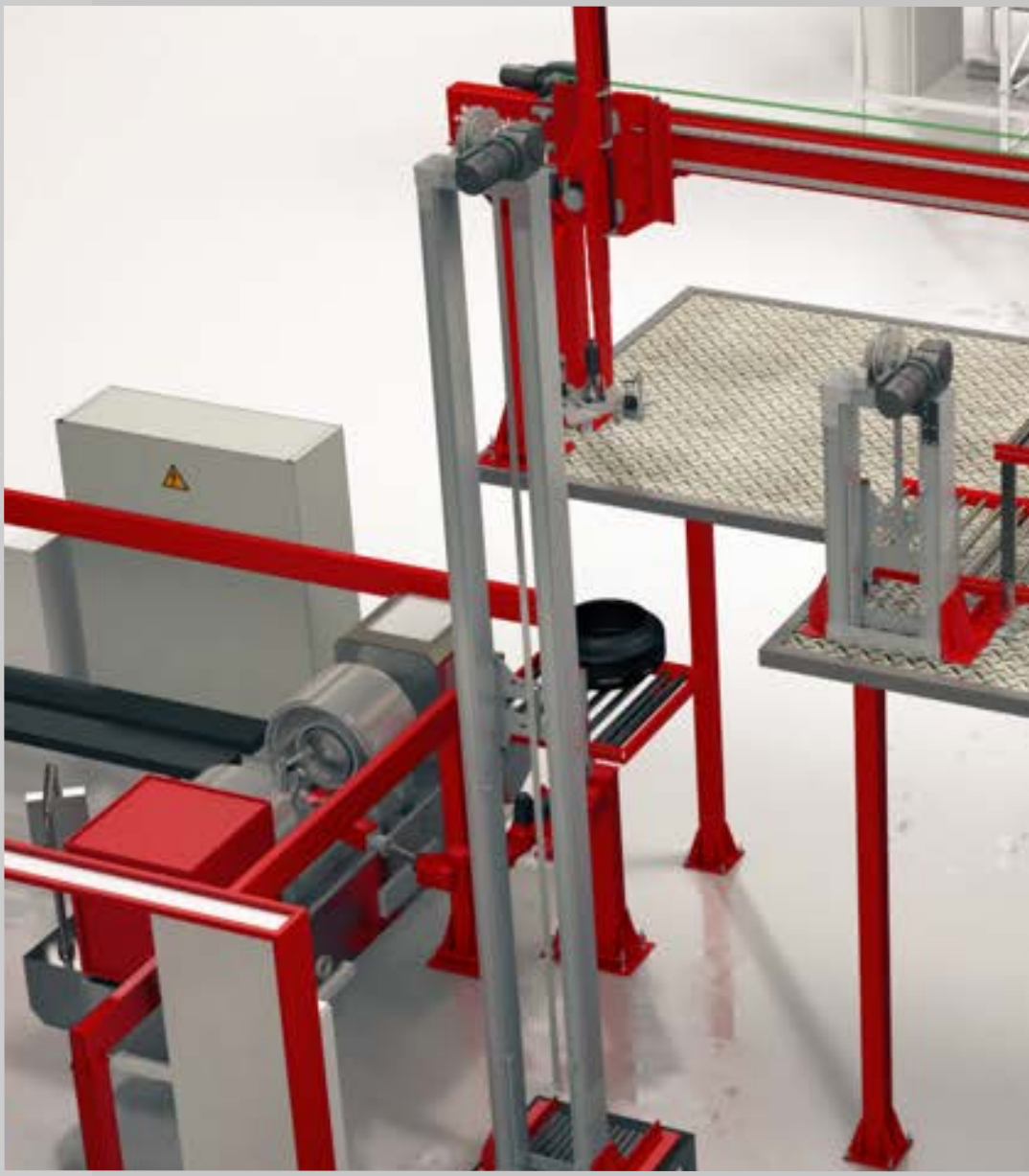


# 01

# TIRE BUILDING MACHINE AREA

Cassioli systems are the ideal solution to increase profit in companies specialising in tire production, since they enable creation of an excellent Green Tire (GT) buffer between the Tire Building Machine (TBM/TAM) and the presses, optimising material flow and considerably reducing waiting times.

The Green Tire handling system begins on TBM output, where each GT is positioned by a robot or by a manipulator on a specifically shaped pallet (Tote), or directly on the conveyor. The Green Tire then continues along a system of conveyors, up to Painting Machine, which treats it with a specific solution and, having completed treatment, is repositioned on the conveyor to then continue towards the automatic warehouse (Green Tire Storage Area).



## FOCUS

### VAST RANGE OF GT CONVEYORS WITH OR WITHOUT TOTE

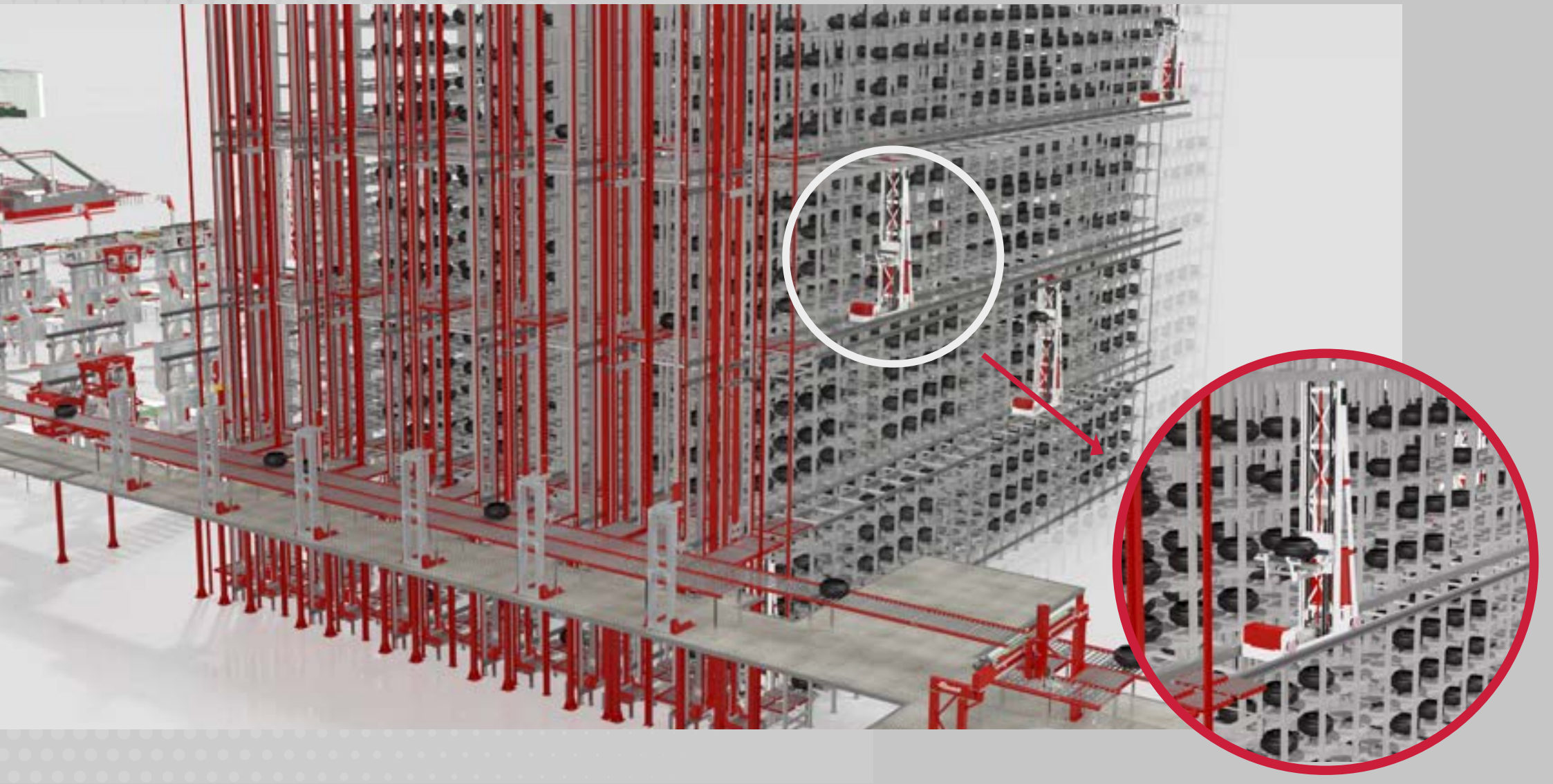
*Cassioli produces various types of automatic handling systems, including conveyor systems to enable Green Tire handling from one area to another in the plant. Based on customer needs and the characteristics of the production area, Cassioli will find the most suitable solution to guarantee rapidity and efficiency. Green Tires can be transported both by tote/pallet and directly on a conveyor.*

### GT on tote/pallet

### GT directly on conveyor

# 02

# GREEN TIRE STORAGE AREA



# GREEN TIRE AUTOMATIC STORAGE

Having exited the TBM, the Green Tires are transported towards intermediate Green Tire warehouses, in standby for vulcanisation inside the presses. In fact, to have the presses running at full operation, the Green Tires has to be immediately available in the warehouse.

The high performance levels which can be reached, in terms of use in the intensive storage areas therefore justify implementation of the automatic warehouses. Compared to manual storage systems, automatic warehouses guarantee higher load and handling potential and are therefore the ideal solution in industrial plants specialising in tire production.

The Cassioli Green Tire automatic warehouse is a fully customisable system, which allows you to arrange the storage units based on specific customer needs, in terms of space available, capacity and flows.

Cassioli experts make available five machinery ranges which, based on the manufacturer's needs, allow a highly customised solution to be obtained with optimised costs/benefits.

- MULTI-LEVEL SHUTTLE
- STACKER CRANE
- CARTESIO
- CARTESIO VX
- GANTRY

# GREEN TIRE STORAGE:
# MULTI-LEVEL SHUTTLE (MLS)

The new storage system, called the Multi-Level Shuttle (MLS), is formed by compact, single mini stacker cranes, however offering high performance, which can be stacked in the same lane, increasing system throughput. Cassioli's MLS was designed for storage of different types of materials and products, from Green Tires to finished tires. In an automatic warehouse with single or double depth, the Multi-Level Shuttle works on specific storage shelves and is presented as a shuttle with light design, capable of reaching higher performances than traditional stacker cranes for storage/retrieval. Having various shuttles on one another available means more flexible configuration is possible of the warehouse and the modularity of the system allows its development based on needs, the production potential required by the client and the type of product to handle.

## Picking system

**GT without tote/pallet**

CROSS TELESCOPIC FORK

**GT with tote/pallet**

STANDARD TELESCOPIC FORK

## Load Configuration

SINGLE LOAD UNIT

2 LOAD UNITS IN LINE

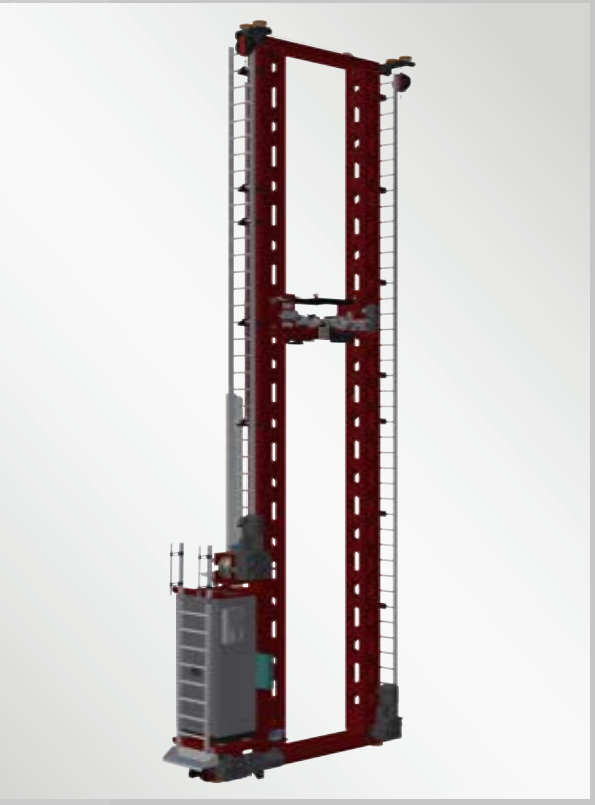
The compact design and the reduced weight contribute to making the system more dynamic, guaranteeing greater production capacity, with a high storage density, high efficiency from an energy point of view and low maintenance costs. Like all Cassioli systems, the Multi-Level Shuttle is managed by software developed inhouse, equipped with a simple and intuitive interface and capable of interacting perfectly with the client management software.

# GREEN TIRE STORAGE: STACKER CRANE

The Cassioli automatic warehouse with stacker crane is a completely customizable system, which allows the Green Tires to be arranged according to the specific needs of the customer, in terms of available space, capacity and flows. The warehouse for Green Tire with stacker crane is the most common solution in greenfields and where there are no space problems between existing machinery. In order to meet the different flow and interlocking logic requirements of the presses, Cassioli has designed two types of stacker cranes: single and double column.

For each of them, different load configurations are available. The stacker cranes are able to move up to four tires at the same time; each fork, however, can be independent from the others, in order to guarantee, if necessary, the maximum flexibility of batch one. Inside the automatic warehouse there is the possibility of storing the Green Tires with or without tote / pallet: in the first case, the stacker lift will carry out the picking with a standard telescopic fork, while in the absence of the tote, the stacker lift will be configured with telescopic cross fork.

## Miniload Stacker Crane Single Mast



# Miniload Stacker Crane Double Mast

The stacker crane represents the most common greenfield solution and is also implemented in scenarios where space constraints arise due to the presence of existing machinery.

To address various flow requirements and service logic for presses, Cassioli has developed single-column and double-column stacker cranes. Each of these designs offers multiple loading configurations. The stacker cranes can handle up to four tires simultaneously; however, each fork can operate independently of the others, ensuring maximum flexibility even for a single batch.

## Picking system

**GT without tote/pallet**

CROSS TELESCOPIC FORK

**GT with tote/pallet**

STANDARD TELESCOPIC FORK

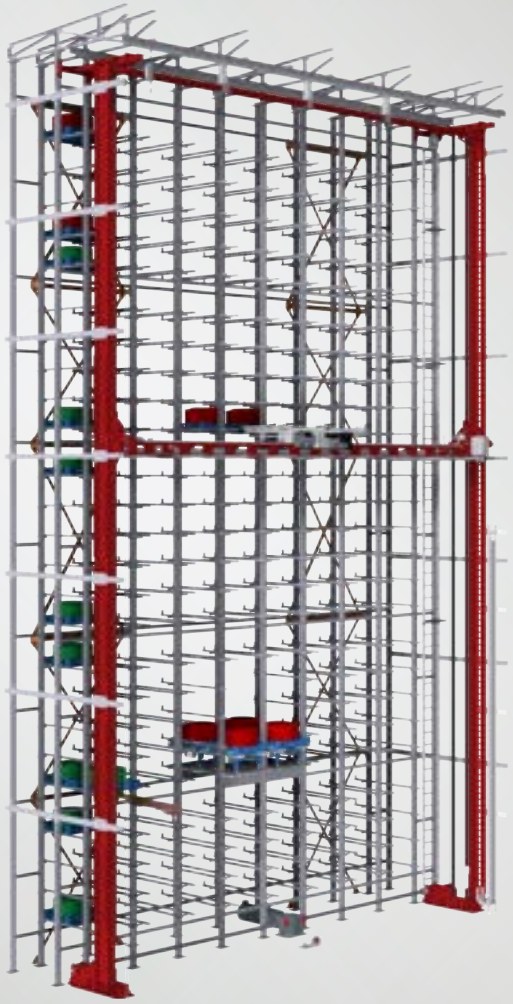
## Load Configuration

- 4 LOAD UNITS DOUBLE DEPTH
- 4 LOAD UNITS IN LINE
- 2 LOAD UNITS IN LINE
- SINGLE LOAD UNIT

Double Mast

Single Mast

# GREEN TIRE STORAGE: CARTESIO

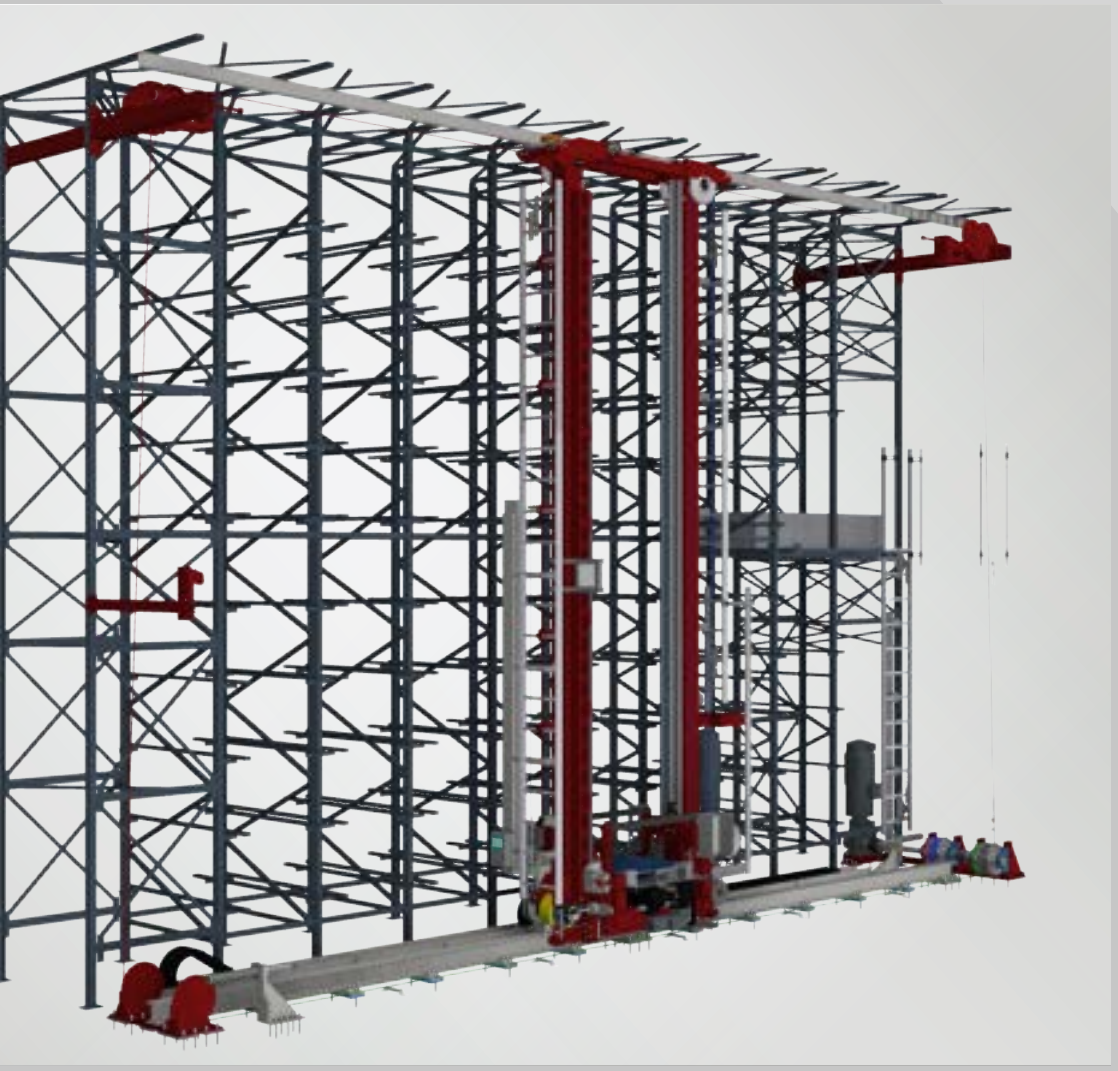


The Green Tire automatic warehouses with Cartesio and Cartesio VX are the ideal solution for brownfield applications, where plants with narrow or poorly distributed spaces require the maximum capacity to be obtained in terms of Green Tire quantity stored and flows.

The Cartesio system perfectly adapts to high throughput in very narrow spaces (maximum width up to 9.5 metres).

The Cartesio VX system, also optimised for narrow spaces, is instead an optimised solution in cost/benefit terms for lengths under 20 metres

# GREEN TIRE STORAGE:
# CARTESIO VX



## Picking system

GT without tote/pallet

CROSS TELESCOPIC FORK

GT with tote/pallet

STANDARD TELESCOPIC FORK

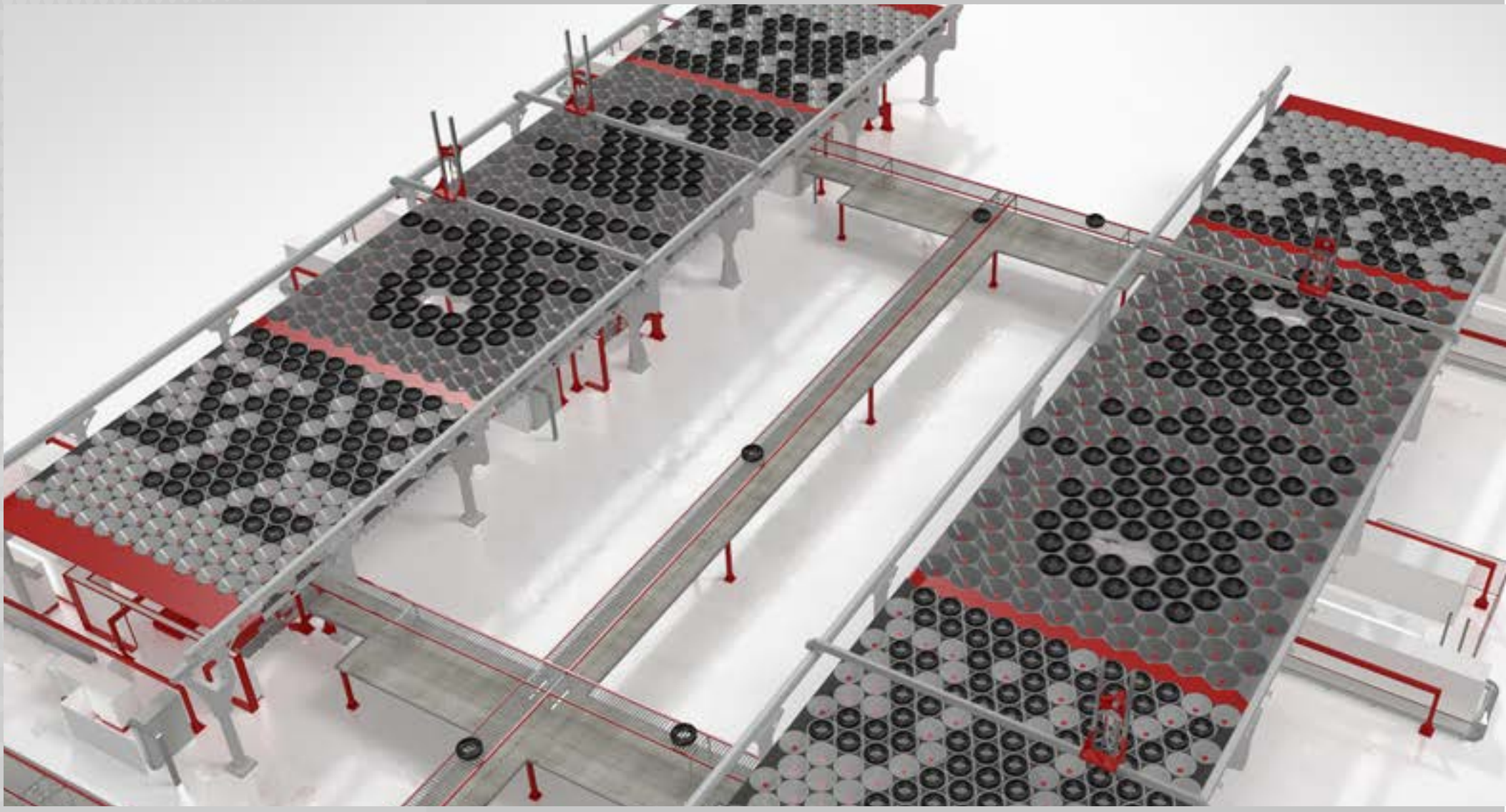
## Load Configuration

SINGLE LOAD UNIT

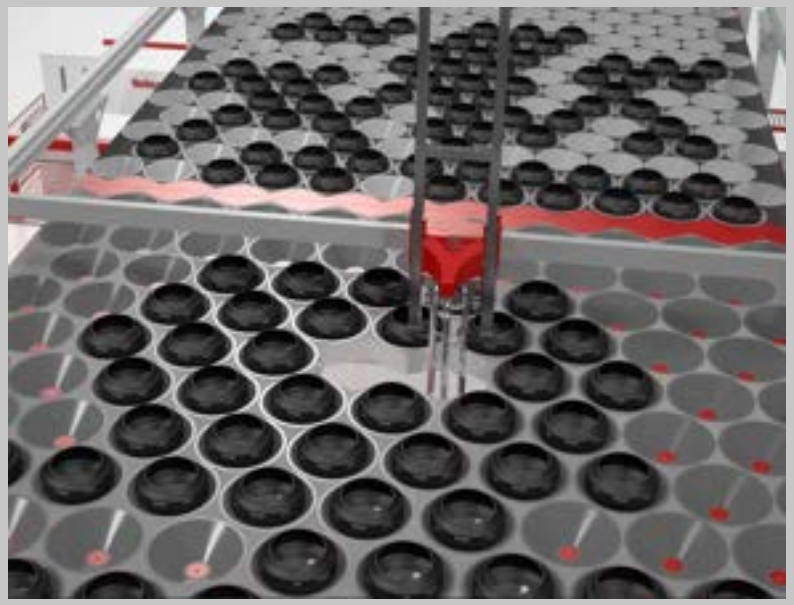
2 LOAD UNITS IN LINE

# GREEN TIRE STORAGE: GANTRY

*The ideal solution to maximize the available space above the TBM*



The automatic warehouse for Green Tire with Gantry robot is the ideal solution for those customers who have a well-organized production process and who do not need a large buffer between the rubber construction phase and the subsequent vulcanization.
With this solution it is possible to exploit the space available above the Tire Building Machine (TBM), not requiring other storage areas from the factory and reducing Green Tire handling as much as possible.



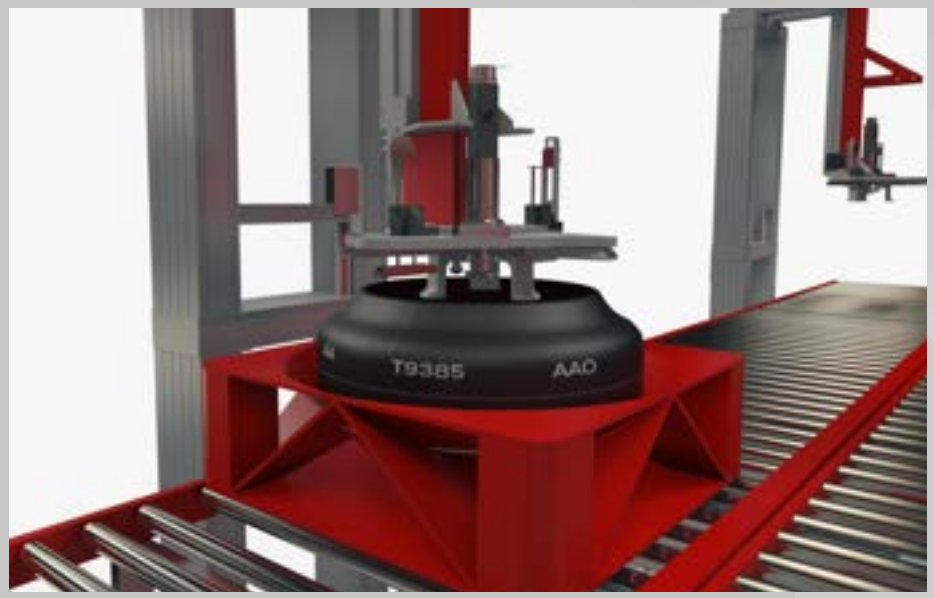
The Gantry system picks up the tires directly from the conveyors leaving the TBM and allocates them in fixed and shaped supports, waiting for them to be called for the exit towards the Vulcanization area.
This system combines its great compactness with extreme flexibility and brings advantages both for the production process and for lower investment and management cost.

# 03

# CURING AREA

The vulcanisation process is used to obtain the final shape of the tire and the design of the tire thread. Vulcanisation is carried out in the press areas, using heat and pressure in tire moulding. When the Green Tire is called to feed the presses, the tires are treated in the painting machine, designed for painting green tires, both inside and out, with special emulsions that enable easy Green Tire detachment following vulcanisation in the press. Cassioli systems can interface with the spraying machine to manage various spraying compositions and to exchange information on process results.

## PAINTING/DOPING SPRAYING MACHINE »

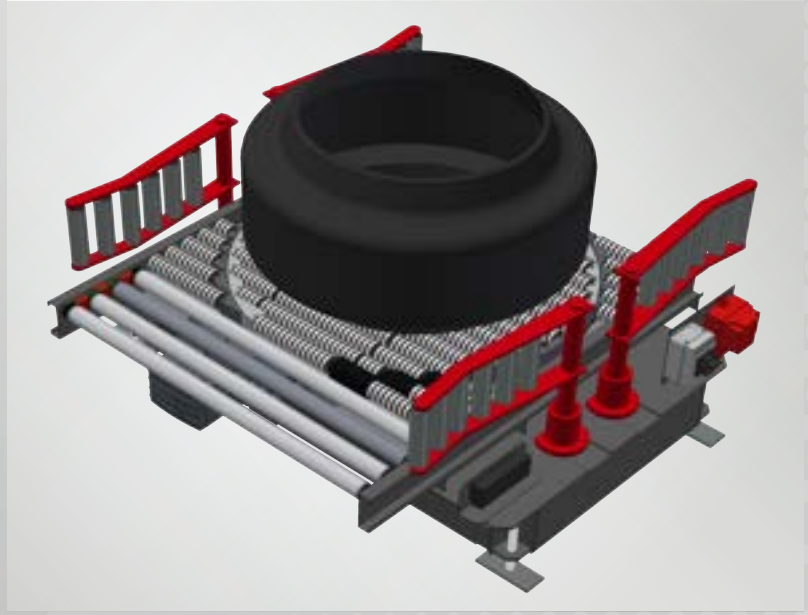



## GREEN TIRE ANGLE CORRECTION MACHINE

After being treated by the spraying machine, the Green Tires pass through the Angle Correction Machine: this, through the aid of a handling unit and a barcode reader, rotates the Green Tire and prepares it at the correct angle position for the presses.

## TIRE CENTERING-ORIENTING DEVICE - EMS AREA

If tires are handled without totes, in the EMS pick-up position it is necessary to carry out both centering and orientation. Centering takes place using pneumatically activated arms and allows the center of the tire to be always in the same position, so that it can be picked up easily by the EMS. Carried out by a BCR station and a rotary table, the orientation prepares the tire for the press at the right angle.



# » GREEN TIRE DELIVERY TO PRESS

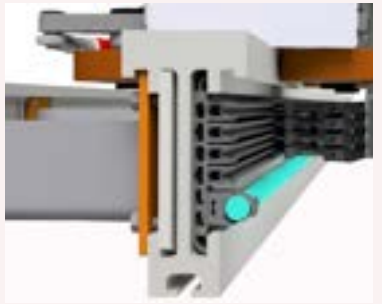
## EMS

### (ELECTRIFIED MONORAIL SYSTEM)

Using the conveyor system, the Green Tire exits the ASRS and reaches the press feeding area. Here, it is picked by the EMS using a specific gripper that holds the tire and lifts it inside. The EMS is an automated shuttle capable of travelling any route along an overhead track. The machine is composed of a frame, two wheel units, one automated and the one idle, a lifting device, a fall-stop device and an electric box. The shuttle can fully automatically manage different tire measurements and interface with different press types. The GT pick and place phase requires ascent and descent movement of the gripping clamp obtained using four cables. The absolute flexibility of the shuttle allows unloading of the tire at different heights, thereby managing to feed the most wide-ranging press loading devices (revolving unit, tilting unit, conveyors, etc.).

The track is supported by specific portals designed and dimensioned to allow open access to forklifts for mould change operations. Through automated exchange, the shuttle can be positioned in a specific maintenance area, which will allow the operator to intervene without interrupting or obstructing the functionality of the entire system.
In its standard configuration the EMS is powered by sliding contacts (brushes) that slide along the path on electrified tracks (busbar). It is also available a version that uses a non-contact energy transfer system (electromagnetic induction) between a fixed part and a mobile one. In this case, the fixed part is installed in the track, while a special collector that gathers energy is installed in the EMS.

## Electrical feeding by busbar

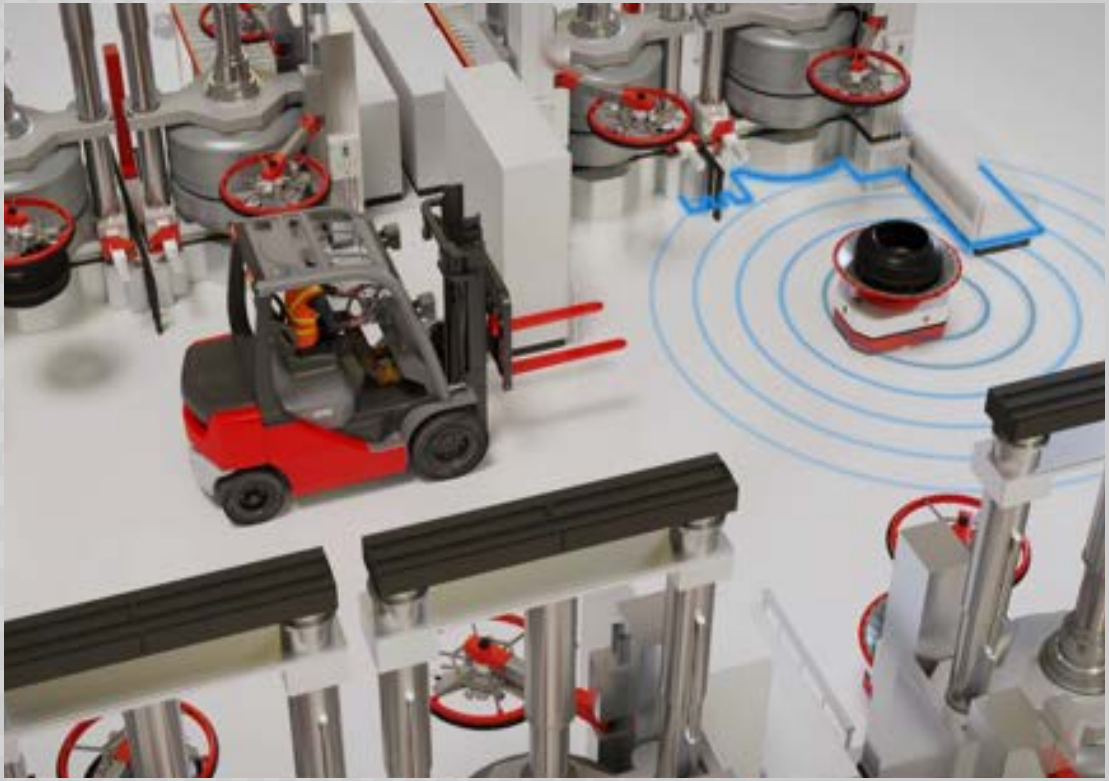


## Electrical feeding by induction

# AMR

## (AUTONOMOUS MOBILE ROBOT)

The AMRs - Autonomous Mobile Robots - are the new generation of AGV systems, but unlike AGVs, AMRs navigate freely using the natural features of the facilities and they are the ideal solution for last-meters delivery where flexibility is needed. The AMRs are equipped with sophisticated cameras, radars and sensors, and they are guided by artificial intelligence algorithms. Easy to get up and running, they requiring no construction, no installation of magnets and minimal programming.



The software and mapping tools can control an individual robot or the entire fleet of robots, in an easy-to-read color-coded map; they are equipped with sensors and guided by a smart software so they can reach their destination freely and independently, safety avoiding any obstacles in their path".

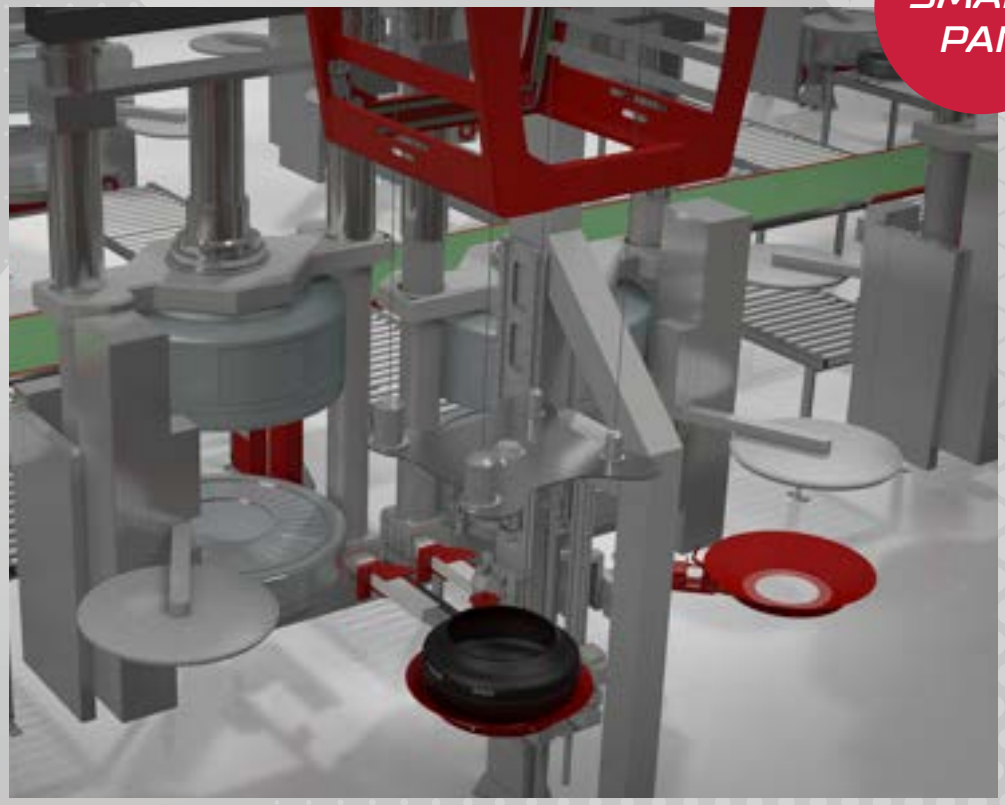
Autonomous Mobile Robots (AMRs), are equipped with tops, such as conveyors, carts, lifts and even cobot arms to carry out tasks such as pick-up and delivery of goods between warehouse area and presses.

# GREEN TIRE PRESS BUFFER

Once the Green Tire has been picked up, the EMS reaches the curing area through the suspended tracks and then deposits the GT in one of the equipment interfacing with the presses. The interface equipment between the EMS and the press can be designed in different ways, such as horizontal and vertical revolving units, smart pan, conveyors, trays, GT Stand, etc...
The feeding devices are designed to always have a minimum buffer for the press, so that the Green Tire is always available for the press as soon as the previous one has been loaded. Both the smart Pan and the GT Stand can have the stretching device.

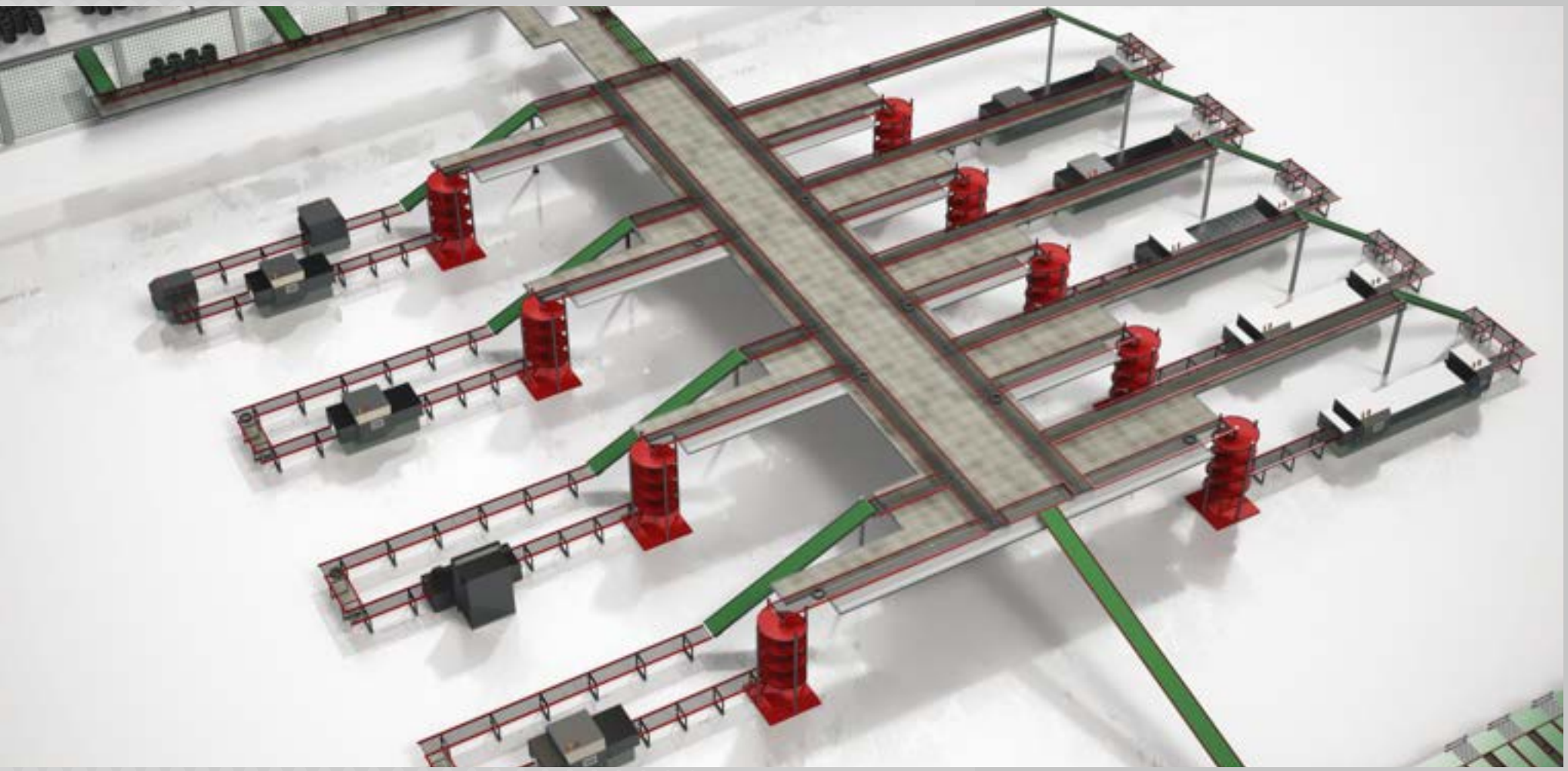
GT STAND


SMART PAN



# 04

# FINISHING AREA



From the curing press, the tire is ready for the quality control phase. The conveyor system takes the tires to the manual inspection stations (visual control) and to the automatic quality control phase with special machinery (testing machines). Each manufacturer follows a specific set of inspection protocols and quality tests on products, in order to verify that all the tires coming off the production line are free of damage and/or defects.
After the inspection bay, an automatic handling system transfers them to the storage and palletization area.

## BENEFITS

- *Flexibility*
- *High throughput and performance*
- *User-friendly and safe maintenance*

## SYSTEM HIGHLIGHTS

### CONVEYOR SYSTEM FOR FINISHED PRODUCT

- *Safe working environments*
- *Space optimization*
- *Flexibility in product handling and rapid transport*

### SPIRAL CONVEYOR SYSTEM

- *Space optimization*
- *Buffer increase*
- *High throughput*

### SOFTWARE INTERFACE WITH:

- *Testing Machine*
- *Label Printer*
- *Quality Inspection Area*

# 05

# BUFFERING & PALLETIZATION AREA

From the inspection area, the tires are conveyed for storage and palletizing.
Palletizing starts with the Gantry, designed and built to manage the tires for intensive storage.
The palletizing area contains several Gantries, that pick-up the tires that arrive in a random manner on the infeed conveyor and stack them one by one on the floor, setting them in order according to the product code. Each Gantry has its own working area inside the storage area. Perfect management and safe machine control are ensured by the complete integration of the three fundamental aspects of automation: mechanical, electrical and software management.
Since it is suspended off the ground, the Gantry is the ideal solution to best optimize space: this particular machine is designed to simultaneously manage several different tire sizes.

## HIGH PERFORMANCE

*The use of two synchronized servomotors enables the machine to reach sustained speeds and accelerations for the masses involved , in order to maximize production capacity.*

## CARE OF THE PRODUCT

*Thanks to its special design, the gripper can collect the stack of tires and safeguard the product quality.*

## MANAGEMENT SYSTEM

*The GMS software (Gantry Management System), part of the LOGIS platform, can manage the inputs and outputs from the storage area to supply information in real time for control and verification of the production process of every single tire.*

# PALLETIZATION CELL

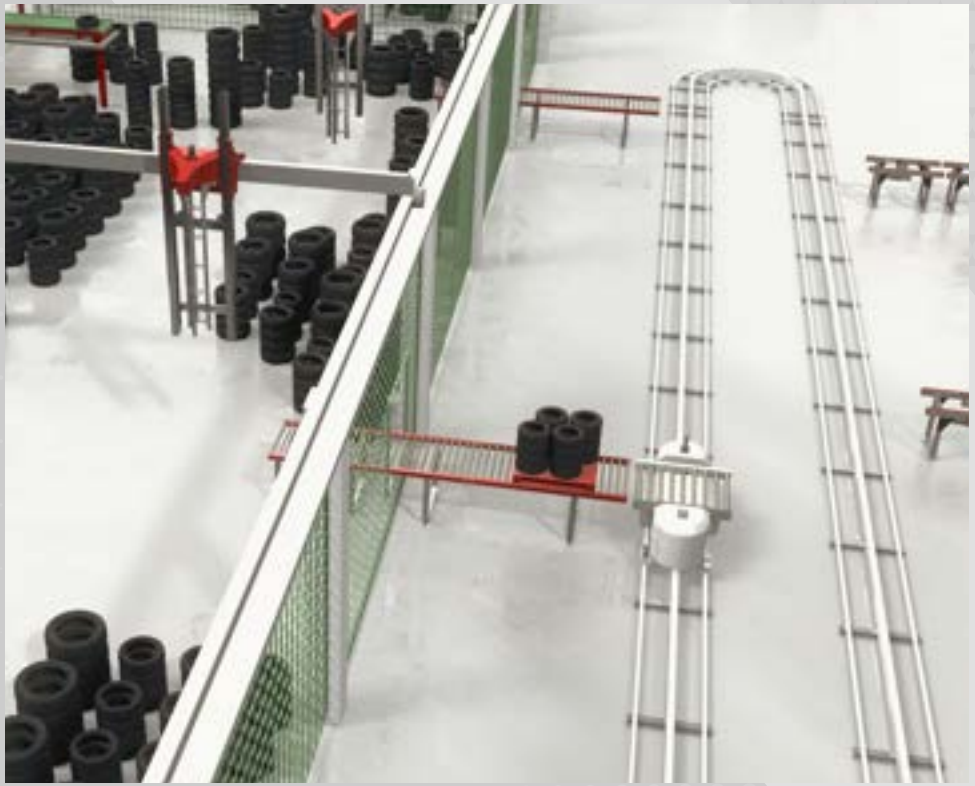
Each palletization cell is equipped with a six-axis anthropomorphic robot, able to load two or more pallet stations; therefore, while the robot is loading one pallet, an operator or an automatic system can take the other complete pallet and reposition an empty one. The robot may be fitted with different types of grippers: double grippers for rick-rack palletizing, grippers for vertical palletizing and grippers for horizontal palletizing (on tread). The operator works in safe conditions, because every palletization area is segregated with automatic doors and Safety Light Curtain. In addition to the fencing, the robot has a certified double-check safety system.

## PALLETIZATION SYSTEM

- Horizontal
- Vertical
- Rick-Rack

# SHUTTLE LOOP SYSTEM (SLS)

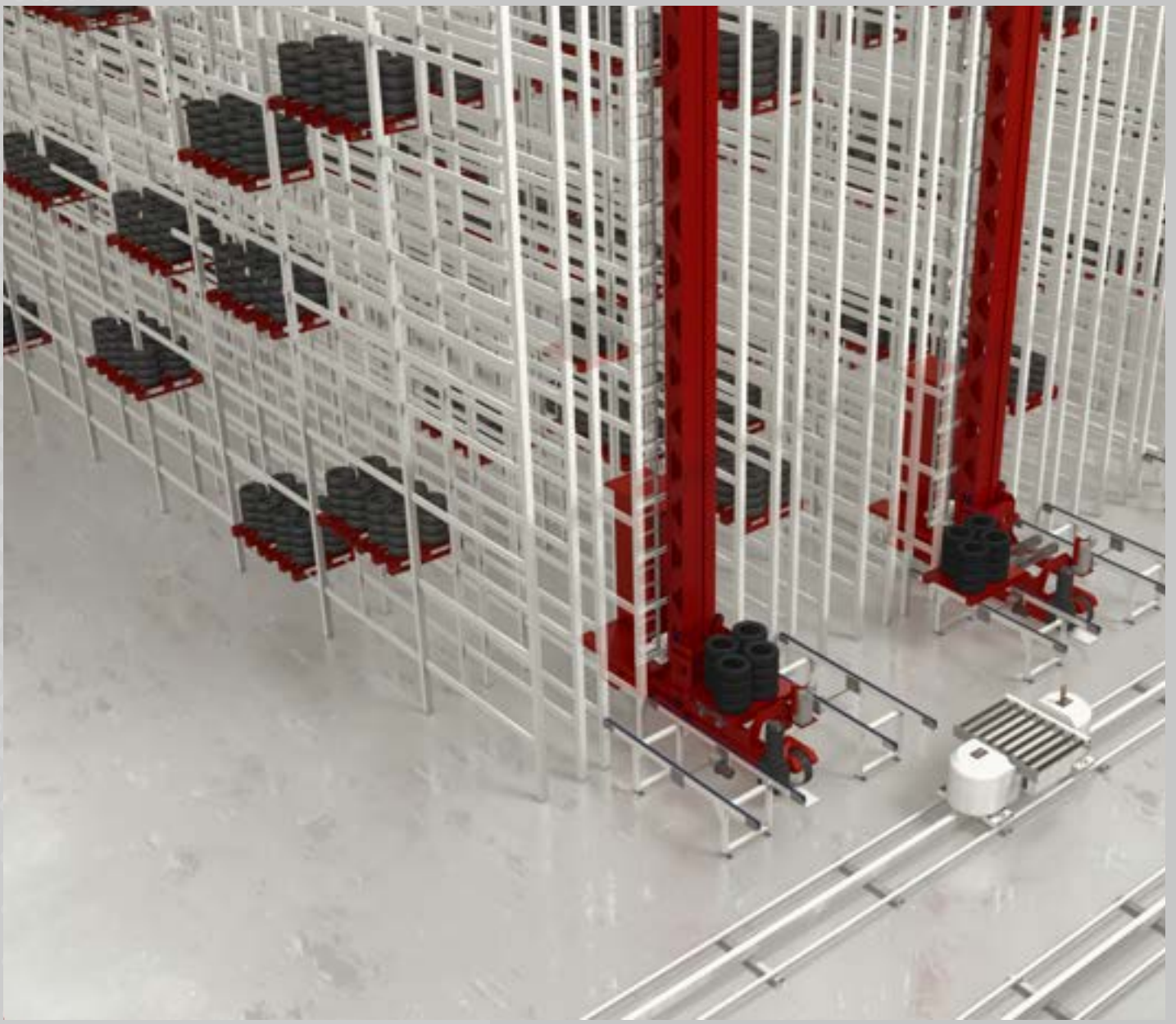
Cassioli's SLS (Shuttle Loop System) are composed of multiple self-propelled, steering shuttles that move on a closed circuit consisting of a track fixed to the ground. Cassioli's SLS allow transport of the product from one part to another of the plant in a flexible manner, reducing the travelling time compared to a conveyor system.



# FINISHED TIRE STORAGE AREA

After the pallet has been completed with the tires, it is taken to the Finished Product High Bay Storage, that can reach a height of 40 meters.

In fact, the finished tires have to be retrieved and delivered according to the customers orders and at the right time: with the Cassioli automatic storage areas, the tires can be stored and made easily available when it is necessary to retrieve them for shipping.

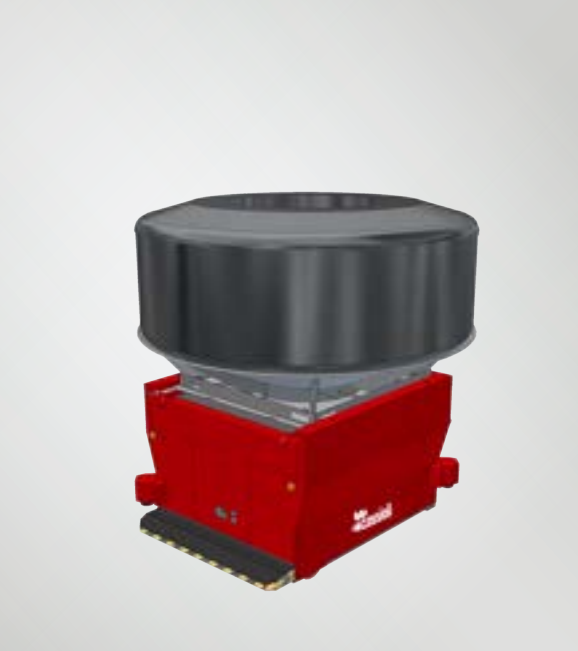


# AGV (Automated Guided Vehicles)

An AGV/LGV system is a flexible way to handle loading units with a high level of automation. The Cassioli AGV system ensures complete integration with the customer's high level IT system (customer's Host, departmental system, SAP, etc...) and with other handling systems or devices.
The AGV may be equipped with natural navigation or laser navigation (LGV).

## STANDARD LGV FOR MATERIAL HANDLING

## SPECIAL AGV FOR AGRO GT



# 06

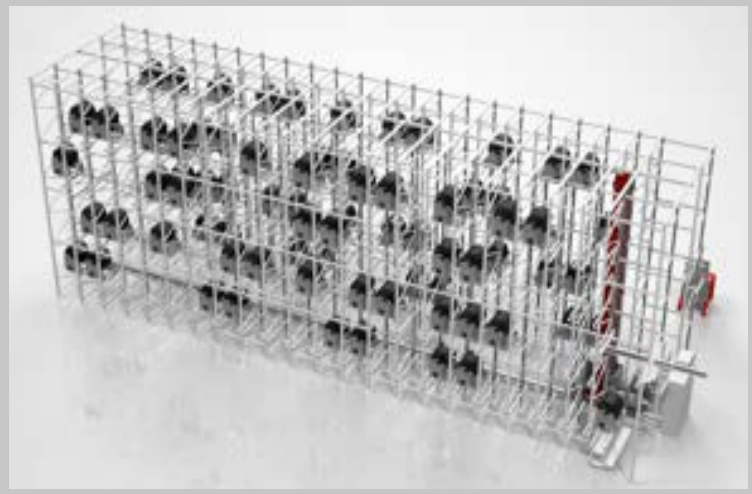
# AS/RS

## RAW MATERIAL STORAGE

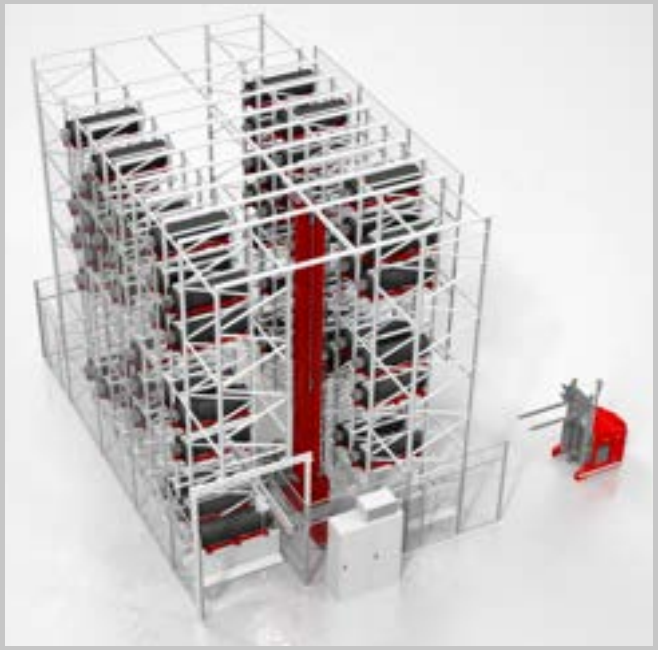
The Cassioli storage unit for raw materials is the ideal solution to stock raw materials in an orderly and functional manner, so they are ready to be transferred to the mixing area. The storage unit is equipped with one or more stacker cranes to allow for an excellent storage of the raw materials and to facilitate retrieval of the same for the subsequent processing stages. Our management system for the storage unit control efficiently manages the entire process flow, cataloguing the materials handled in detailed and ensuring full traceability of the loading units and inventory in real time.

## CASSETTE STORAGE

The Cassioli systems are also designed to handle and store specific trays (cassettes) for the production of the tire's inner liner. The Cassioli automatic storage unit for cassettes ensures low operating costs and rapid access, avoiding standby times during production, and facilitating a continuous production flow. As in the other automatic storage units, in the cassette automatic storage unit, one or more stacker cranes deal with the handling, storage and retrieving the cassettes.



# DRUMS STORAGE



Automatic warehouse and retrieval system for drums on pallets. Cassioli's warehouse for drums enables rapid, safe and efficient warehousing of drums which will then be intended for the Tire Building Machine to construct the tires. The warehouse avails of one or more stacker cranes to enable easy movement of the drums, store them and prepare them for picking for subsequent process phases. Cassioli's management system for warehouse control manages the materials flow and ensure complete data management.

# MOLD STORAGE

The Cassioli molds storage units are automatic storage units to stock and retrieve units composed of molds and other parts (side walls) placed on metal pallets. These storage units have one or more stacker cranes and a management system to store, set in order and retrieve the molds from the storage and correctly transfer them to the curing press.

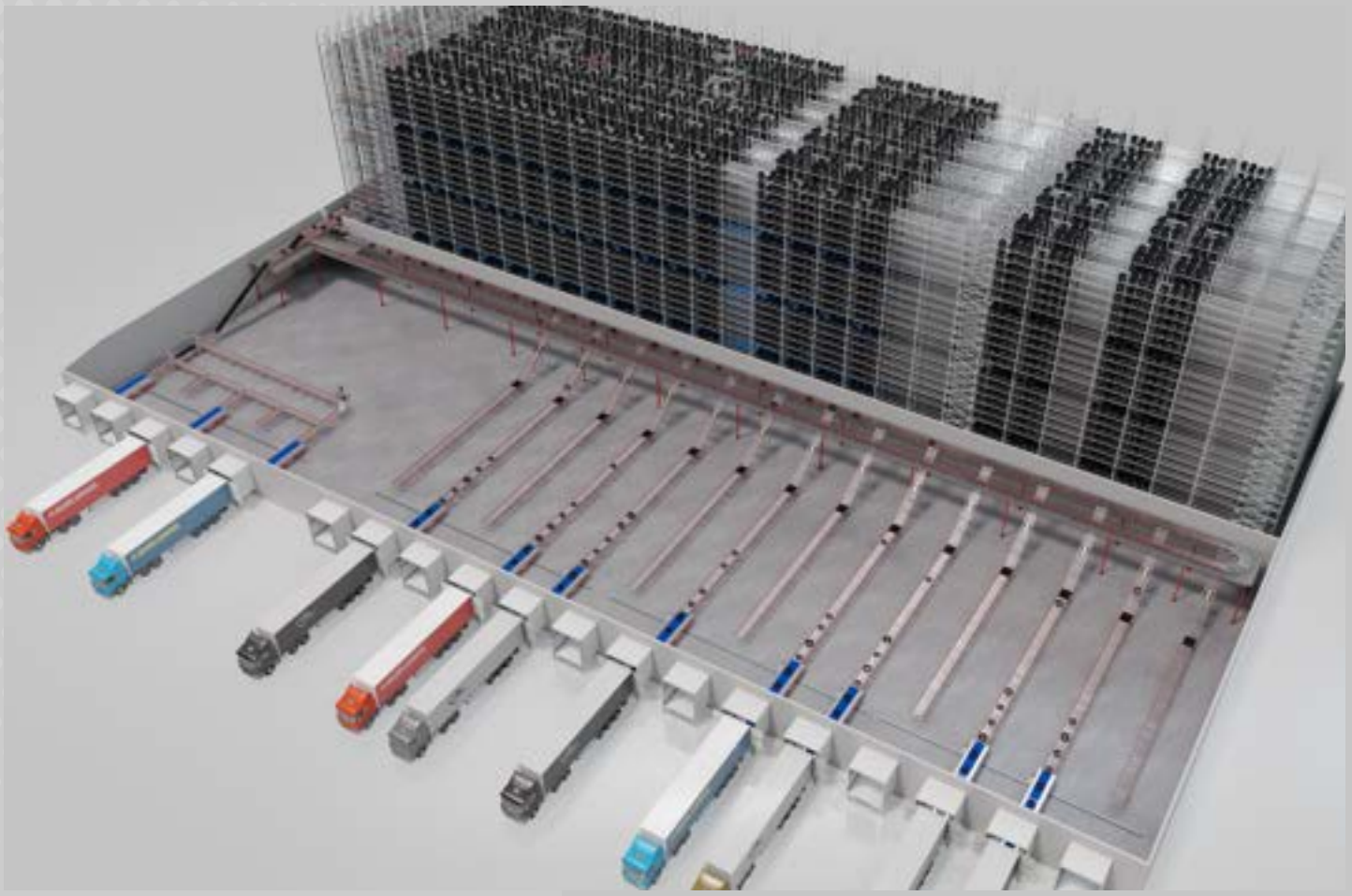
# GREEN TIRE AGRO / OTR STORAGE

The Cassioli storage units for heavy tires for agricultural machines can store large-sized tires in a practical, orderly and functional manner. The Cassioli automatic storage unit for Agro Green Tire (AGR Tire) has one or more stacker cranes for excellent storage of tires for tractors, trailers, building trade machinery and much more, facilitating tire storage and retrieval.

# 07

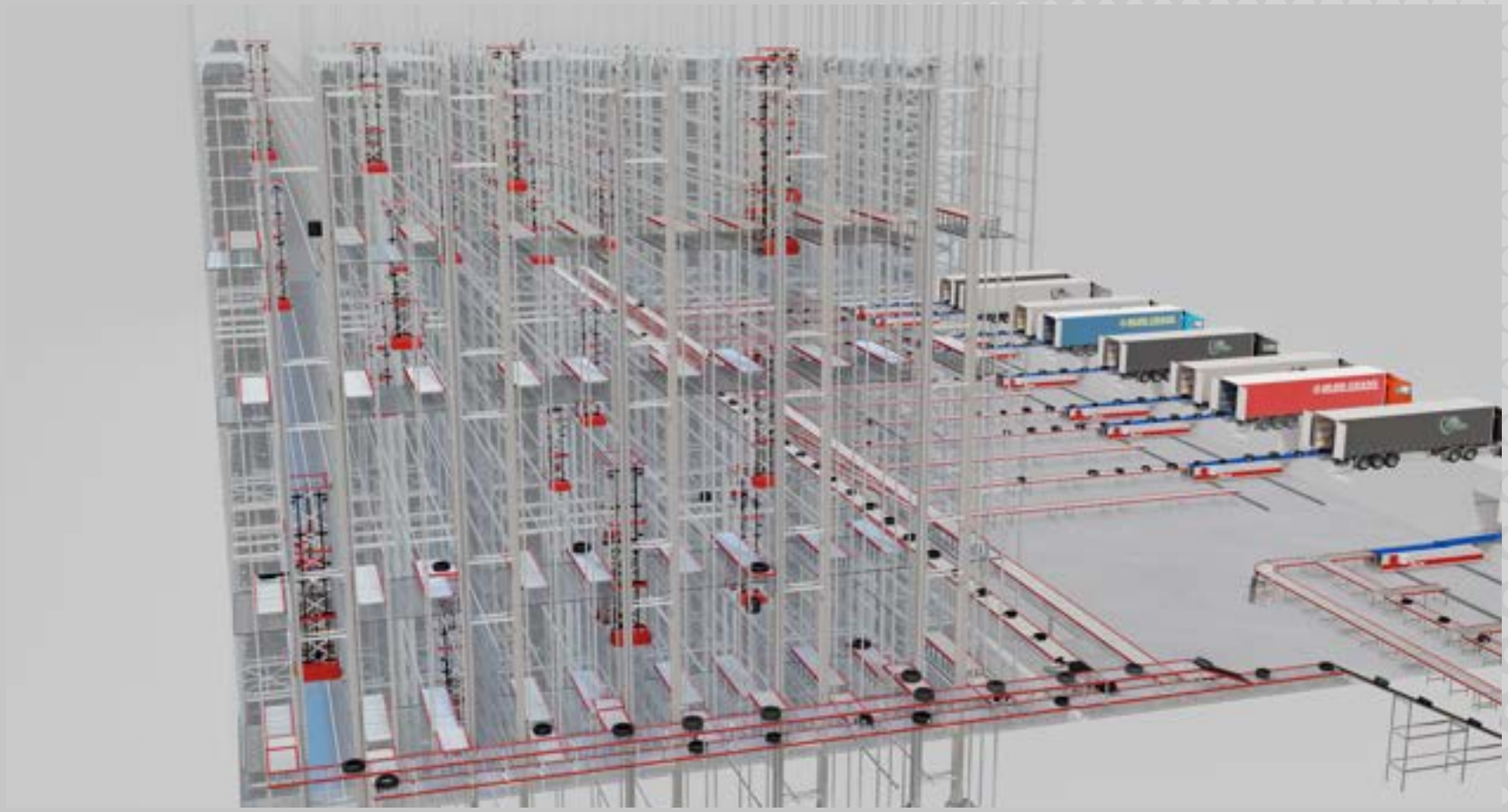
# DISTRIBUTION CENTERS

Growing market demand is increasingly pushing more Tire Distribution Centres towards innovation which includes the changeover from semi-automatic systems to fully automated systems. With an internal research and development department dedicated to designing specific automated systems for tire distribution centres, Cassioli has designed, manufactured and patented automatic systems capable of considerably increasing production and storage capacity, significantly reducing the number of errors compared to semi-automatic systems where manual operations are far greater and more complex than fully automated systems.



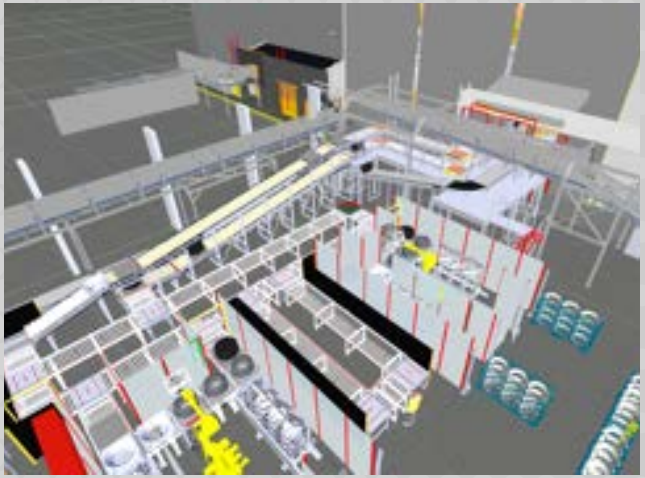
Cassioli systems can carry out the following operations in a fully automated manner.

- Identification and control of the tires entering the system;
- Storage inside the automatic warehouses specifically designed to optimise space saturation;
- Fast and reliable recovery system of the goods to dispatch, taking account of the analysedoutbound flows;
- Automatic labelling systems, which are completely customisable;
- Loading systems of ergonomic devices and simple management



# 08

# INTEGRATED MECHANICAL DESIGN



- **Realistic Layout Visualization:** 3D design provides an accurate, lifelike representation of the final layout, offering clients a clear view of what to expect.
- **Early Visualization for Better Communication:** By incorporating 3D design from the pre-sales phase, we provide detailed, realistic previews that ensure smoother communication and faster decision-making.
- **Enhanced Decision-Making:** Detailed 3D images highlight design features, technical specifications, and dimensions, making it easier for clients to make informed decisions.
- **Aligned Expectations:** 3D layouts offer clients a clear preview of the end result, minimizing misunderstandings and aligning expectations throughout the project.

- **Efficient Brownfield Project Planning:** For brownfield projects, our 3D layouts can be integrated with your existing 3D factory layouts or point cloud reconstructions for a seamless design process.
- **Seamless Integration for Complex Projects:** Our 3D design capabilities are crucial for integrating new systems into existing facilities or updating them, especially in brownfield environments.
- **Conflict Resolution Through Clash Detection:** Early identification of potential conflicts via 3D clash detection analysis helps avoid costly errors and delays.

- **State-of-the-Art Software:** Cassioli uses the latest 3D design tools for both machine-specific designs and comprehensive layout planning.
- **Accelerated Delivery and Cost Savings:** Our 3D design approach reduces time and costs, ensuring faster project delivery without compromising quality.
- **Maximized Precision and Efficiency:** Investing in 3D design means better resource optimization, higher-quality results, and more precise, timely project completion.

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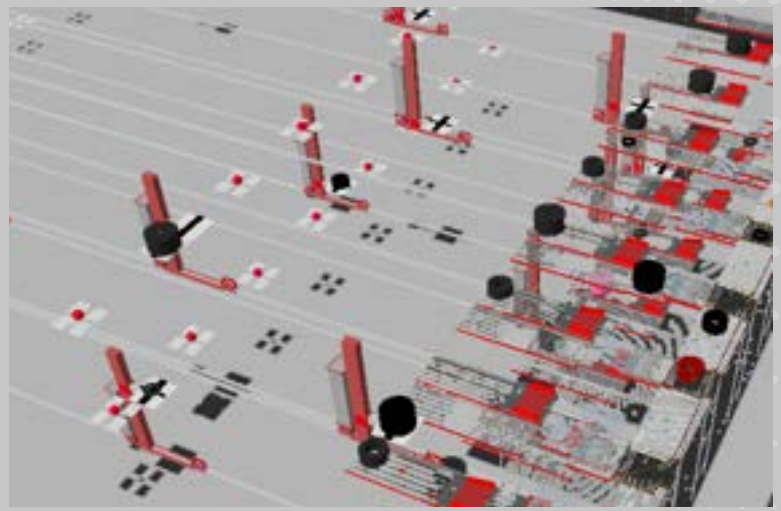
# SIMULATION/EMULATION

- **Simulation and Scenario Analysis:** During the layout study and consolidation phase, the plant layout can be recreated and its behavior simulated in specific and critical scenarios with a very high level of precision.
- **Early Validation of the Layout:** The simulation helps identify and correct critical points, bottlenecks, sorting logic, buffer sizing and the layout itself during the design phase.
- **Digital Twin:** Using the same model prepared for the simulation, Virtual Commissioning can be performed to test and verify the software of the real system before the actual assembly phase with Emulation tools.



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With 4 different production plants, offices and commercial partners spread out over the world, Cassioli is divided into 6 divisions: Intralogistics Division; Ceramics Intralogistic Division; Manufacturing Division; Airport Division; Tire Division, Service Division.
Whenever it is necessary to transfer or handle finished products, semi-finished products, component kits or raw materials in a more or less automatic manner, CASSIOLI can provide the transfer or storage systems that are most suitable in terms of operating capacity, cost, safety and ergonomics.

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