



Automated intralogistics

Pulp & paper industry

PESMEL

Material Flow How® for pulp and paper

Pesmel's Material Flow How® concept is designed to optimize a mill's intralogistics and make the supply chain more efficient. Our concept includes automated handling and high-bay warehousing integrated with our proprietary warehouse management system (WMS) software.

The main idea of the concept is having automated warehouses in the mill area capable of handling all material flows from the production lines. With centralized warehousing operations overall logistics is simplified, and the need for satellite or external warehouses is removed. Automated high-bay warehouses offer full integration with logistics processes and enables a truly streamlined supply chain.

Pesmel is a single source of automated intralogistics with a deep understanding of customers' needs. Whether brainstorming at an early stage, detailed engineering or provision of hardware and control software, the customer gets a comprehensive one-stop-shop service from a dedicated team of specialists.

- Pesmel – a single source for automated intralogistics:**
- Engineering
 - Simulation
 - Handling systems
 - Warehouse systems
 - Material flow WMS
 - 24/7 Helpdesk
 - Maintenance and spare parts
 - Upgrades



Customer reported results from Material Flow How® vs. manual floor warehouse:



75%
less space needed

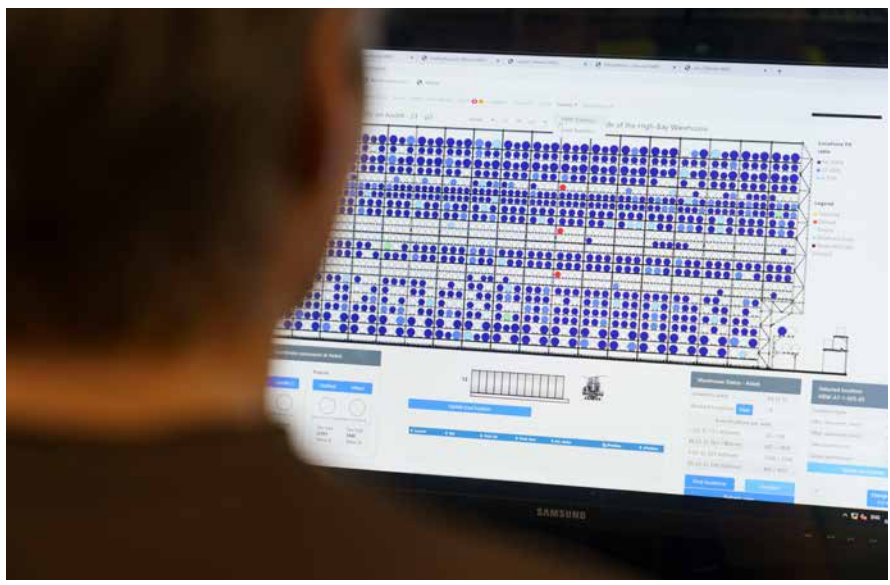
6 = 1
clamp trucks = 1 stacker crane



One centralized warehouse for WIP and dispatching

100%
accuracy with 0% broke

< 20 mins
order discharge to shipping



High-bay warehouses for advanced intralogistics

Optimizing warehouse operations lays the foundation for improvements across the entire supply chain. Pesimal's solutions help mills to manage their supply chain models and run their businesses smoothly. A proactive supply chain that is able to react faster to changes in the market and to customer demands is achieved with efficient storing and dispatching.

Pesimal's high-bay warehouses are based on deep lane storing technology, where products are stored horizontally in deep lane channels. Compared to any other warehousing method it provides the largest storing density with the smallest footprint, making it a particularly good solution for dense mill areas and enabling centralization of the warehouse.

Best performance and capacity

High-bay deep lane warehouses are suitable solutions for demanding intralogistics applications due to their high performance. Automated stacker cranes handle products in sets enabling 2-6 times larger handling capacities compared to other warehouse alternatives. Different roll sizes can also be handled simultaneously without limitations.

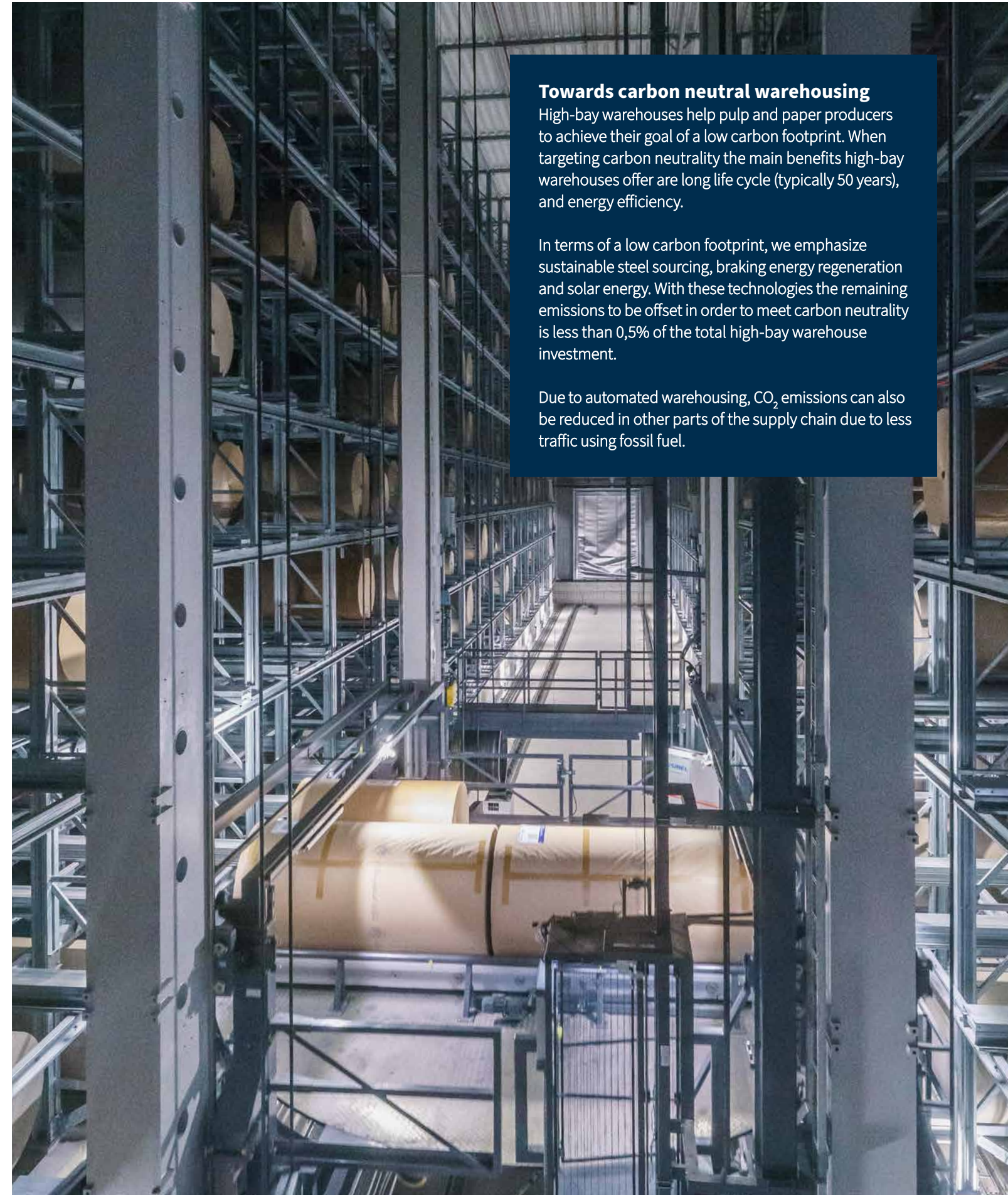
The high-bay warehouse retains its full operational capacity up to an 85% fill rate. Depending on the complexity of production and/or shipping, a warehouse can be equipped with sorting vehicles.

Towards carbon neutral warehousing

High-bay warehouses help pulp and paper producers to achieve their goal of a low carbon footprint. When targeting carbon neutrality the main benefits high-bay warehouses offer are long life cycle (typically 50 years), and energy efficiency.

In terms of a low carbon footprint, we emphasize sustainable steel sourcing, braking energy regeneration and solar energy. With these technologies the remaining emissions to be offset in order to meet carbon neutrality is less than 0,5% of the total high-bay warehouse investment.

Due to automated warehousing, CO₂ emissions can also be reduced in other parts of the supply chain due to less traffic using fossil fuel.



Main characteristics of different warehouse types used in paper mills and converting plants

Warehouse types		Handling capabilities	Max. storing densities
ASRS	HBW Deep Channel	+++++	7 metric tons/m ²
	HBW Single Pocket	+++	4 metric tons/m ²
	Overhead Cranes	+++	5 metric tons/m ²
	AGV	+	1,5 metric tons/m ²
Manual PIT		++	1,5 metric tons/m ²

ASRS = Automated Storage and Retrieval System = Automated warehouse

HBW deep = High-Bay Warehouse, rack type ASRS to store rolls on deep storing channels

HBW single = High-Bay Warehouse, rack type ASRS to store rolls on single roll channel pocket

OHC = Over-Head Crane ASRS to stack rolls on floor

AGV = Automated Guided Vehicle, rolls stacked on floor

Manual PIT = Manually operated Powered Industrial Trucks equipped with clamps to stack rolls on floor

Proofing the concept – the simulation steps

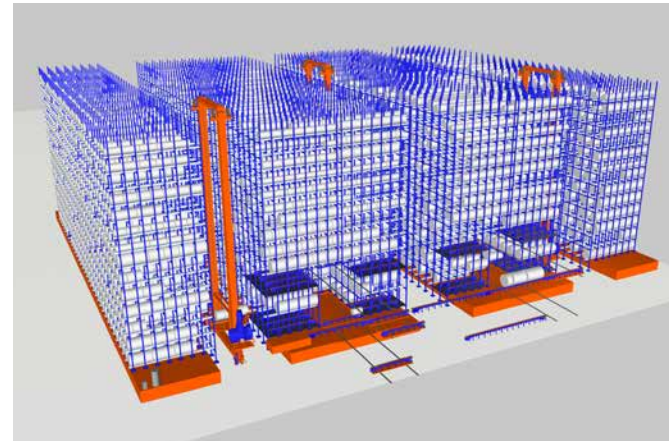
While engineering and evaluating a mill's intralogistic alternatives the prime target is to ensure that a system is built to meet specific requirements. The system should be lean, flexible and not contain hidden bottlenecks. This is ensured by simulating the warehouse processes in several steps.

Step-by-step simulations

The first step is to properly perform data analyses of existing or predicted production data to identify true functionality and capacity requirements for correct layout dimensioning. In practice, this involves clearly defining product dimensions and required handling, sorting and storing volumes.

The second step is to validate the proposed layout solution through a capacity simulation to ensure there are no bottlenecks in the integration, and that material flow visually makes sense and is correctly understood.

The third step, after the layout has been drafted based on the first two steps, is to build the actual material flow simulation to finetune it. Digital twin models are used to test and virtually commission the warehouse management system (WMS) functionality.



Efficiency with automation and WMS integration

A high level of automation and correct IT integration are the keys to fluent material flow. Pesimal's proprietary warehouse management system (WMS), coupled with their high-bay storage, offers excellent opportunities to improve management of the entire supply chain. It enables simultaneous monitoring and running of several complex systems and is designed to make in-mill logistics and supply chains simple and effective.

Integrated automation gives efficiency

Pesimal's material flow WMS connects to customer's ERP and upper-level functions serving as a single point for other systems to integrate, simplifying the overall architecture of the facility. Besides warehouse functions, Pesimal WMS can control third-party material handling equipment such as conveyor systems, automated guided vehicles, overhead cranes, and forklift trucks.

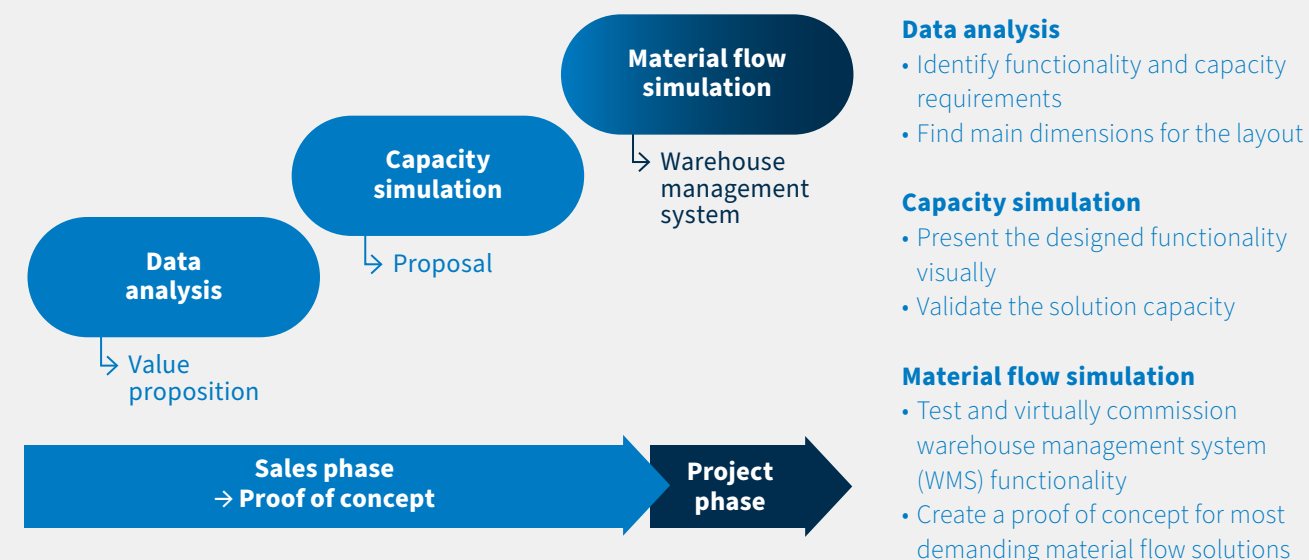
The single piece of software displays the warehouse's activities via a user-friendly interface and makes the overall system status easy to understand, reducing downtime and enabling prompt diagnosis of material handling equipment performance.

Serving customers better

The WMS blends connectivity and information-sharing with 100 percent inventory optimization and control. For example, automated order handling lets the central storage feed products for further processing according to the just-in-time (JIT) principle. This, in turn, allows producers to serve their customers better with simple and effective dispatch and on-time deliveries.

Individual products are picked and dispatched according to customer orders, as the system automatically knows the location of each item. The high-bay storage brings the products to the loading area efficiently. Automation, with its high handling capacity, ensures smoother, faster turnaround times thanks to efficient roll flow and short truck loading times.

Simulation tools in sales and project phases



Pesimal material flow WMS features

- Warehouse management (inventory, real-time tracking, identification)
- Material flow and warehouse optimization
- Single point integration to mill information system
- Integration to production lines
- Management of third-party material handling equipment
- User-friendly human resource interface (reporting, monitoring, alarms)
- Pesimal WMS support (24/7 helpdesk, remote connection)
- Software maintenance and upgrade services



The two Material Flow How® concept cornerstones:

High-bay storage and in-house developed WMS



Manufacturing or distribution management

- Production data
- Order information



Bales

TransBale™ high-bay warehouse for pulp bale unit



Rolls

TransRoll™ high-bay warehouse for paper and board rolls



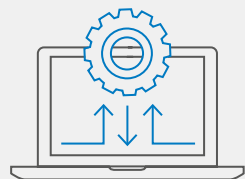
Pallets

TransPallet™ high-bay warehouse for pallets



Non-Woven

TransRoll™ high-bay warehouse for special fibres



Warehouse Management System (WMS)

- Inventory management
- Material flow management
 - Order picking
- Shipment and loading plans

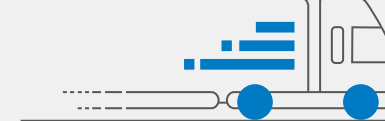


Logistics management

- Identification
- Waybills



External logistics



Pesmel ASRS solutions for paper industry

High-bay, deep-channel ASRS systems with one or more stacker crane aisles with flexible height, width and length dimensioning and unlimited connections make mill integration simple and cost effective.



TransBale™

Instead of 3-4 level manual pulp bale units piling on the floor, the TransBale high bay storages can store up to 15 levels with fully automated unit handling. Deep storing channels and stacker cranes equipped with a pair of flatbed sorter cars enable the pick-up, storage and delivery of pulp bale units to dispatching according to orders. Integration with automated rail car and truck trailer loading is possible.



TransRoll™

A high-bay roll warehouse where rolls are stored in queues in deep storing channels. Stacker cranes equipped with sorter cars handle horizontal roll sets using a cradle. The sorter car collects incoming roll sets directly from incoming conveyors, distributes rolls on the deep storing channels, and collects rolls according to the shipment orders.



TransPallet™

TransPallet high-bay storage handles and stores multiple pallet sizes without slave pallets on deep storing channels. A high handling and sorting capacity achieved is by multidimensional pallet set handling.



TransRoll™ for non-woven

The TransRoll concept can be adjusted to handle and store roll shaped objects with a wide size range.

Engineering guidelines for high-bay storage design

High-bay warehouses and related software are custom built to meet customers' specific logistics needs and requirements. System design requires versatile methodology and knowhow, and certain engineering guidelines are provided to facilitate efficient design implementation.

Engineering variables and norms

High-bay warehouse types

Deep lane:

- Channel depth up to 30 meters (case specific)
- Warehouse height up to 45 meters

Stacker crane types

For rolls:

- Roll set handling width up to 6,0 meters
- Payload up to 15 metric tons
- Diameter from 400 mm to 2500 mm

For pulp units:

- Number of pulp units up to 8
- Payload up to 16 metric tons

For pallets:

- Multi-size pallet handling (400x400 to 1600x1600) without slave pallet
- Pallet set handling width up to 5 meters
- Payload up to 10 metric tons

Stacker crane performance data

- X movement 3.5 m/s
- Y movement 1.2 m/s
- Z movement 1.5 m/s
- FEM cycles 30-40/hour

Design norms and regulations

- FEM 9.221 Performance data of SRM
- FEM 9.851 Performance data of SRM, cycle times
- FEM 9.311 Rules for the design of SRM, structures
- FEM 1.001 Rules for the Design of Hoisting Appliances
- EN 12100-1/-2 Safety of machinery, basic concepts, general principles for design
- EN 528 Storage and retrieval machines, safety
- EN 60204-1 Safety of machinery – electrical equipment of machines

Electrification

- High industrial standards
 - IEC/CE for Europe
 - NEMA/UL for North America
- Customer-specific electrification solutions
- Regenerative drives for lifting and travelling movements

System control

- System control by Pesmel WMS
 - Connected with any ERP or MES system
- Machine control PLC
 - Siemens Simatic
 - Rockwell Allen-Bradley
- Embedded SCADA in WMS UI

Racking types

- Free-standing → built inside a separate building
- Rack-supported building → storage and building integrated (walls and roof connected to racking)

Design norms and regulations

- EN1993: (Eurocode 3) Design of steel structures
- IBC (North America)
- EN1090: (EXC 2) Execution
- Consequence class CC2
- Fire class P0 (performance-based fire safety design)
- Combination of external loads (based on national regulations)
- Earthquake load
- Wind load
- Snow load

Fire protection

- Sprinkler system (wet pipe, dry pipe)
- Oxygen reduction system

Conveyor connections

- Pesmel can deliver all necessary conveyors

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