Simulation based design of an electrified monorail system (EMS) with high throughput and short delivery times

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Dr. Monika Schneider, Conveyor Systems, Eisenmann Anlagenbau GmbH & Co. KG

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About Eisenmann

Eisenmann is a leading international systems supplier for finishing technology, material flow automation, and for environmental and thermal process technology.

- Plant design and construction experts
- Highly flexible systems integrator
- Market and technology leader in components as well as in complete systems
- Service provider with a broad range of service products
- Family-owned company with a very sound financial foundation and sustainable economic management
- Innovative high-tech company due to a wide range of R&D activities as well as testing facilities & laboratories
Eisenmann Conveyor Systems – Overview

**COMPLETE SOLUTIONS FOR INTRALOGISTICS**
- Turn-key logistics centers with tailored solutions for storage technology and material flow automation

**ELECTRIFIED MONORAIL SYSTEMS**
- Highly intelligent, robust, flexible, high-performance and energy-efficient material flow solutions for floor-free transportation

**RGV CONVEYING SYSTEMS**
- Clever solutions with the technological advantages of the electrified monorail system for compact areas and low design heights

**LOGIMOVER**
- Driverless transport systems for the automation of pallet transport

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Conveyor Systems – Complete Solutions for Intralogistics

**Solutions for complex logistical tasks:**
- Experienced project planning, planning and simulation for clever solutions and optimal concepts
- Independent selection of the ideal storage and picking technology to meet specific demands
- Holistic expertise: IT, control technology, mechanics and steel construction from a single source
Conveyor Systems – Electrified Monorail Systems

High-performance systems for demanding transport tasks:

- Linking of different areas
- Picking system
- Workpiece carrier on assembly lines

Conveyor Systems - Simulation

- Use of Plant Simulation since over 20 years supporting the design of logistic systems
- Simulation of rail guided systems (Electrified Monorail system, Electrified floor track system, Inverted electrified monorail system)
  - Static calculation of trolley number is not reliable
  - The detection of bottlenecks is often based on a combination of several layout properties (switches, exchange stations, curves, fire gates)
  - Animation of pallet flow as an easy way to explain the installation
- Object Libraries and semi-automatic model generation

Reliable results and animation
Design project – Logistic centre

Logistic center with High Bay Warehouse (HBW) and pallet conveyor system

Main material flow
- Production and receiving to HBW
- HBW to picking and back
- HBW to shipping

Challenges during design phase
- Increasing high performance from the HBW up to 430 pallets / hour
- Sequencing of 390 pallets to the shipping area
- Short delivery times to the shipping area of less than 35 minutes

Design project step 1

Layout and material flow of request for quotation

Layout of HBW zone:
- Outbound flow of HBW 320 pallets / hour
- Inbound flow to HBW 280 pallets / hour
- Fire protection wall

First question to simulation: Is the monorail layout capable to handle the material flow?

Input data:
- Layout (no requested file-format)
  - Generate a bitmap with the standard scale 1 m = 10 pixel
- Transport data
  - Generate a transportation matrix for the rail guided system of the peak hour (From / To)
Plant Simulation: Semi-automatic model generation

- Manual setup of track system
  - independent of layout-file format (even *.pdf is possible)
  - effort

- Semi-automatic process of further model generation
  - Calculate shortest way to destination using Floyd-Warshall Algorithm
  - Setup the curve speed based on the segment table
  - Detect track switches and insert switch control
  - Generate exchange stations and assign to the tracks by drag- and drop
  - Flow counters for areas of exchange stations
  - Destination list (assignment destination name to track)
  - Empty trolley guiding

Demonstration

Plant Simulation: Evaluation of simulation run

- Analysis of hourly flow => comparing to the transportation matrix
- Analysis of queues at the inbound stations
- Detection of bottlenecks
  - Animation (e.g. permanent congestions in front of HBW front zone)
  - Analysis of capacity utilisation of fire doors or track switches (e.g. occupation of 95% signals bottleneck)
  - Factor of one trolley (waiting in front of switch or at the exchange station) blocking other trolleys
### Design project step 1 - Results

- HBW front zone is bottleneck
- Redesign of rail track and conveyors
  - Increase of exchange stations
  - Fire doors only on the rail
- New version of the simulation model
  - HBW front zone can handle the material flow

### Design Project Step 2 - Cost reduction

**Next Step: budget reduction required**

- Goal: Save second floor level of pallet conveyors
- New material flow figures for the monorail system of 430 pallets from the HBW / h
- Redesign supported by the simulation
  - Support of mechanical engineering: Describe the required dynamic parameters (speed / acceleration) of the monorail trolley
  - New layout of the HBW front zone
  - New layout of the sortation buffer to shipping to avoid double flow of the pallets
Design Project Step 3 - Sequence and delivery times to shipping

Next step: details of the order structure

- **Goal:** Confirm order sequence and delivery times
- **Project specific implementation**
  - Pallet conveyor layout
  - Order management
  - Control strategies (HBW, empty trolley disposition, transfer car)
  - Statistics
- **Result:** The performance requirements can be met.

Conclusion

- Animation and presentation of results in an early project phase
- Simulation creates confidence to the customer
- Design reliability in the quotation process
- Scenarios can be analysed in an early phase
- Simulation model can be extended to meet the specific project requirements
Any questions?

Your contact

**Dr. Monika Schneider**

Expert Intralogistics Simulation
Conveyor Systems

Phone:  +49 7031 78-2957
E-mail: monika.schneider@eisenmann.com
Daimlerstr. 5, 71088 Holzgerlingen, Germany